Mathematical model for fitting multiple epidemic waves of COVID-19 in the Aragon community

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SUMMARY

In this study it is proposed a modified Susceptible-Exposed-Infectious-Removed (SEIR) model (cf. [1]) describes the time behavior of symptomatic, asymptomatic, and hospitalized patients in multiples waves of an epidemic of COVID-19 in Aragon community, taking into account the effect of the demographic evolution. Unlike most of the recent studies where a constant ratio of new individuals is considered, we consider a more correct assumption that the growth ratio is proportional to the total population (cf. [2]). This work aims to propose a model that permits the study of the multiple community outbreaks of COVID-19, using for this purpose a deterministic mathematical model combined with surveillance data to obtain a model capable of describing the multiple waves of contagion observed. The model is fitted to experimental data corresponding to the pandemic evolution in Aragon, showing a proper behavior of infected, accumulated, and recovered patients for 6 epidemic waves. In conclusion, the model seems to be an adequate tool for the study and control of infectious diseases in particular the COVID-19 disease transmission.

Keywords: Mathematical model, COVID-19, disease transmission,...

AMS Classification: 92B05, 37N25

References

[1] MARTCHEVA, M.. *An introduction to mathematical epidemiology.* Springer, 2015.

[2] MENA-LORCAT, J., HETHCOTE, H.W. *Journal of mathematical biology* **30**(7), 693-716, 1992.

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