Lv, Jinlong; Guo, Songbai; Cui, Jing-An; Tian, Jianjun Paul
Asymptomatic transmission shifts epidemic dynamics. (English) Zbl 1471.92329

Summary: Asymptomatic transmission of infectious diseases has been recognized recently in several epidemics or pandemics. There is a great need to incorporate asymptomatic transmissions into traditional modeling of infectious diseases and to study how asymptomatic transmissions shift epidemic dynamics. In this work, we propose a compartmental model with asymptomatic transmissions for waterborne infectious diseases. We conduct a detailed analysis and numerical study with shigellosis data. Two parameters, the proportion $p$ of asymptomatic infected individuals and the proportion $k$ of asymptomatic infectious individuals who can asymptotically transmit diseases, play major rules in the epidemic dynamics. The basic reproduction number $R_0$ is a decreasing function of parameter $p$ when parameter $k$ is smaller than a critical value while $R_0$ is an increasing function of $p$ when $k$ is greater than the critical value. $R_0$ is an increasing function of $k$ for any value of $p$. When $R_0$ passes through 1 as $p$ or $k$ varies, the dynamics of epidemics is shifted. If asymptomatic transmissions are not counted, $R_0$ will be underestimated while the final size may be overestimated or underestimated. Our study provides a theoretical example for investigating other asymptomatic transmissions and useful information for public health measurements in waterborne infectious diseases.

MSC: 92D30 Epidemiology

Keywords: asymptomatic transmission; basic reproduction number; final size

Full Text: DOI

References:

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.