

THE TRANSMISSIBILITY OF INFLUENZA PANDEMICS. THE CASE OF 1889-1890 AND 1918-1920 IN A LARGE URBAN ENVIRONMENT: AN SPATIAL ANALYSIS OF MADRID, SPAIN, BY BOROUGH AND DISTRICT.

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Abstract.

The 1918–1919 pandemic influenza, the “Spanish” flu, killed about 50 million people worldwide. There have been many studies of the transmissibility of the 1918 Spanish flu virus. Many analyses have involved fitting transmission models to the observed epidemic curves based on published data from cities in Europe or America. These attempts to estimate the rate of transmissibility of influenza among people have the objective of planning mitigation strategies and control of infectious diseases from potential new pandemics. Quite often these estimations rely on historical published data from where parameters that model the transmission of the disease are estimated.

The transmissibility of the influenza can be quantified by the basic reproductive number (R_0), an epidemic that represents the number of secondary infections arising from each of the primary cases of infection in a susceptible population. There is abundant literature contributing to the estimation of R_0 from total counts of deaths, using sometimes cause of deaths and not that often other socioeconomic variables (See bibliography below).

Other pandemics, like the influenza pandemic during the winter of 1889-1890, the "Russian Flu", was one of the most important pandemics during the XIXth century and it was the first influenza pandemic in an interconnected world. There have been several studies in recent years which have estimated the rate at which influenza moved worldwide as an attempt to know the diffusion and speed at which an influenza epidemic can spread. An example of this is found in the research carried out by the Institut National de la Santé et Recherche Médicale in Paris, in which they estimated that the diffusion of the 1889-1890 pandemic was truly amazing, moving around great part of the World in just four months. The average speed was estimated at 394 km/week for the European continent and 1,015 km/week within the United States. The transmissibility rate for the 1889-1890 pandemic in Europe was estimated to be $R_0=2.1$. While the transmissibility rate of the 1918-1919 pandemic was estimated approximately to be $R_0=2$ and 3 for 45 cities in the United States. For a more recent Pandemic influenza, the 2009 A (H1N1) in Spain, the R_0 value was estimated to be 1.29.

Therefore, the estimation of this parameter and the patterns of geographical distribution within a big urban environment are of great interest because it will allow determining the potential diffusion of an epidemic and how that epidemic could be tackled and controlled. Therefore, the scientific goal of this contribution is to estimate

transmissibility rates and the geographical distribution of two influenza pandemics 1889-1890 and 1918-1920 in the boroughs and districts of the City of Madrid, which had a population around 500.000 inhabitants in 1900 and c700.000 in 1920. We will use the Longitudinal Historical Population Register of the City of Madrid which uses individual level information for all the individuals who lived and died in Madrid. The Register includes c20.000 deaths per year, during the period 1889-1923. The information included is, beside other variables, age, sex, causes of death, place and day of death, civil status.

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