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The Epidemiology of Influenza in Children Hospitalized at the Hospital of Sikasso, Mali 2015-2019

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Abstract

Introduction: Influenza is an acute respiratory infectious disease, highly contagious due to influenza viruses. The objective of this work was to identify, understand the epidemiology of circulating strains and estimate disease transmission. **Patients and Methods:** The study was carried out in the pediatric department of the Sikasso Hospital. This was a prospective, longitudinal descriptive study over a five-year period (January 1, 2015 to December 31, 2019). She was interested in severe acute respiratory infections (SARI) for hospitalized patients in the pediatric department. **Results:** During the study period the prevalence of severe acute respiratory infections among hospitalized children was 21.85‰. The majority of cases were observed in 2019 with 58 cases, the sex ratio was 1.8. The age group from 0 to 1 was the most represented with 100 cases (48.30%) followed by 2 to 4 years 73 cases (35.24%) and 5 to 15 years 34 cases (16.46%). More than half of the patients lived in rural areas 129 (62.31%). Fever and cough were present in the majority of patients. No children had received influenza vaccination. In study 36 (17.39%) cases were positive for influenza A and B.

Keywords

Sentinel Surveillance, Seasonal Influenza, Sikasso Hospital

1. Introduction

Seasonal influenza is now recognized in children. Its underestimation persists due to the non-specificity of symptoms and the overlap of other winter viral epidemics [1]. According to the World Health Organization (WHO), annual epidemics cause about 3 to 5 million severe cases (requiring hospitalization) and 250,000 to 500,000 deaths per year worldwide [1]. Influenza viruses are characterized by their frequent mutations responsible for the emergence of new viral strains for which populations have little or no immunity and these new strains can in turn be responsible for seasonal epidemics or pandemics that are sometimes very severe and deadly [2]. During annual seasonal epidemics, the infection rate is highest among children, especially school-age children, contributing to the widespread of the influenza virus. The incidence of influenza disease leading to hospitalization is highest in children under 2 years of age [3]. Indeed, the risk of the appearance of particularly virulent pandemic viruses is a haunting for public health actors [2] [3]. As the threat is a matter of concern, measures to combat influenza, including epidemiological surveillance, have been strengthened. Thus, sentinel surveillance, ambulatory surveillance of influenza-like illness and surveillance of severe acute respiratory infections (SARI) in hospitalized patients are recommended by WHO [1]. In the WHO/AFRO region, this surveillance should be done in accordance with the Integrated Disease Surveillance and Response (SIMR) strategy [1]. In order to participate effectively in the global response to the risk of an influenza pandemic, the Ministry of Health of Mali, through the CVD-Mali, is committed to improving influenza surveillance through the creation of sentinel sites. This effort is supported by WHO and the U.S. Government through the Centers for Disease Control and Prevention (CDC) and the Naval Medical Research Unit-3 (NAMRU-3) to enable the implementation of an effective system for the detection of suspected cases and confirmation by state-of-the-art technology (real-time PCR). This sentinel surveillance of influenza at Sikasso Hospital will identify, understand the epidemiology of circulating strains and estimate disease transmission.

2. Patients and Methods

The surveillance was carried out in the pediatric department of the Sikasso hospital in Mali. The Sikasso region is the 3rd administrative region of Mali, it is located in the southern part of Mali, with an area of 71,790 km^2. It is bounded to the north by the Ségou region, to the south by the Republic of Côte d'Ivoire, to the west by the Republic of Guinea Conakry, to the east by Burkina Faso and to the northwest by the region Koulokoro. This service consists of an outpatient unit, a neonatology unit, a paediatric oncology unit, a general paediatric inpatient unit and an intense nutritional recovery unit (URENI). It has a capacity of 40 beds and receives an average of 2000 admissions per year.

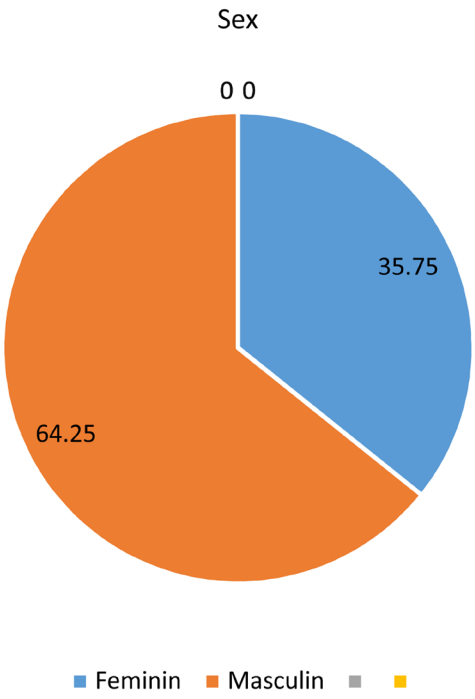
This was a prospective, longitudinal descriptive study over a five-year period (2015 to 2019).

