ANALYSIS OF THE ITALIAN VACCINATION CAMPAIGN AGAINST COVID-19 USING THE SUIHTER MODEL

Nicola Parolini

MOX, Dipartimento di Matematica, Politecnico di Milano
P.zza Leonardo da Vinci 32, 20133 Milano, Italy
`nicola.parolini@polimi.it`

Keywords: *COVID-19, compartmental model, virus variants, vaccination*

The SUIHTER model, originally proposed in [1] and later extended in [2], has been successfully used to analyse the evolution of the COVID-19 epidemics in Italy. Good performances in term of (short term) forecast capabilities have been shown by extensive comparisons with other single-model and ensemble forecasts.

In this talk, we present a generalization of the original SUIHTER model to describe the evolution of multiple virus variants (with specific transmissibility, disease severity, waning immunity) during the progress of the vaccination campaign in Italy. The vaccine model accounts for the different levels of protections that the first, second and third (booster) doses are able to guarantee by reducing the risks of infection, severe illness, hospitalization and death.

Even if the model does not explicitly account for age stratification, some relevant age-dependent effects, such as, for instance, the age heterogeneity in the vaccination campaign, as well as age-specific non pharmaceutical interventions (NPIs), are considered. In particular, an ad-hoc model measuring the impact on the transmission rate of NPIs involving specific age-groups or contexts of exposition is proposed. The model has been used to perform forecast scenario analyses comparing the impact of different NPIs, as well as retrospective what-if scenarios to analyse the impact of the vaccination campaign on the evolution of the epidemic.

This is a joint work with G. Ardenghi, L. Dede', A. Quarteroni and G. Villani.

REFERENCES

[1] N. Parolini, L. Dede', P. F. Antonietti, G. Ardenghi, A. Manzoni, E. Miglio, A. Pugliese, M. Verani and A. Quarteroni, SUIHTER: a new mathematical model for COVID-19. Application to the analysis of the second epidemic outbreak in Italy. *Proc. R. Soc. A.*, 4772021002720210027, 2021.

[2] N. Parolini, G. Ardenghi, L. Dede' and A. Quarteroni. A mathematical dashboard for the analysis of Italian COVID-19 epidemic data. *Int. J. Numer. Meth. Biomed. Engng.*, e3513, 2021.