Effect of non-Gaussian fluctuations on the spreading time of a SWIR epidemic model.

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A few years ago, there happened a big controversy on the scaling behavior of the golden time required to reach a entire outbreak on inter-dependent (ID) networks. At the transition point, the average cascade time $\langle t_c \rangle$ scales with the system size N as $\langle t_c \rangle \sim N^{\zeta}$. The exponent ζ was a controversial issue. It was argued in Zhou *et al.* (PRE 90, 012803) $\zeta = 1/4$. On the other hand, in Grassberger (PRE 91, 062806), it was argued that the exponent value $\zeta = 1/4$ is incorrect, but rather 0.280 after extensive simulations. Resolution or even finding the origin of this discrepancy seemed to be difficult thus far.

In our study, we find that ζ for several other cascade dynamics models such as SWIR model, k-core percolation, and the threshold model of Watts are also measured to be slightly larger than 1/4. In the framework of SWIR model, which is also known as a generalized epidemic model, we found that non-Gaussian distribution of the finite-size fluctuation is majorly responsible for ζ being larger than 1/4. We also confirmed that this is true for the case of k-core percolation too. However, due to the decreasing asymmetry of the non-Gaussian distribution for larger systems, it remains open whether or not ζ reduces to 1/4 in the asymptotically large-N limit. †.

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