This surveillance was sentinel on a weekly basis and took place throughout the year, she has been interested in severe acute respiratory infections (SARI) in pediatric hospitalized children. Meeting the case definition: Anyone with a history of fever or fever measured ≥38˚C and respiratory signs (coughing, sneezing, rhinitis, breathing difficulties) with onset in the last ten days. The data collected through an individual notification sheet for each case collected in the sentinel sites from Monday to Thursday were transmitted to the NIC-CVD-Mali at the same time as the samples. Surveillance combined epidemiological information and laboratory results in a single database. This will allow a joint analysis of these two types of data. In parallel with the virological surveillance, epidemiological surveillance was carried out. All patients matching the case definitions were systematically registered and collected. A notification sheet prepared for this purpose has been made available to sentinel sites. It includes the socio-demographic characteristics of the patients, the history, the nature and characteristics of the exposure, the clinical signs, the course of the disease etc. The completed weekly notification form is sent to the National Directorate of Health. All patients meeting the case definition criteria were collected from Monday to Thursday. Sampling, packaging and transport equipment, including swabs, virus transport media (MTV) and notification forms, have been made available to sentinel sites by NIC-CVD-Mali. The operation involves introducing either into a nostril or into the throat a sterile swab and collecting epithelial cells that may contain the viruses by scraping it. The goal is to collect naso and/or oropharyngeal samples in search of respiratory viruses. The samples collected by the clinicians of the sentinel site are stored in the Viral Transport Medium (MTV) in a refrigerator and regularly monitored at a temperature of +4˚C (2˚C to 8˚C). The coolers or insulated boxes containing the samples are sent to the laboratory of the NIC-CVD-Mali twice a week (Tuesday and Thursday) through the carriers contracted with the WHO for the transport of samples of other notifiable diseases. A real-time reverse transcription polymerase chain reaction (RT-PCR) was performed to identify and subtype influenza strains. The samples collected are transported to the reference laboratory. The laboratory receives the samples and checks the acceptability conditions. The samples are placed in a viral transport medium comprising the 2 swabs at a temperature of 2˚C and 8˚C in well-closed containers within a given period of 72 hours. Samples are divided into three aliquots, one for CDC, one for CVD-Mali archives and the third for testing. If samples are not tested within 72 hours they are stored at or below −80˚. The real-time PCR technique consists in carrying out a PCR in a single step by using in the reaction medium both primers allowing amplification but also a probe allowing the detection of the PCR products as and when they appear. The probe is labeled with a fluorochrome and fluorescence emission occurs when the probe hybridizes with the target DNA present in the sample. The fluorescence emission is detected at each PCR cycle by the real-time PCR machine; the amount of fluorescence emitted is proportional to the amount of target

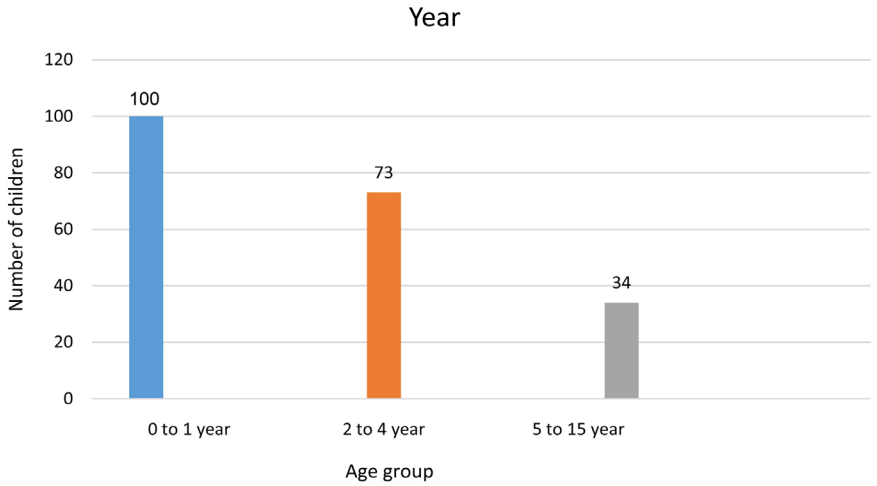
present in the sample. This technology has a triple advantage over the traditional PCR technique: it avoids contamination since the tube containing the PCR products does not need to be opened, it is quantitative and it is very easy to automate. It is also possible to carry out so-called multiplex PCR that is to say that in the same tube several viral genomes are detected thanks to the presence of a mixture of primers and specific probes of several viruses.

