The Libyan International Medical University

Faculty of Basic Medical Science

Environmental Role of Influenza Virus Outbreaks

Yousaf Saleh Al-shilmany

Supervised by: Dr. Rashad Shawgi

Assisted by: Dr. Mohammed

Report Submitted to fulfill the requirements for Scientific Research Activity

Date of Submission: 2/3/ 2019

Abstract

Improving knowledge about influenza transmission is crucial to upgrade surveillance network and to develop accurate predicting models to enhance public health intervention strategies. Epidemics usually occur in winter in temperate countries and during the rainy season for tropical countries, suggesting a climate impact on influenza spread. Despite a lot of studies, the role of weather on influenza spread is not yet fully understood. In the present study, we investigated that the role of environment in influenza outbreaks. A consideration that only a fraction of the human population isn't susceptible at the beginning of a year due to immunity acquired from previous years. These results suggest that, among the six factors that appeared to be significant, only two could in fact have a real effect on influenza spread, although it is not possible to determine which one based on a purely statistical argument. Our results support the idea of an important role of climate on the spread of influenza.

Introduction

Influenza is one of the most significant diseases in humans, generating worldwide annual epidemics, which result in about three to five million cases of severe illness, and about 250,000 to 500,000 deaths ,Improving influenza knowledge about key epidemiological parameters such as survival, transmission and reproduction in hosts is essential to upgrade surveillance network and to develop more accurate predicting models. Better epidemic predictions would set up more appropriate public health prevention and intervention strategies.[1]

Epidemics occur mainly during the winter season months in temperate countries, unlike in tropical and sub-tropical countries where they generally happen during the rainy season. These differences suggest a climate impact on influenza spread.[1] Climate might affect influenza diffusion (onset, duration, size) by impacting individuals' contact rates (frequency and duration),[2] population immunity and virus survival outside human body. The role of weather is however not fully understood ,despite a lot of laboratory studies of host susceptibility according to environmental conditions ,and mathematical modeling approaches analyzing the link between influenza morbidity or mortality and climatic factors Various climatic factors such as temperature, humidity, rainfalls, UV radiation, sunshine duration and wind speed might have an impact on influenza spread. In temperate countries, humidity and temperature might play an important role in influenza spread.[2]

Several laboratory works showed that a cold and dry weather promotes a higher virus survival outside human body and a better transmission ,Cold air inhalation chills nasal epithelium leading to an inhibition of mechanical defenses of the respiratory mucosa and of the immune system ,Otherwise models explaining influenza epidemics (e.g., onset, peak, mortality) according to climatic factors reinforce the role of humidity and temperature in influenza spread in the United States] as well as in Europe Rainfalls might have an impact in tropical and sub-tropical countries such as in Central and South America and in Asia]. Another theory suggests a link between vitamin D secretion and influenza immunity [3], which is supported by experiments. As UV radiation is involved in vitamin D production, a lack of UV radiation in winter, for temperate countries, leads to a reduction of vitamin D production and might boost influenza epidemics Dowell also suggested a role of dark/light cycles and photoperiod on the immune systems caused by melatonin fluctuations.[3] Thereby UV radiation and sunshine duration might have an indirect effect on influenza infections. Finally, in China, Xiao et al. proposed that a low wind speed contribute to influenza spread. In fact, a strong wind speed may have a dispersive effect on influenza in the environment limiting its diffusion,[3]

Aim

The aim of this study is to quantify the impact of several environmental factors such as temperature, humidity, and rainfalls, on influenza outbreaks based on data collected from an online survey targeting population in Libya.

Methods and materials

Enrolment of data in this report depended on data collected by an online survey, in a period extended from October 2019 to January 2020 , a number of 46 individuals 50% (n=23) were male and 50%(n=23) were female, age of them ranging from 11yrs (5%) ,15 to 17yrs (10%) ,18 to 25yrs (75%) ,26 and above (10%) ,a history of any associated chronic illness was also investigated ,statistics revealed no significant diseases except for asthma and psoriasis , in addition ,frequencies of seasonal influenza infections and self-medications were covered in this study in summer and winter seasons.

