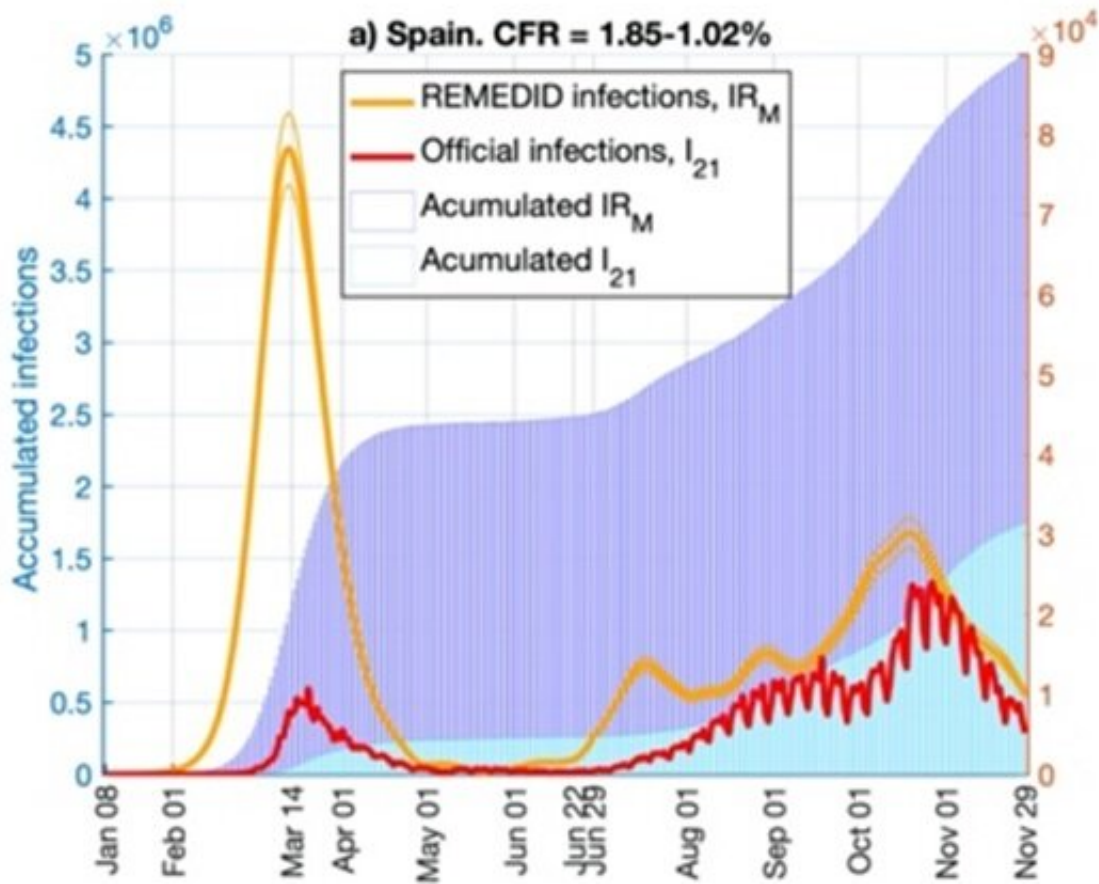


Scientists develop mathematical model to calculate the daily rate of COVID-19 infections

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Credit: Asociacion RUVID

According to their data, published in *Scientific Reports*, the number of

people infected with COVID-19 on the day the state of alert was declared, 14 March 2020, was at least 35 times higher than the number of people registered.

The number of new infections per day is one of the main parameters for understanding the dynamics of an epidemic. However, during the COVID-19 pandemic in 2020, this information has been of low quality, especially during the first months, due to the bias of the official figures because of the insufficient number of diagnostic tests performed. In this context, a multidisciplinary team of researchers from the University of Alicante (UA) and the Carlos III Health Institute (ISCIII) in Madrid has designed a retrospective methodology, called REMEDID (Retrospective Methodology to Estimate Daily Infections from Deaths), capable of estimating daily infections from the number of deaths, a figure documented with greater precision.

This work helps analyze and understand the dynamics of the pandemic and evaluate the efficiency of the measures adopted at different spatial and temporal scales, as explained by the team's coordinator, César Bordehore, Ph.D. in Biology and researcher at the UA Ramón Margalef Institute for Environmental Research.

REMEDID enables the calculation of time series of daily infections from time series of daily deaths. High-fidelity time series of each parameter of an epidemic are crucial to run reliable epidemiological models. We assume that in the early months of a pandemic, official infection data are highly biased downwards, Bordehore insisted.

Data analysis

The team of experts has applied this precise mathematical model to estimated [time](#) series of infections, between 8 January and 29 November 2020, in Spain and its 17 autonomous communities and two autonomous

cities. The results show that the probable infections were between 35 and 42 times more than the official ones on 14 March, when the government decreed national confinement, David García said, professor in the UA Department of Applied Mathematics and first author of the article.

According to this work, the first [infection](#) in Spain could have occurred between 8 and 9 January 2020, some 43 days before the official records during the first wave. "Serology studies conducted by the Instituto de Salud Carlos III have given us a realistic estimate of the total number of infections, showing that the official data were underestimated. The REMEDID methodology complements these studies by reconstructing the temporal evolution of these infections, García reported.

Also, national lockdowns had an immediate effect on virus transmission, as shown by the rapid decline in the slope around 14 March. This immediacy in the decline of transmission (the epidemiological R) was not seen in the official data on the number of infected people.

This methodology is useful for refining models and improving understanding of the dynamics of the pandemic, including the effectiveness of different measures taken to flatten the curve and design safe post-lockdown measures. More realistic and accurate models could be obtained by using a more reliable daily [number](#) of infections provided by REMEDID, which, in turn, would improve the output of the models and improve comparisons of different transmission-slowing measures, Bordehore said.

More information: David García-García et al, Retrospective methodology to estimate daily infections from deaths (REMEDID) in COVID-19: the Spain case study, *Scientific Reports* (2021). [DOI: 10.1038/s41598-021-90051-7](https://doi.org/10.1038/s41598-021-90051-7)

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