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In this paper, we applied stochastic methods to influenza transmission models, the 2009 H1N1 influenza transmission dynamics in Korea. Gillespie's stochastic simulation algorithm (SSA) is one of well-known exact simulation methods. But since the epidemic model includes large population size and fast infection process, the SSA has the low efficiency caused by the Monte-Carlo procedure. However, the moment closure method (MCM) shows reduced computational time and efficient costs with the accuracy. We also present simulation results that there is a considerable discrepancy between the results of stochastic and deterministic models especially when a number of initial infectious individuals is small. (Received September 20, 2016)