Results

According to the data has been conducted, Seasonal variations appears supporting and explaining the impact of the weather in influenza outbreaks and its transmission seasonally, the scheme below shows a total number of 46 participants, 50% (n=23) were male and 50%(n=23) were female in Figure (1), and demonstrates a frequency of infection in wintry season is 54% (0-2 times), 33% (2-4 times), 13% (5-9 times) in Figure (2), and a symptomatic duration about 51% (3-4 days), 39% (7 days), 10% (14-21 days) in Figure (3), and demonstrates susceptible individuals in summer season which is 51% says yes, 26% says no, and 23% says maybe in Figure (4).

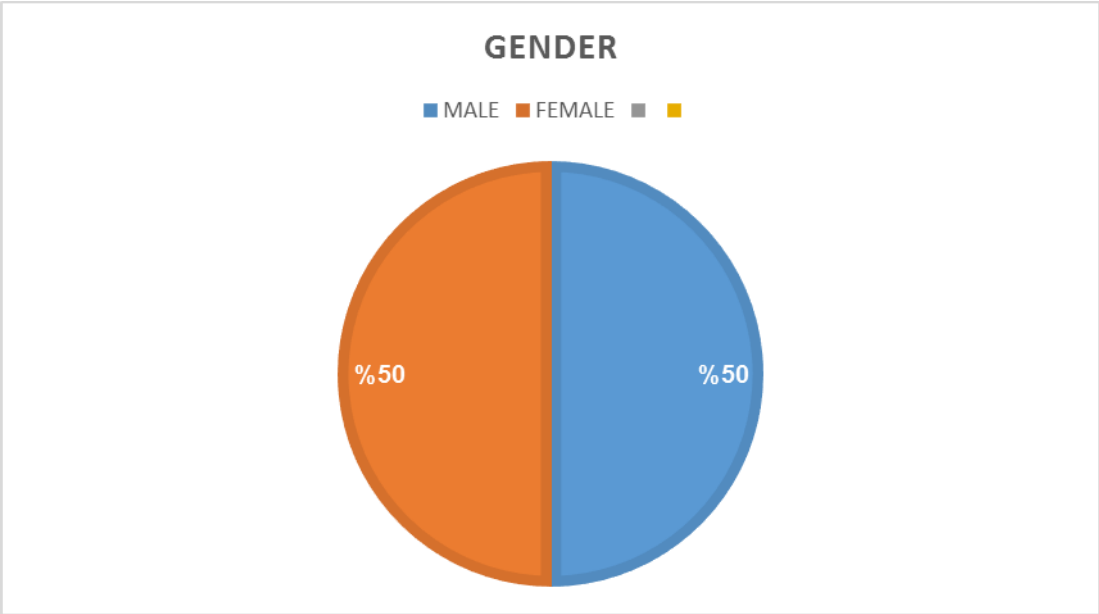

Figure (1) shows gender involved in this study

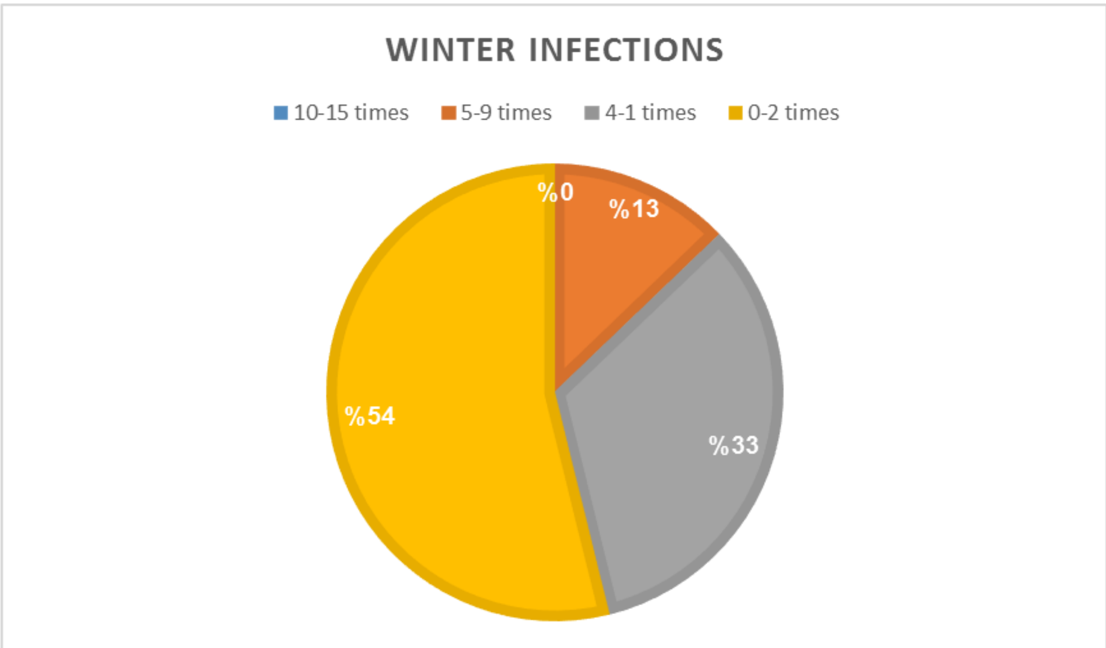

Figure (2) Demonstrate infection frequencies in wintry season

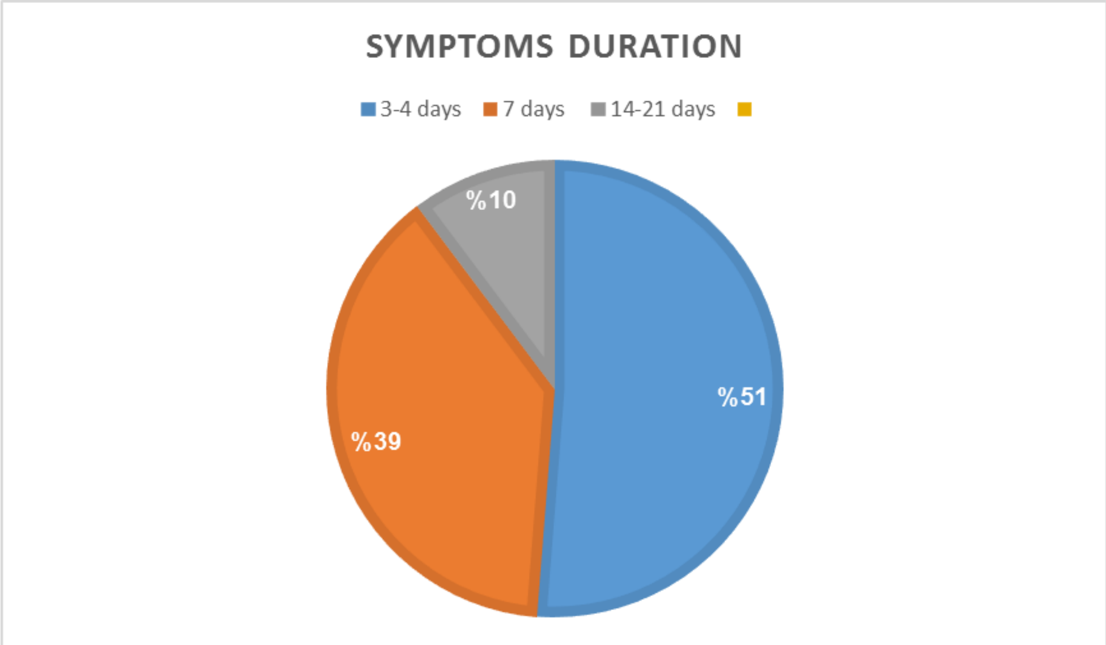

Figure (3) shows symptomatic duration in this study

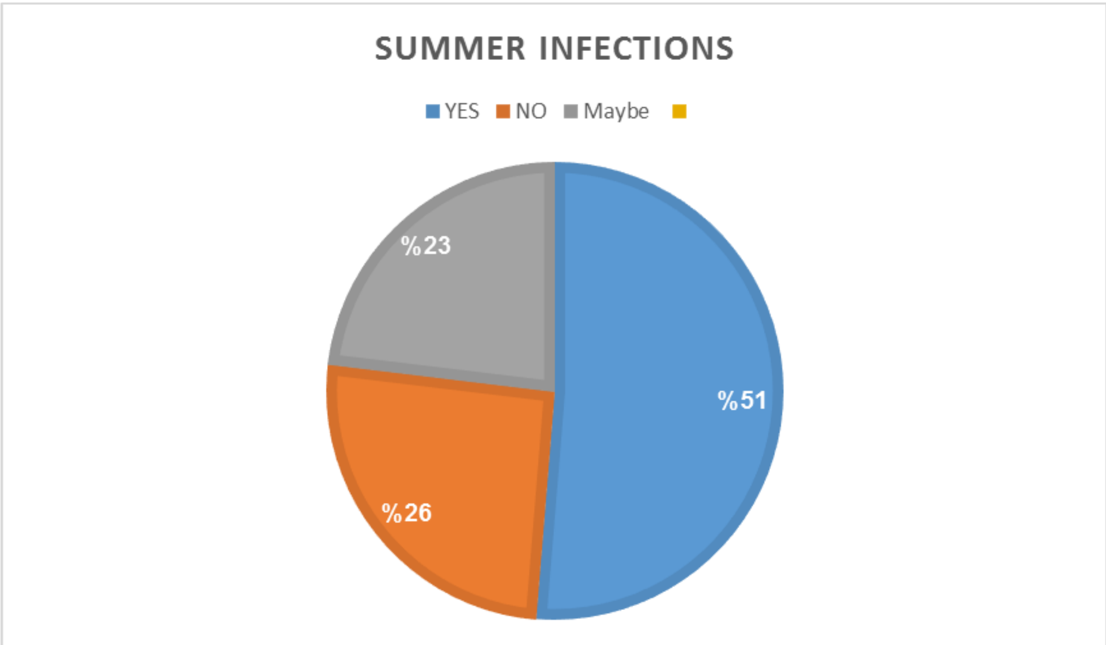

Figure (4) demonstrate susceptible individuals in summer season

Discussion

Our results agreed with number of other studies for example, Data were obtained from the French Réseau[4] des GROG sentinel network. The network is based on voluntary practitioners who i) record acute respiratory infection and ii) randomly send nasal samples for an antigenic confirmation (or rejection) of influenza infection. Based on