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Título: Some features linking modelling and epidemics data for different stages of COVID-19 in Brazil

Resumo:

There are different stages of COVID-19 epidemics around the world since March 2020: the first wave of SARS-CoV-2; the entrance of variants, such as gamma, delta and omicron, leading to other waves; the vaccination, whose start of application varies for each country; in Brazil, the vaccination starts at the beginning of 2021 when the variants have been circulating. In order to observe the dynamics of the first wave of COVID-19, in a previous work [1], we consider an epidemics model considering variation of the transmission with time due to assumption of more restricted or less restricted sanitary measures, which was applied to the epidemics in Brazil [2]. In this talk, we show that the initial growth of cumulative number of COVID19 cases due to SARS-CoV-2 obeys a q-exponential function with q varying from 0.4 to 1.4 in Brazilian states; the time interval corresponds, for each state and its capital, from the day when the first case was notified until the date of first change of transmission rate, revealing that the derivative of cumulative cases in relation to time, at this stage, depends on a power law of number of cases which maybe associated with heterogeneous infectivity [3]. Motivated by the analysis of heterogeneous infectivity, we consider a SIRtype model for which each susceptible individual may have a trace that defines how he/she interacts with the infectious ones (associated with his/her immunity, social behavior and so on); assuming gamma probability distributions for susceptibility with different averages and variances, depending on the phase of the epidemics, we obtain a modified SIR model whose nonlinear term scales with a power law of the number of susceptible individuals [4]. Applying it to the states of Brazil until September 2020, in the Northeast region, the measured values of Gamma distribution's averages are smaller than in other regions, besides the progressive reduction in the considered intervals. Finally we generalize the model of [1] taking into account the vaccine and representing the action of variants by the time variation of transmission rate. In the case of Bahia's state, we applied the model from January 2021 to September 2021, that cover the waves associated with gamma and delta variants; besides fitting epidemics data, we obtain the reproduction number and measure the effect of increasing vaccination rate and vaccine efficacy on the number of cases and deaths. It is a multidisciplinary research whose team is composed by under-graduated and graduated students as well as researchers of IF-UFBA, EP-UFBA, IFT-UNESP, CIDACS-FIOCRUZ-BA.