A GIS Study of Pandemic Influenza Characteristics

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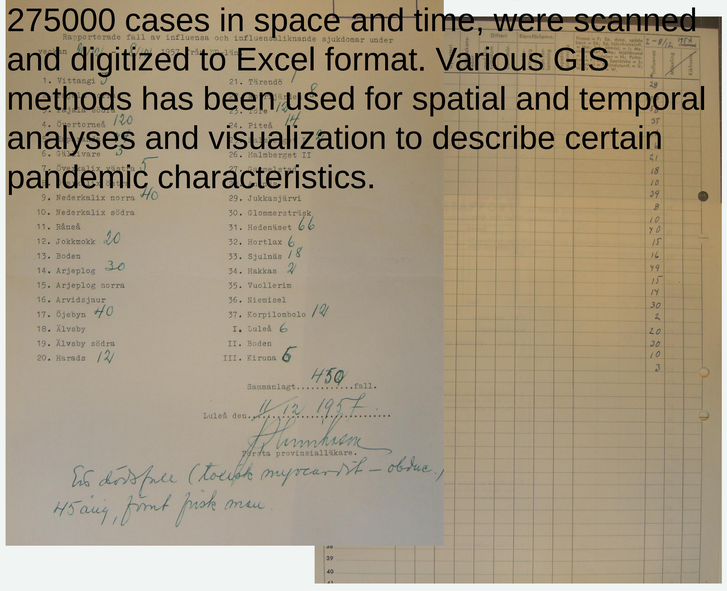
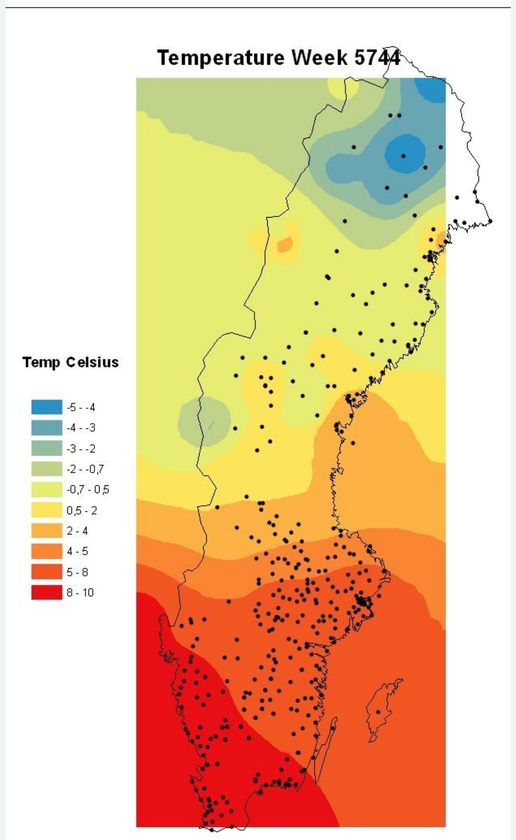
Background

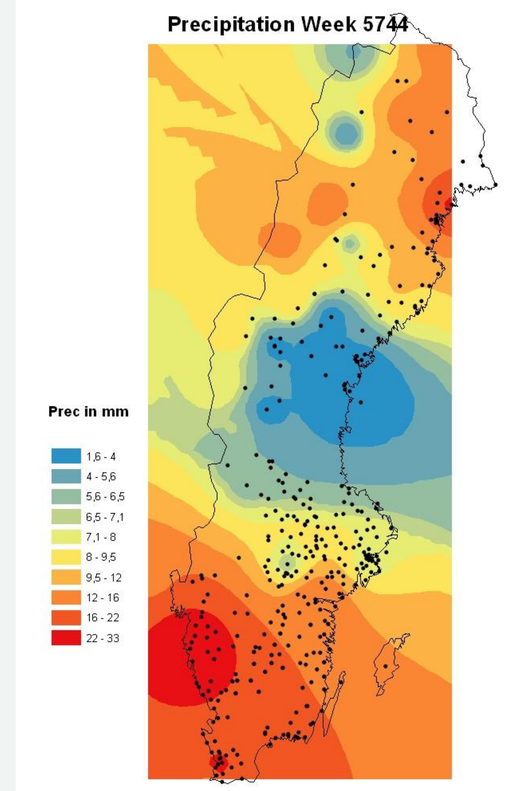
Are there common geographic patterns for spread of pandemics in Sweden? Does weather conditions influence influenza dissemination? Comprehensive data from the Asiatic Influenza in Sweden 1957-58, form questionnaires on the Russian flu 1889 covering around 1 % of the population, and mandatory case reporting of 11001 cases of the pandemic flu 2009 were analysed geographically. The 1957 and the 1889 data were specified as to place of disease, for 2009 only county localisation was available. In 1957, the Swedish Medical Board (Medicinal-styrelsen) asked all general practitioners for information on number of influenza cases on a weekly basis. The data acquired from the reports have been located in the Swedish National Archives. They represent the number of diagnosed cases, reported to the district physicians during the period of June1957 to January1958.

