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Modelling of the Spread of MERS-CoV

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Middle East Respiratory Syndrome Coronavirus (MERS-CoV) has been persistent in the Middle East region since 2012. Abundant scientific evidence showed that dromedary camels are the primary host of the virus. Majority of human cases (i.e. 75% or 88%) are due to human-to-human transmission, while the others are due to camel-to-human transmission. Mathematical modelling of MERS-CoV camel-to-camel transmission was lacking. Using the plug-and-play likelihood-based inference framework, we fitted a susceptible-exposed-infectious-recovered-susceptible model of camels to the reported human cases with a constant proportion of human cases from camels (i.e. either 25% or 12%). We considered two scenarios: (i) the transmission rate among camels is time-varying with a constant spill-over rate from camels to human, or (ii) the spill-over rate is time-varying with a constant transmission rate among camels. Our estimated loss-of-immunity rate and prevalence of MERS-CoV infections among camels largely matched previous serological or virological studies, shedding light on this issue. We recommended including dromedary camels in animal surveillance and control of MERS-CoV in Saudi Arabia which could help reduce their sporadic introductions to humans.

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