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MODELING TO SUPPORT DECISION-MAKING AGAINST COVID-19: THE ITALIAN EXPERIENCE

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Italy was the first country of the Western hemisphere to experience a catastrophic COVID-19 epidemic in early 2020. Mathematical modelling was used to assist the government in risk assessment and decision-making since the early days. We provide an overview of modelling activities performed in support of epidemic monitoring, public health interventions, and the quantitative evaluation of implemented interventions throughout 2020.

A mechanistic model of SARS-CoV-2 transmission was developed to advice the government on post-lockdown reopening strategies in the spring of 2020 [1]. The model represents transmission in different settings, including eight employment categories and considers occupation-specific integrated risks. It was calibrated against the time series of hospitalized cases and validated against the time-series of Rt and the occupation of intensive and non-intensive hospital wards. Earlier or massive reopening from lockdown would have resulted in disproportionately higher hospitalization incidence. The model was able to correctly project the large COVID-19 wave associated with the fall of 2020.

A modified version of the same model was applied to evaluate the impact of the COVID-19 vaccination campaign in Italy, estimating prospects for returns to pre-pandemic social life under different coverage scenarios [2]. We estimated that by June 30, 2021, COVID-19 vaccination allowed the resumption of about half the social contacts that were recorded in pre-pandemic times. In absence of vaccination, to obtain the same number of cases only about one third of pre-pandemic contacts could have been resumed, with about 12,100 (95%CI: 6,600-21,000) extra deaths (+27%; 95%CI: 15-47%). The future of the epidemic is surrounded by substantial uncertainty. Considering the transmissibility of the Delta variant, a complete return to the pre-pandemic life could be envisioned only with a coverage >90% of the eligible population (i.e., including children from 5 years on).

During the COVID-19 pandemic, the Italian experience of using mathematical modeling in strict collaboration with public health decision makers constituted an important precedent for the improvement of the country's preparedness towards current and future infectious disease threats.

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