Methods

For all three epidemics, data was geocoded, and the weekly % of total infections per pandemic and week and place was calculated. For the 1957 epidemic, 1200 pages of records from the Swedish Medical Board , describing more than 275000 cases in space and time, were scanned and digitized to Excel format. Various GIS methods has been used for spatial and temporal analyses and visualization to describe certain pandemic characteristics.







Did temperature or/and precipitation influence the dissemination of the Asiatic influenza? Historical daily observations on temperature and precipitation from 39 weather stations, were acquired from the Swedish Meteorological and Hydrological Institute. Mean temperature and accumulated precipitation, for the weather stations, was calculated for each week the Asiatic Flu lasted in Sweden. Using spatial statistics in ArcGIS weekly weather data for all locations with diagnosed cases of influenza (black dots on the maps to the left) could be calculated. The two maps show the weather situation for week 44 in 1957.

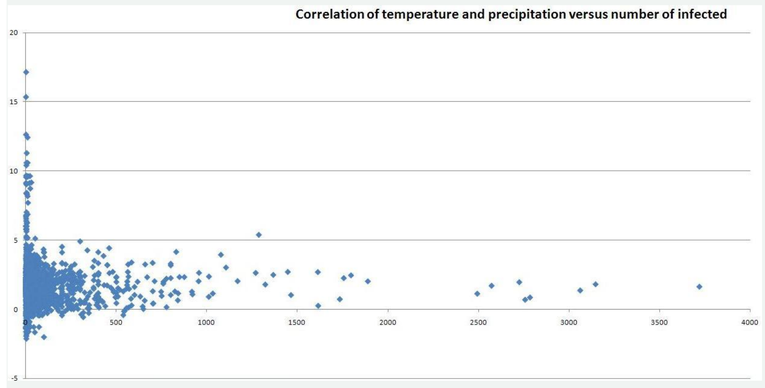
Results

Comparing small places versus larger places, no significant difference regarding the duration of the peak (defined as the time for reporting of 75% of the cases for any place) could be identified.

