Trends of Seasonal Influenza Incidence among the Population of Abha, Saudi Arabia During 2019

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Background: Influenza is one of the infections in which a specific pattern is observed according to seasons which result in severe forms of disease. By providing regular and extensive quality in epidemiological studies, the surveillance system can help in reducing the threat to public health

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posed by influenza that eventually minimizes the effect of illness. They also help in reporting the health ministry about the relevant information as an aid to reduce the impact of disease on public health.

Objective: To assess the incidence of seasonal influenza in Abha City, Saudi Arabia.

Methods: This surveillance report conducted among citizens of Abha, Saudi Arabia, 2019. It is based on sentinel surveillance and case-based data collection of laboratory-confirmed cases through electronic health records. All data were obtained from the department of infectious diseases of public health department in Aseer health directorate.

Results: The total reported positive cases for influenza viruses were 808 (22.30%) patients in the city of Abha for the year 2019, among them 435 males and 373 females (F= 9.5149; P=0.002038) which 665 (82.3%) were typed as influenza A and 143 (17.7%) as influenza B. (F= 674.46; P=0.001). The prevalence of the disease is commonly seen in the age group of 5-15 (42.35 %) with a mean age of 15.45±4.50 followed by 16 to 50 years age (37.45%) and 51-65 age group (10%). There was no death registered among these cases. In February maximum cases were found, whereas in June and July minimum cases were recorded. The influenza positivity rate showed one primary peak and three secondary peaks that were recorded in February and January, March and December.

Conclusion: Importance of conducting effective epidemiological surveillance for influenza virus in various regions in Abha specially in winter season with a peak in the month of February.

1. INTRODUCTION

Influenza is an infection of respiratory tract in which the viruses are extremely contagious and spread across the globe. Approximately it is estimated that 3-5 million cases of severe illness were recorded and 2-5 lakh deaths were noted throughout the world [1]. Even though all three A, B, and C types of influenza were known in humans, type C was seen much less frequently than the other two types and the disease has tendency to cause infection that is quite mild [1]. Moreover, type A and B caused breakout and widespread of the illness.

According to research by World Health Organization (WHO), the virus that is spreading among individuals are H1N1 (A (H1N1) pdm09) and H3N2 subtype sand B/Yamagata and B/Victoria known to be the subtypes of Influenza virus a and B respectively. The Gulf countries are regarded as a prime location for spread of influenza in a span of year time by considering its location and population density.

A large population of Muslims from around the globe visits the holy places of Mecca and Medina for pilgrimation to Omura and Mecca throughout the year. Such huge gathering of people may increase the possibility of spread of respiratory pathogen and cross-infection in pilgrims and visitors, which eventually has the possibility for the pathogens to spread globally as the infection rate is on the higher side which

arises concern and targets a lot of public [2]. Moreover, there are a varied group of viruses which attack across the globe and have potential to spread between immunologically naive hosts. Hence infections of respiratory tract are very common during the pilgrimage as the viruses are most commonly retrieved from symptomatic patients during the Hajj season are namely the Saudi Arabian rhinovirus (hRV), influenza virus, and the Middle East. It was a novel respiratory syndrome coronavirus (MERSCoV). Its characteristic unique nature is known and has a high mortality rate of 35-40% [3].

The provision of free vaccination is provided by Saudi Ministry of Health (MOH), Team of MOH employees work by injecting inactivated influenza virus over 6 months each year, also, they encourage vaccination through promotional programs in order to increase number of vaccinations [4]. The various media, health centres and the Saudi Ministry of Health website promotes the effectiveness of influenza vaccination specifically prior to the annual pilgrimage season [5]. With collaborative efforts among various stakeholders, the immunization rate globally has gradually increased, from 17.8% in 2009 to 44.5% in 2018 [4,6].

Abha is the largest city in the Asir region. Located southwest of Saudi Arabia, it covers an area of over 81,000 KM^2. The region extends from the alpine mountains of Sarawat (3200 m above sea level) to the Red Sea, a few

kilometers from the northern border of Yemen. A tourist center in the Gulf region, its climate, location, and beautiful nature are the most common factors that attract thousands of tourists each year [7]. Previous reports from this region have observed the presence of human respiratory syncytial virus (HRSV), human metapneumovirus, and human adenovirus (HAdV) in children suffering from respiratory infections [8]. However, the presence of influenza in this area has rarely been observed. Therefore, the purpose of this study was to investigate the trend of the incidence of seasonal influenza in the city of Abha in 2019.

2. MATERIALS AND METHODS

We undertook a descriptive, surveillance system based cross-sectional study. All available and related data from the Health Electronic Surveillance Network (HESN) and Influenza surveillance system (ISS) of Abha City for the year 2019 were obtained. A formal consent from the supervisor of these systems was done. The operational definition of seasonal influenza cases in our study was based on the following; clinically diagnosed Influenza-like Illness (ILI), laboratory-confirmed influenza A (including critically ill patients) and lab-confirmed cases through HESN. Extensively, all the following: ILI, ARI, laboratory-confirmed influenza cases through (RT-PCR, Viral Culture or four-fold rise in influenza virus-specific neutralizing antibodies) and severe acute respiratory infection (SARI). ILI was defined as an acute respiratory illness with onset during the last 7 days with measured temperature ≥ 38° and cough. ARI was defined as an acute onset of at least one of the following four respiratory symptoms: cough, sore throat, shortness of breath, coryza and a clinician's judgment that the illness was due to an infection. ARI may present with or without fever. HESN considers all ILI and ARI was carried out throughout the calendar year and the weekly monitoring and reporting to (MOH) is carried out during the entire year.