those two pieces of information, the Réseau des GROG sentinel network provides influenza incidence estimates of clinical cases. Two metrics were used for linking virus spread to climatic data: weekly incidence data of clinical cases and the epidemic size – measured as the total number of recorded clinical cases over the epidemic period. [5]

Another important question arising from our results is about of the disparity of the link of climatic factors with influenza spread using weekly incidence data and epidemic size data. The first obvious potential explanation is the lower statistical power associated to epidemic size data[6]. Epidemic size is estimated only once per year while incidence is estimated every week. So epidemic size data contain less statistical information.[7]

Conclusion

Epidemiological analyses, spurred by experimental data on influenza virus transmission and stability, have identified absolute humidity and temperature as climatic predictors of influenza epidemics in temperate regions of the world**,** Human influenza infections exhibit a strong seasonal cycle in temperate regions, and suggest that low humidity facilitates the airborne survival and transmission of the virus in temperate regions.

Future Work

Several improvements could be brought to our analysis. First, it would be interesting to differentiate between the different subtypes of influenza. Second increasing the number of data by cooperating with statistical centers in hospitals and, creating more surveys with higher population number and larger geographic field.

References

1. Viboud C, Boëlle P-Y, Pakdaman K, Carrat F, Valleron A-J, Flahault A. Influenza Epidemics in the United States, France, and Australia, 1972–1997. Emerg Infect Dis J. 2004;10:32–9.
2. Tamerius JD, Shaman J, Alonso WJ, Bloom-Feshbach K, Uejio CK, Comrie A, Viboud C. Environmental predictors of seasonal influenza epidemics across temperate and tropical climates. PLoS Pathog. 2013;9:e1003194.
3. Finkelman BS, Viboud C, Koelle K, Ferrari MJ, Bharti N, Grenfell BT. Global Patterns in Seasonal Activity of Influenza A/H3N2, A/H1N1, and B from 1997 to 2005: Viral Coexistence and Latitudinal Gradients. PLoS One. 2007;2:e1296.
4. Moura FEA, Perdigão ACB, Siqueira MM. Seasonality of influenza in the tropics: a distinct pattern in Northeastern Brazil. Am J Trop Med Hyg. 2009;81:180–3.
5. Rao BL, Banerjee K. Influenza surveillance in Pune, India, 1978–90. Bull WHO. 1993;71:177–81.
6. Rao BL, Yeolekar LR, Kadam SS, Pawar MS, Kulkarni PB, More BA, Khude MR. Influenza surveillance in Pune, India, 2003. Southeast Asian J Trop Med Public Health. 2005;36:906–9..
7. Dosseh A, Ndiaye K, Spiegel A, Sagna M, Mathiot C. Epidemiological and virological influenza survey in Dakar, Senegal: 1996-1998. Am J Trop Med Hyg. 2000;62:639–43.