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Backward bifurcation et analyse de stabilité des équilibres d?un modèle de transmission de la COVID-19 avec réinfection

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We consider a system of five ordinary differential equations describing COVID-19 transmission when both asymptomatic and symptomatic infectious individuals reinfect recovered individuals. We have exhibited that the probability of an incubated individual recovering, p_r, or death probability p_d, and the weighted average of secondary cases of reinfection generated by an initial infectious case introduced into a class of recovered individuals during its effective infectious period, α, govern the existence and local stability of an endemic equilibrium for certain values of the basic reproduction number R_0. Indeed, we have shown that if $p_r\alpha + p_d > 1$, an unstable endemic equilibrium exists when $R_0 \ll 1$. But, when $p_r\alpha + p_d < 1$, $R_0 > 1$ and R_0 close to 1, there exists a locally asymptotically stable endemic equilibrium. Furthermore, we have shown that the disease-free equilibrium is globally asymptotically stable for the model when the basic reproduction number is below a threshold value ξ such that $R_0 < \xi < 1$. Finally, we have performed a sensitivity analysis of the model to assess the impact of the associated parameters on the COVID-19 epidemic and numerical simulations to support the theoretical results.