General practitioners, emergency department physicians and pediatricians in all primary healthcare centers and hospitals in Abha were employed to report ILI and ARI cases through electronic registration (HESN). This information was aggregated in the central database of the department of infectious diseases of Public Health in Abha city. Data were cleaned, synthesized, imported and combined in a MS Excel sheet for analysis. The number of positive

cases for Influenza in the year 2019 and percentage was revealed and compared based on age, gender, Influenza virus Type and seasonal variation using descriptive analysis.

2.1 Statistical Analysis

We used the Edwards harmonic technique method to measure the peak-to-low ratio [9]. The Edwards technique is a geometrical model, which is an approach that fits a sine curve to a time series of frequencies by the use of ordinary regression methods. The peak-to-low ratio was interpreted as a measure of relative risk that compares the month with the highest incidence (peak) with the month with the lowest incidence (low or trough). The positivity rates for influenza virus during the discrete peak and low periods were compared using a direct method (χ2-test) to analyze statistical significance. Categorical variables like gender and age group distribution are presented as numbers and percentages. P-values were calculated using the chi-square test and a p-value of <0.05 was considered to indicate significance and were performed with SPSS version 23.0 (SPSS Inc., Chicago, IL, USA).

3. RESULTS

Among the visitors of healthcare facilities in Abha for the year 2019, the regional laboratory tested more than 3623 specimens during that period. 808 cases were positive for influenza viruses (Table 1) among them males (435) were significantly more affected than females (373) [F= 9.5149; P=0.002038].

The disease was significantly seen in the adolescence age group of 5-15 (42.35 %) with a mean age of 15.45±4.50 (95% CI) followed by 16 to 50 years age (37.45%) and 51 – 65 age group (10%) (F= 6.097; p<0.01) (Fig. 2).

Influenza type A was present in 665 (82.3%) individuals as compared to influenza type B in 143 (17.7%) [F= 674.46; P=0.001] as the data collected from electronic or actually monitored through hospitals and primary health care centers for which a laboratory examination was performed. There was no death registered among these cases (Table 2).

In winters, there was a significant increase in specimen number and the rate of infection of viruses when compared to other seasons (F= 7.845; p<0.05) (Fig. 1). The trends of positivity

rates were statistically the highest in the month of February and lowest in July and June month (F=13.560; p<0.05). The influenza positivity rate showed one peak and three secondary peaks, which occurred in February and January, March and December (Fig. 1). Influenza type A was the most frequent subtype of influenza and was detected throughout the year. The peak-to-low ratio of this viruses was 1.78 (95% CI: 1.34-2.29) showed significant seasonality ($P < 0.01$); i.e.,

influenza A virus has a notable risk in and showed seasonal behavior characteristics. The number of Positive cases was large enough to evaluate the associated seasonality. The peak-to-low ratio of seasonal influenza was 3.15 (95% CI: 1.56-3.38) and it had significant seasonality ($P < 0.01$); i.e., seasonal influenza has notable risk in the February month and showed seasonal behavior characteristics.

Table 1. Positive Cases for Influenza in the year 2019

Positive cases	808(22.30%)		
	Males	Females	P value (Chi Square)
	435(53.83%)	373(46.16%)	0.00203

Table 2. Positive Cases according to type of Influenza in the year 2019

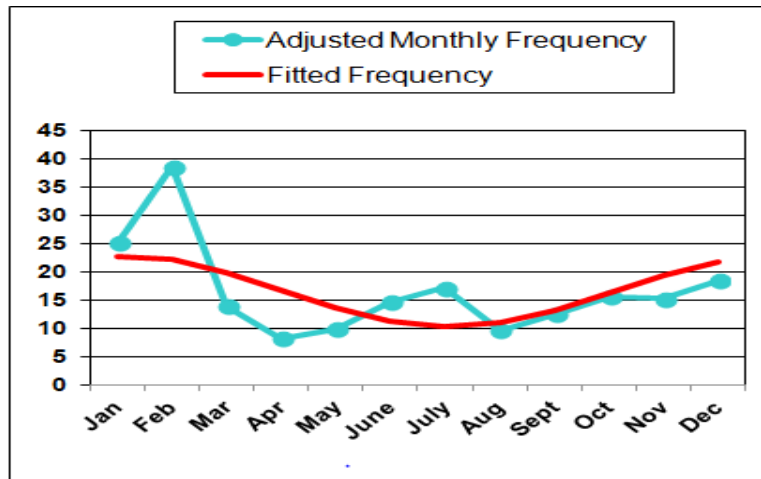| Positive cases	808(22.30%)		
	Influenza A	Influenza B	P value (Chi Square)
	665(82.3%)	143(17.7%)	0.0010