3. Results

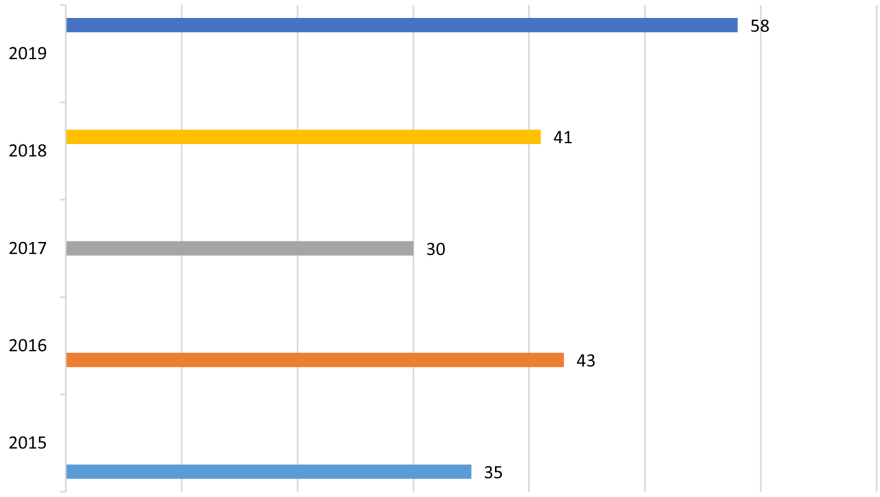
From 2015 to 2019, 9472 patients were hospitalized in the pediatric department of the Sikasso Hospital, including 207 for severe acute respiratory infection (SARI) or 21.85‰. We recorded 133 boys (64.25%) and 74 girls (35.75%) with a sex ratio of 1.8 compared to Graph 1. The age group from 0 to 1 was the most represented with 100 cases (48.30%) followed by 2 to 4 years 73 cases (35.24%) and 5 to 15 years 34 cases (16.46%) detailed on Graph 2. More than half of the patients lived in rural areas 129 (62.31%) of the cases and 78 (37.69) cases were in urban areas. Graph 3 gives us the repair by year of cases of severe acute respiratory infection, the majority of cases were observed in 2019 with 58 cases followed by 2016 with 43 cases then 2018 with 41 cases and 2015 with 35 cases. More than half of the A and B influence viruses were detected during the cool period, November, December, January and February. Fever and cough were present in the majority of patients with 83.9% respectively; 90% followed by runny nose in 65.22% of the cases detailed in Table 1. We recorded 4 cases (1.93%) of chronic condition in children. No patients had received influenza vaccination. In study 36 (17.39%) cases were positive for influenza. ten types of



Graph 1. Distribution of cases by sex.



Graph 2. Distribution of cases by age group.

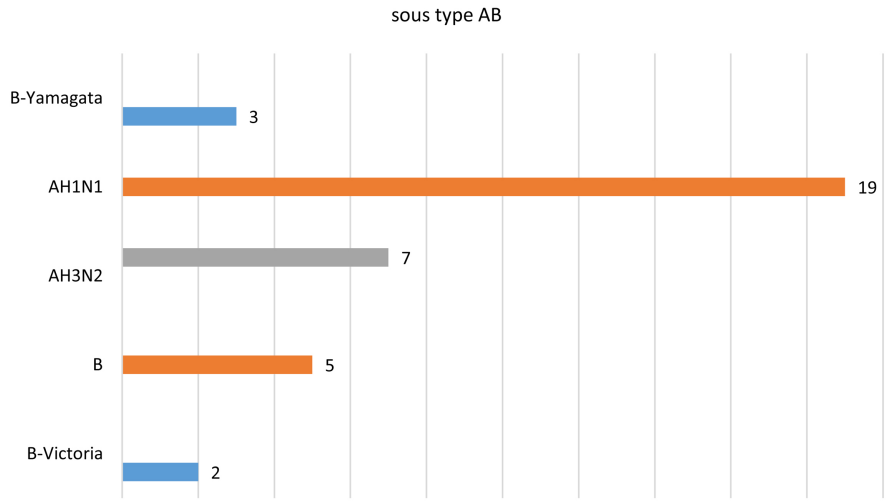


Graph 3. Distribution of cases by year.

