Agent-based modeling and random calibration of seasonal influenza: a global approach to the disease.

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Abstract

Seasonal influenza is an endemic infectious respiratory disease that affects 3 to 5 million people and kills between 290,000 and 650,000 people worldwide every year [1]. From the epidemiological point of view, influenza is a very complex disease to analyze due to the multiple factors to be taken into account: the risk of infection depending on the individual characteristics, the seasonality, the heterogeneity of social contacts, the natural or vaccination immunity, etc. [3]. In addition, infection processes have an inherent uncertainty due to its random nature. Faced with this complexity, classical epidemiological models, particularly those based on differential equations, are focused on modeling only one or a few of these factors. However, advances in computational models, such as agent-based models, offer the opportunity to develop more complex models including all aspects of interest simultaneously and obtaining the results from the population level to the individual level [2]. In this work, we propose a new agent-based model of seasonal influenza disease, incorporating the most relevant factors affecting its dynamics and population. Likewise, to demonstrate its applicability, we also propose a random calibration process based on the Particle Swarm Optimization (PSO) algorithm [4] to adjust the model to a real-world scenario: the 2011-2019 influenza reported cases from the Castellón health department (Valencian Community, Spain). Finally, the analysis and discussion of the results will show the advantages of agent-based modeling from a global approach to the disease.

References

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