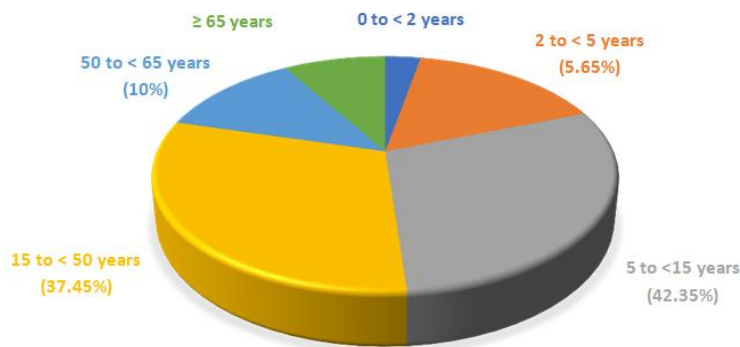**Fig. 1. Positive Influenza Laboratory reported to the department of infectious diseases of Public Health in Abha in 2019**

Fig. 2. Patients with lab-confirmed influenza reported by age group in Abha, 2019

1314

4. DISCUSSION

In our study we reported higher prevalence of Influenza virus type A and this variant was seen the most throughout the year. Our findings were in accordance with a recent systematic review and metanalysis [10] wherein the authors reported an overall influenza virus prevalence of 10.2% pooled from the studies from 17 countries in the middle east region including Saudi Arabia [11-15] and majority of them belongs to virus subtype A. The reason behind the high frequency of Type-A variant may be due to characteristic of these infections to cause severe illness among the patients leading to increased number of people requiring intensive care units or urgent attention of doctors. Other factors that might be attributed are the various characteristics of a population like the population density in a region, vaccinated population, old and infant population and herd immunity [16].

During the 2019 season in Abha, the severity of influenza virus spreading all over the world generally followed past trends and peak influenza activity was generally similar to that in previous season in 2018. The increasing in influenza activity were detected in late November to mid- December and influenza activity peaked from the end of December to mid-March, which is relatively cold season in this region (Fig. 2). The time at which influenza epidemics occurred was same for the most countries in the Northern Hemisphere. The first peak, being the largest was seen between January and March and there were no more peaks after that. However, there were a few exceptions. One of them being Jordan which showed a secondary peak in April and other countries showing earlier primary peaks that is in November and December and a very detectable second peak in March. Moreover, Oman had two peaks of similar intensities in January and April. Conversely, southernmost countries like Bahrain, Qatar and Oman saw less occurrence of influenza seasonality and numerous epidemic peaks like those of countries situated at same latitudes such as India [17] and southern China [18].

Climate constraints such as absolute humidness and precipitation form seasonal occurrence of influenza epidemic in both temperate and tropical countries [19] and is probable to be the main cause for influenza seasonality in the Middle East and North Africa. Migratory populations like nomadic tribes, people on pilgrimages, migrants can also help determine the seasonal occurrences of influenza in few countries and the spread of the epidemic in that region.

Despite the differences observed between countries and the uncertainties about the major causes of the influenza pandemic, primary and / or secondary peaks occur between January and March in all countries surveyed. It is important to note that you did. Therefore, as currently recommended by WHO, it seems justified to match the timing recommendations for annual vaccination campaigns in all countries in the region with the recommendations for Northern Hemisphere (i.e., late fall) [20]. According to this research, the total positive rate of influenza virus and the frequency of it in different age groups were quite alike to those reported in earlier studies clarifying the epidemiology of this virus [21]. Numerous researches have stated that men are more vulnerable to viral infections and have stronger immune and behavioral responses [22]. Although, according to our study; there was no dissimilarity in the number of positive cases or occurrence of ARI by gender. In the children group, there has been higher respiratory virus positivity rates in the pediatric group which were similar to those reported in previous studies [23]. In addition, a significant number of reports of influenza infections in pediatric patients in the Kingdom of Saudi Arabia have been confirmed in the literature [24,25].

Every seasonal influenza epidemic leads to many hardships to the healthcare systems all over the world. To prevent the virus causing harm and spreading in the world, it is imperative to be proactive in deploying resources like adequate medicine supplies, specifically at regional levels. Reports like this with detailed analysis can help in making people realize the need of vaccinating the vulnerable population and save them from the deadly effects of the influenza virus. It also increases the accuracy of clinical diagnosis and the frequency of samples that are taken for laboratory testing [26-27].

This report is based on data on the 2019 influenza season from the Infectious Diseases Department of the Public Health Service of the City of Abha, consistent with the previous year's treatment period. This study did not symbolize true incidence, as the limitation included cases enrolled in the HESN system without considering influenza deaths. Also, there is no data on the percentage of influenza-positive cases who also

have other underlying chronic diseases and how the different variants of mutating influenza virus match with seasonal influenza vaccines.

5. CONCLUSION

In conclusion, this study highlights the importance of conducting effective epidemiological surveillance for influenza virus in various regions in Abha especially in winter season with a peak in the month of February. After every influenza-season, further investigation should be taken to get a summarized assessment of influenza activity that occurred in that season.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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