On the critical behaviour of simple epidemics

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SUMMARY

We show how ideas and models which were originally introduced to gain an understanding of critical phenomena can be used to interpret the dynamics of epidemics of communicable disease in real populations. Specifically, we present an analysis of the dynamics of disease outbreaks for three common communicable infections from a small isolated island population. The strongly fluctuating nature of the temporal incidence of disease is captured by the model, and comparisons between exponents calculated from the data and from simulations are made. A forest-fire model with sparks is used to classify the observed scaling dynamics of the epidemics and provides a unified picture of the epidemiology which conventional epidemiological analysis is unable to reproduce. This study suggests that power-law scaling can emerge in natural systems when they are driven on widely separated time-scales, in accordance with recent analytic renormalization group calculations.