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Fractional differential equation models for disease dynamics: hepatitis B-virus with two-age structures as an example

I will start with a brief introduction to the fractional calculus and the use of fractional differential equations (FDEs) in different areas including in modelling infectious diseases. I will then consider our work on a fractional order model of hepatitis B virus transmission dynamics with two-age structures under vaccination. In this work, some qualitative properties of the model are presented followed by a numerical simulation to investigate the effect of memory on hepatitis B disease dynamics by varying order of derivatives and to simulate the effects of vaccinating newborns immediately after birth, vaccinating children, and adult vaccination. Then, we compared their effects on hepatitis B disease dynamics in the sense of control. It is observed that the number of infective individuals decreases faster and even falls to zero over the long run for the model with memory than the memory-less model. Comparing results between vaccination of different ages show that increasing newborn vaccination immediately after birth has the highest effect on hepatitis B disease control.