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NUMERICAL MODELLING OF OPTIMAL VACCINATION STRATEGIES FOR SARS-COV-2

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Since the beginning of the actual COVID19 pandemic the mathematical community has developed sophisticated data-driven methods for real-time descriptions and future previsions of further outbreaks (e.g. [1]). When vaccine drugs have been finally approved by competent authorities around the world, policy makers have planned the vaccination campaign in order to be fast and effective, minimizing risks and economical and social costs.

In this talk, we present recent results obtained by solving optimal vaccination problems based on a new compartmental model (SEIHRDVW), which is completely conceived with the infectious dynamics of the coronavirus pathogen and with the two-dose vaccination campaign as implemented in EU countries. In particular, we control vaccine first and second administrations imposing timing constraints for subsequent doses, alongside with other constraints related to doses availability and maximum daily administration capability. Moreover, we evaluate the impact of vaccine efficacies (on both transmissibility and severe symptoms) and of Non-Pharmaceutical Interventions (NPIs) on the optimal vaccination strategy minimizing deceased and infectious individuals in a fixed timeframe. Finally, we explore the solution of the optimal vaccination problem when an age-dependant epidemic model is employed.

The results presented in this talk have been obtained as part of the activities of the epiMOX research group at Politecnico di Milano.

REFERENCES

[1] Nicola Parolini, Luca Dede', Paola Francesca Antonietti, Giovanni Ardenghi, Andrea Manzoni, Edie Miglio, Andrea Pugliese, Marco Verani and Alfio Quarteroni. *SUIHTER: a new mathematical model for COVID-19. Application to the analysis of the second epidemic outbreak in Italy*. Proc. R. Soc. A. http://doi.org/10.1098/rspa.2021.0027, 2021.