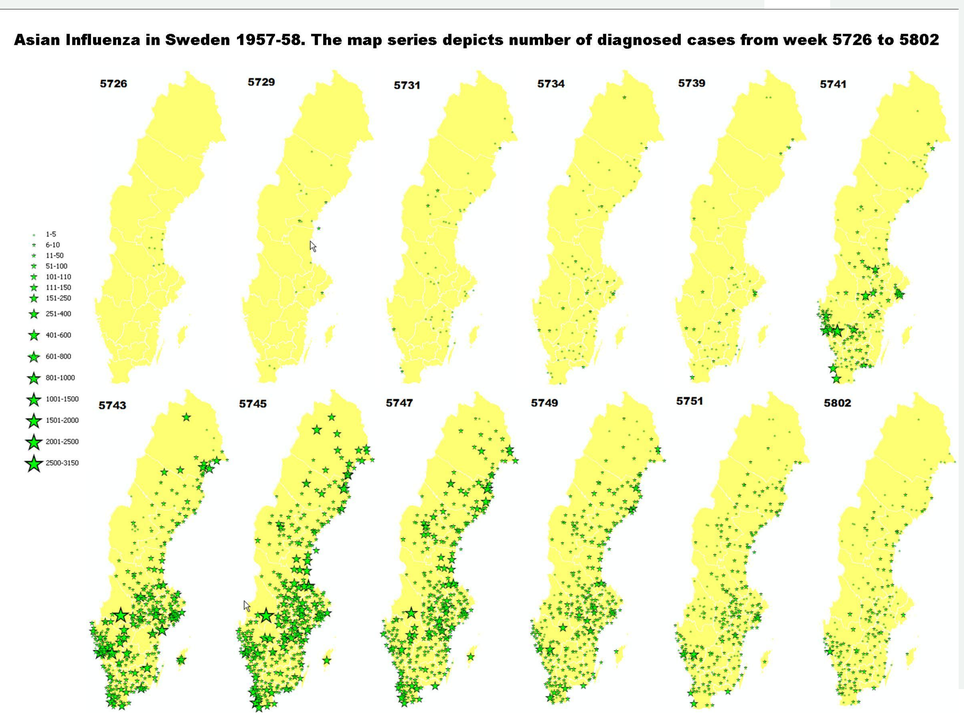
TABLE 1

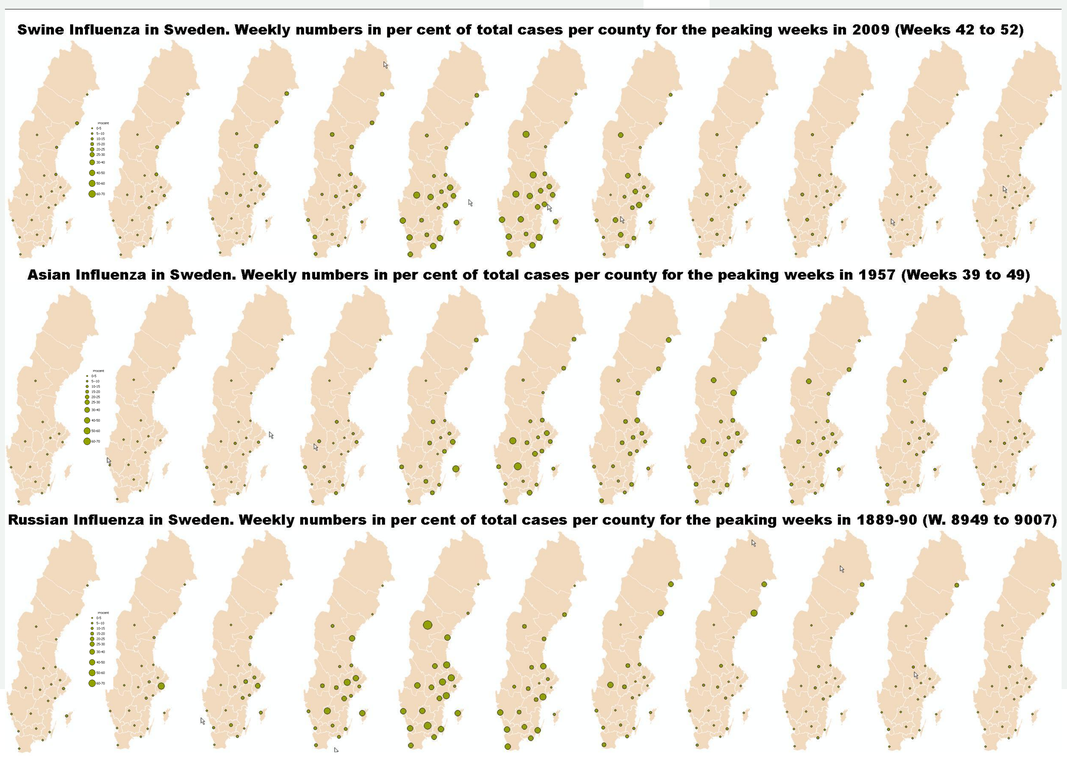
Category	Count	Min	Max	Sum	Mean	STDV
Small	18	3	9	95	5.3	1.76
Big	13	4	7	73	5.6	0.92

There was no correlation found between temperature or/and precipitation versus number of infected a certain week. The reason is probably that the temperature variation is too small.



Three influenza pandemics, assessed in three different ways; the 2009 pandemic from laboratory verified cases, the Asian Influenza 50 years ago, from diagnoses from district physicians and the Russian Influenza 1989 from questionnaire data (ref). The dissemination patterns differ. Especially notable is the early spread in the northern part of Sweden for the recent pandemic, but they all have in common that the duration of the major activity for an influenza pandemic in Sweden has been close to 3 months.





Conclusions

GIS analysis of epidemiological data in combination with meteorological data brings new possibilities to epidemiologists to better understand the nature of influenza dissemination. GIS also provides simple tools to detect common patterns for epidemics in general.

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