Table 1. Distribution of cases by signs/symptoms.

Clinical signs	YES	NO	TOTAL
History of fever	57.3%	42.7%	100%
Fever 38	83.09%	16.91%	100%
Cough	90%	10%	100%
Sore throat	46.7%	53.3%	100%
Nasal flow	34.78%	65.22%	100%
Difficulty breathing	48.31%	51.69%	100%
Danger signs	35.55%	65.45%	100%
Stridor	10.5%	89.5%	100%

influenza B (2 B and 2 B Victoria), 26 types of influenza A (19 A/H1N1 pandemic, 7 A/H3N2) (Graph 4). We did not record cases of avian influenza and the lethality of influenza-positive cases was 1.2%.



Graph 4. Distribution of positive cases by subtype AB.

4. Discussion

In temperate climates, seasonal epidemics occur mainly during the winter, while tropical and subtropical regions, influenza can appear throughout the year, with more irregular outbreaks [4]. Hence the need for annual surveillance of cases of influenza-like illness and SARI. In the tropics and subtropics, data on the burden and impact of influenza are limited. However, there is growing evidence that the burden of influenza may be significant and probably comparable to the impact of the disease on health in developed countries [4] [5]. Influenza is a winter disease: In this study, 40% of influenza A and B viruses are isolated in January and February, compared to 25% in November and December, and 8% in March and April. The annual attack rate is estimated at 5% - 10% in adults and 20% - 30% in children [5]. During this study, children under two contributed to the high rate of transmission. There are three types of seasonal influenza named: A, B, and C, of decreasing importance. The epidemic most often combines the two types A and B of viruses. These viruses belong to the family Orthomyxoviridae [6]. Influenza A viruses are subdivided into subtypes according to the different kinds and associations of surface proteins of the virus. Among the many subtypes of influenza viruses, subtypes A/H1N1 and A/H3N2 are currently circulating in men [7]. Circulating influenza B viruses can be divided into two main groups, or lineages, called the B/Yamagata and B/Victoria lines. Influenza B viruses are not classified as subtypes [7]. The influenza C virus is only very rarely detected and generally causes only mild infections, so its impact on public health is of lesser importance [6] [7]. A and B were detected in the study. The child is a prime target for influenza virus infections. He is very exposed because he has the first contact with the viruses of this family, and the community lifestyle of nurseries and schools facilitates contamination. A French study shows that the highest rate of seasonal influenza attack is observed in school-aged children [8]. In Finland, it has been shown that the seasonal influenza attack rate can reach 30% of children between five and 14 years of age, and in the United States, the

highest rates of influenza hospitalizations are observed in children under four years of age and those over 65 years of age [9] [10]. Seasonal influenza is usually characterized by the sudden onset of fever, headache, myalgia, dry cough, sore throat and rhinitis [11]. In a population of infected and non-hospitalized patients, the positive predictive value of the presence of fever, cough and sudden onset does not exceed 30% [12]. In subjects over 65 years of age, carriers of chronic pathologies and hospitalized, this value reaches 53% on the criteria of fever, cough and a disease of less than seven days [13]. The identification of influenza A or B virus infection is particularly useful in the pre- or post-epidemic period. It is essential in all subjects hospitalized for respiratory syndrome or who have consulted for influenza-like illness. There are many tools allowing a direct search for the virus or its constituents in respiratory secretions: isolation of the virus in culture, The isolation of influenza viruses in culture on embryonated chicken egg or on mammalian cells cultivated in vitro is still today the reference method for the identification of influenza viruses [14], the detection of antigens by immunofluorescence (IF) or immunoenzymatic (IEA) have been developed by several virology laboratories for the search for influenza viruses. Most often, the technique is the same, and the differences relate to the preparation of the antigen and the type of antibodies [15], and the search for RNA by RT-PCR is particularly interesting to detect influenza virus infection when samples are taken more than four days after infection [16]. The PCR technique was used for analysis of our samples at the National Reference Laboratory, Samples of suspected cases of H5N1 and undetermined samples will be immediately sent to a WHO reference laboratory (NAMRU-3) or to a WHO collaborating center (CDC-Atlanta, etc.) for further analysis.

5. Conclusion

Five years of sentinel surveillance of seasonal influenza have shown that influenza is a public health problem in the Sikasso region of Mali. Vaccination would be a useful prevention strategy.

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Conflicts of Interest

No conflict of interest.

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