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Letter to Editor

Growth Factor: an Important Factor in Determining the Fate of Outbreaks

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ABSTRACT

Introduction: Epidemic curves are a type of time series data consisting of the number of events that occur over a period of time. The time unit in this data can be a day, a week, or a month, etc.
Methods: In the current letter, the authors tried to explain the growth factor and its effect on epidemic curves by using some literature.
Results: In the outbreaks setting, the number of cases can increase with different patterns. When the number of cases is increasing exponentially, it means that the number of cases is increasing at a certain speed, which is determined by a factor called an exponential growth factor. When this factor is greater than one, it means that the cases are increasing exponentially, and when this coefficient is equal to 1, it means that we have reached an inflection point that we will face a change in the growth rate of the cases.
Conclusion: Some factors such as reducing the contact between infected and healthy people, run the social distancing program, and so on can have an effective role in decreasing epidemic growth factor and controlling the epidemic.

Epidemic curves are a type of time series data consisting of the number of events that occur over a period of time. The time unit in this data can be a day, a week, or a month, etc. It is an important indication for the potential spread of an epidemic as a function of time (1). In the outbreaks of infectious diseases, it is important to consider not only the number of cases but also the rate at which the number of cases is increasing this rate is called Growth Rate (GR). In fact, Growth rates refer to the percentage change of a particular variable within a specific period. GR is a fundamental criterion for understanding and monitoring the outbreak situation (2). This is because a high GR could lead to an increase in the number of cases, even if the current number of cases is low compared to other diseases. In the outbreaks setting, the number of cases can increase with different patterns. When the number of cases is increasing exponentially, it means that the number of cases is increasing at a certain

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speed, which is determined by a factor called an exponential growth factor. This factor is affected by the occurrence of new cases every day. These new cases themselves are affected by the average number of people infected by exposure to other people (Basic Reproductive Number=R0) and the probability that any exposure will cause infection. The growth factor can also be used to infer the value of R01. It shows how fast the number of new cases of the disease is going up or down. In an epidemic, there is an initial stochastic phase followed by exponential growth continuing until the number of the non-susceptible persons becomes large. So the growth factor is an important factor during the epidemic period, which is calculated from the following formula:

$$\text{Growth factor} = \frac{\text{number of new cases in one dey}}{\text{number of new cases in previous day}}$$

When this factor is greater than one, it means that the cases are increasing exponentially, and when this coefficient is equal to 1, it means that we have reached an inflection point that we will face a change in the growth rate of the cases. That means we are moving from the rapid growth of cases to slow growth[1]. The Exponential Growth of cases using the growth factor is calculated using the following formula:

Exponential Growth (y) = a * (1 + r) n (3)

Where a presents the current number of cases, r is the growth rate and n is the time interval.

For example, if the current number of cases was 30,000, and the growth factor of cases was 1.15, the number of cases will reach about 151 million in the next 61 days at a rate of 15% of daily exponential growth. But if the growth rate drops to 5% (1.05) in the next 61 days, we will have a little more than 588,000 cases. Whenever one wants to compare the growth factor reported by different countries, one should pay attention to the fact that the same amounts reported from different populations can have different meanings depending on the severity of the outbreak in that population and the stage of the epidemic. For example, a growth factor of 0.9 in a population with thousands of new cases each day represents a problem. On the other hand, a growth factor of 0.9 in a population where new daily cases are low represents a better situation. Growth rates are very important right now. The growth rate lower than 1 indicates a better situation. This factor can be affected by different factors such as the level of contact between the populations. In other words, taking measures such as reducing the transportation of people such as traveling, perform to programs such as social distancing and reducing the entry of infected people into suspect populations, as well as reducing the exposure between infected people and healthy people, can beneficial in decreasing of this factor and controlling the epidemic.

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