Different Temperature fluctuations and how they effect the seasonality of certain viruses

Abstract

Many different factors can come into play when observing and studying upper respiratory infection syndrome(URTI) viruses such as Rhinovirus, Adenovirus, Influenzas A-B (IAV, IAB) viruses, Respiratory Syncytial Virus, Human parainfluenza viruses 1-3 (HPIV) and Human Metapneumovirus(HMPV) and seeing what exactly makes them work most efficiently. The study was conducted in Edinburgh, Scotland in hopes to relate temperature and other seasonal factors such as humidity percentage, dew point percentage as well air pressure, wind speed and duration of day light (these three did not show significant data therefore no results were presented) and see how they contribute to the seasonality of the viruses tested in hopes to better understand and predict when these viruses are more than likely going to spring back up again. This study so far seems to be the first relating certain seasonal factors and the presence of certain viruses throughout the year and ran into uncontrollable outside factors such as people not getting tested when sick and tourists visiting the area which were already sick.

Introduction

The length of the study took about a year, observing the fluctuations of temp., dew point, and humidity. Certain viruses listed in the abstract were noticed to be more prevalent during certain time of the year were the percentages were either higher or lower in those three main categories. When looking at the cases for enveloped viruses such as IAV. Also, certain viruses were present year round and spiked only in certain months such as the Rhinoviruses (present 84.7%) and the Adenoviruses (present 52.3%). Temperature seemed to have the greatest effect on viral seasonality with the average being 9.2oC. and the average relative humidity between the viruses being at about 81%. Currently, since this is the first test notice to ever be conducted to see the relationship between viruses and meteorological factors, there are only other experiments that have tested certain relatable factors with viruses but noting like the experiment in this article. For instance in November 2009 compared to 2015, HMPV tests with temperature change and dew point were positive almost 50% of the time when it came to how common they were as well as Rhinovirus. The reason for their high prevalence could be due to the selective testing done specifically for these viruses. At the end of the study, the viruses were organized into three different categories, one being certain viruses that were found to be non-enveloped viruses (rhinovirus and adenovirus) which are present year round, enveloped viruses which thrive in the winter such as (RSV, HMPV, IAV AND IBV) and the parainfluenza viruses 1-3 and certain enveloped viruses that prefer warmer temperatures compared to the colder climates. In the study, year round presence in rhinoviruses were deemed to be similar to other research reports[[1]](#footnote-1)[[2]](#footnote-2) on the topic but when comparing data found on the rhinovirus peak in November in this article was later than other articles that showed peaks in the months of September and October. But also stated in the article this could be due to the fact that in these months children are going back to school which would result in more direct transmission of the virus and the meteorological factors might not have that much of an effect in the months of September and October. Another difference in data is that on days that rhinovirus is either present or active, there seems to be no real significant difference in the climate or weather factors compare to the negative correlation with the relative humidity report from Germany. When looking at the relative humidity that most viruses live in, this article claims that the average is high (83% to 84%) but other reports have sometimes had inverse findings such as the Iha *Y et al.* reported with an inverse correlation with relative humidity in IAV and IBV from Japan.

Discussion

The results listed in the introductions the comparable data with other researchers seems to be on decent grounds. All of these results can be used in hopes to try and better prepare certain people in these climates for when these viruses are more than likely going to return. Many different factors around the globe can influence whether or not these viruses are going to reappear again or not and it can be difficult to try and compare certain viruses that react better in high humidity areas in a climate with low humidity. But even then the results can be quite confusing and still show prevalence when it wouldn’t make sense to. Another thing that would have effected the test is the amount off people that came to the test site as tourists and were already carrying the virus, and also people who were sick but never went to the local hospital to report said sickness. Now it can be a low percent chance that somebody just contracted one o the viruses just right before traveling to Edinburgh, but its hard to take into account the amount of people that refuses to go to the hospital. Something that could be tested in future tests such like this is the dew point. It was pulled out to try and prevent collinearity which would affect the results of the linear regressions. This could be done by removing temperature and replacing it with dew point to not askew the logistic regression. In the study there seemed to be a relationship between humidity range and viral seasonality. In a later test it would be interesting to asses a similar relationship between other certain ranges which were given in the article such as “temperature-range” and “dewpoint-range”. Best to use other variables that will only be virus specific. Other variables to take into account for the next test would be weather, human behavior and contact, and the immune system. These all can affect how prevalent a virus is or not. Example given in the article is that decrease in vitamin D due to not going outside (Bad weather, cloudy etc..) would increase to a higher chance to becoming infected. Humidity range findings would need more conformation from a tropical environment and also whether or not depending on the age o the population if this has anything to do with viral activity, these two tests are something that could be done in future observations. All of these factors that were tested all showed signs on how meteorological factors can influence the presence of certain viruses, and how these observations could help predict the decline of one virus and when the next one is going to reappear.

**References**

1. du Prel, J. B. *et al*. Are meteorological parameters associated with acute respiratory tract infections? *Clin Infect Dis* **49**, 861–868, <https://doi.org/10.1086/605435> (2009).

2. Monto, A. S. The seasonality of rhinovirus infections and its implications for clinical recognition. *Clin Ther* **24**, 1987–1997 (2002).

3. Price, Rory Henry Macgregor, et al. “Association between Viral Seasonality and Meteorological Factors.” *Nature News*, Nature Publishing Group, 30 Jan. 2019, [www.nature.com/articles/s41598-018-37481-y#Fig1](http://www.nature.com/articles/s41598-018-37481-y#Fig1).

1. du Prel, J. B. *et al*. Are meteorological parameters associated with acute respiratory tract infections? *Clin Infect Dis* **49**, 861–868, <https://doi.org/10.1086/605435> (2009). [↑](#footnote-ref-1)
2. Monto, A. S. The seasonality of rhinovirus infections and its implications for clinical recognition. *Clin Ther* **24**, 1987–1997 (2002). [↑](#footnote-ref-2)