Model I – Agent-Based Model for Pandemic Influenza in Egypt

(purpose)

The model was to simulate the spread of influenza novel H1N1 in Egypt to measure the effectiveness of differential control strategies in intervention of the pandemic and thereby provide medical authorities advice on how to contain the pandemic.

(tools & data)

It collected a variety of necessary information and data to realistically simulate the environment, like population data from Egypt census in 2006, characteristics of the disease like infection channels, infection rate given contacting methods in a time-space based context, incubation time, fatality rate, social structure, demographic and geographic data of Egypt etc. and proposed stochastic multi-agent model based on a previous well-known model SIR (Susceptible-Infections-Recovered) recreated the entire populations and vital dynamics at the time of novel H1N1 epidemic in Egypt, it created software program in Java to simulate the model.

(experiment)

Various experimental scenarios have been tried on the simulation in a closed population of 1000 agents with 3 initially infected agents, (i) leaving the agents in non-intervened condition, (ii) increased awareness control strategy in 50% of the population, (iii) population with 50% vaccinated, (iv) population with implemented 50% of social distancing control strategy, (v) quarantining strategy deployed in 50% of the population. In those experiments, the peak of the infected agents and the time it took to reach the peak had been measured.

(recommendation)

The experimental results concealed that proper control measures like vaccination and increased awareness in the population could drastically reduce the infection rate and thus the fatalities, so suggested the healthcare authorities to take the two measures to mitigate the life and economic loss.

(validation)

The model has been validated by comparison the spread trend with SIR model, it revealed that the spreading curve and distribution were analogous in general, and especially similar in the scenarios where SIR were verified of good performance.

Model II – Agent-Based Modelling of COVID-19: Validation, Analysis, and Recommendations – Cognitive Computations

(purpose)

The model was to simulate the spread of COVID-19 in a city to measure the effectiveness of different control strategy in containing COVID-19, including personal strategies and habits like washing hands, touching eyes or mouth, social distancing, self-quarantining, and public strategies like lock down, increasing awareness in the population, vaccination, governmental policies etc. in the purpose to provide healthcare authorities recommendations on what strategies can be implemented to maximize the effectiveness of handling COVID-19 at a minimum impact to people’s lives.

(tools & data)

It probably leveraged ABM tools but not mentioned in the paper, but it used Python3 programming language to program application running on machines with intel core i7-7700, 16 GM RAM, and also on NVIDIA TITAN XP GPU, and even a cloud computing platform Galileo from Hypernet.

(experiments)

It created experimental scenarios based on collective relevant data and assumptions like city’s location-specific data, using demographics of the inhabitants, i.e., education, employment, life expectancy, percentage of individuals having different professions, transportations, and timing and nature of activities performed by the inhabitants. COVID-19 disease specific data has also been taken to simulate the spread, like spreading methods and respective infection rate; physiological data pertinent to individuals were also collected, like probability of a person coughing and sneezing, touching contaminated objects, physical contact with others, etc.

The agents have been divided into 5 categories, i.e., Not-infected, Infected but not contagious neither symptomatic, Infected and contagious but asymptomatic, Infected and contagious and symptomatic, Dead or recovered

(validation)

Experiments had been done based on combinations of parameters mentioned in the first paragraph and the simulation was measured probably by the literal development of the COVID-19.

(recommendation)

In the end, vaccination and rigid control policies were considered to be helpful to prevent the spreading.

[1] - https://arxiv.org/ftp/arxiv/papers/1001/1001.5275.pdf

[2] – https://link.springer.com/article/10.1007/s12559-020-09801-w