



Letter to Editor/Carta ao Editor

SARIMA for predicting the cases numbers of dengue

SARIMA para predição do número de casos de dengue

Viroj Wiwanitkit¹

Dear Editor:

The recent report by Martinez on predicting the number of cases of dengue based on SARIMA is very informative¹. I have some concerns on this work. First, this work is very similar to another publication by Martinez et al. on using same technique approach for studying². Only a different in setting can be observed. The two works might be a salami publication. Second, the prediction is based on the retrospective data which might not be useful for future prediction in actual life. Due to the rapid change in environmental factors at present, especially for the climate change and global warming, the model might not be effective. The adjustment based on the temperature prediction might be additional helpful. Climatological parameters are required to be implemented in using SARIMA for prediction of the epidemic³.

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Response to letter to the editor: simple statistical models can provide good predictions of dengue incidence

Resposta à carta ao editor: modelos estatísticos simples podem trazer boas predições da incidência da dengue

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Dear Editor,

We thank Professor Wiwanitkit for his interest in our research on forecast models for dengue incidence^{1,2}. We are glad for the opportunity to clarify some important points of our research.

First, Professor Wiwanitkit has argued that two articles produced by our research group might be a salami publication. *Salami-slicing* denotes a type of research misconduct that consists of dividing the results of a research project into a series of articles to maximize the number of publications^{3,4}, and we strongly disagree that our articles^{1,2} are an example of this bad practice. Each of these articles tells its own story, although they present a discussion of the use of the same data analysis strategy. Further, each article deals with different data sets obtained from two different municipalities, evidencing that these localities have different temporal patterns of dengue incidence, and summarizing all these results into a single article would result in a great loss of information and details.

Second, he has stated that the prediction is based on the retrospective data, which might not be useful for future prediction in actual life due to the current rapid change in environmental factors. However, we believe that the high volatility observed in some periods of the time series are primarily due to the introduction and reintroduction of different virus serotypes in a susceptible population, and the results of our articles suggest that the model fits the data adequately, despite the occurrence of this phenomenon within the studied period^{1,2}. In addition, the out-of-sample predictions generated by the SARIMA models are close to the observed values, suggesting that the model is useful and accurate for forecasting purposes.

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Article/Artigo

A SARIMA forecasting model to predict the number of cases of dengue in Campinas, State of São Paulo, Brazil

Um modelo SARIMA para predição do número de casos de dengue em Campinas, Estado de São Paulo

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ABSTRACT

Introduction: Forecasting dengue cases in a population by using time-series models can provide useful information that can be used to facilitate the planning of public health interventions. The objective of this article was to develop a forecasting model for dengue incidence in Campinas, southeast Brazil, considering the Box-Jenkins modeling approach. **Methods:** The forecasting model for dengue incidence was performed with R software using the seasonal autoregressive integrated moving average (SARIMA) model. We fitted a model based on the reported monthly incidence of dengue from 1998 to 2009, and we validated the model using the data collected between January and December of 2009. **Results:** SARIMA (2,1,2)(1,1,1)₁₂ was the model with the best fit for the data. This model indicates that the number of dengue cases in a given month can be estimated by the number of dengue cases occurring one, two and twelve months prior. The predicted values for 2009 are relatively close to the observed values. **Conclusions:** The results of this article indicate that SARIMA models are useful tools for monitoring dengue incidence. We also observe that the SARIMA model is capable of representing with relative precision the number of cases in a next year.

Keywords: Dengue. SARIMA. Time series analysis. Statistics.

INTRODUCTION

Dengue is a disease of great importance for public health in tropical and sub-tropical areas of the world. The disease is transmitted by the bite of infected *Aedes* mosquitoes, and its symptoms, which include headache and muscle and joint pain, are very similar to those of fever-causing illnesses. It is estimated that between 50 and 100 million cases of dengue fever occur each year¹, and about two-thirds of the world's population live in areas infested with dengue vectors². In the first decade of the 21st century Brazil ranked among the countries with the highest dengue incidence in the world³. In Brazil, more than three million cases were reported from 2006 to 2009, comprising approximately 70% of reported dengue fever cases in the Americas⁴.

Dengue can be caused by any of the four serotypes of dengue virus, designated DEN-1, DEN-2, DEN-3, and DEN-4. In Brazil, the first laboratory-confirmed dengue outbreak was reported in 1981-1982 in the State of Pernambuco⁵, and no further dengue activity was reported until 1986 with the introduction of DEN-1 in the State of Rio de Janeiro⁶. The DEN-2 serotype was introduced in 1990 in Rio de Janeiro during a period of DEN-1 serotype circulation⁷. In the following years, the DEN-2 serotype spread to other Brazilian regions, with mass seroconversion events⁸. In 1994, DEN-3 virus was introduced in the Americas after an absence of 16 years, and in 2000, it was introduced in Rio de Janeiro, causing a large epidemic of dengue fever⁹. The first report of DEN-4 in Brazil was in the State of Roraima in 1992¹⁰.

Mathematical and statistical models can provide substantial contributions to the understanding of the dynamics of dengue transmission and the trends of growth in the number of cases of the disease. Recently, statistical tools such as time series analysis¹¹⁻¹³ have been used by several authors to describe and forecast the number of cases of dengue in specific populations¹⁴⁻¹⁷. Among these models, the seasonal autoregressive integrated moving average

Introdução: A predição do número de casos de dengue em uma população utilizando modelos de séries temporais pode trazer informações úteis para um melhor planejamento de intervenções públicas de saúde. O objetivo deste artigo é desenvolver um modelo capaz de descrever e prever a incidência de dengue em Campinas, sudeste do Brasil, considerando a metodologia de Box e Jenkins. **Métodos:** O modelo sazonal autorregressivo integrado de média móvel (SARIMA) para os dados de incidência de dengue em Campinas, foi implementado no programa R. Ajustamos um modelo baseado na incidência mensal noticiada de dengue de 1998 a 2009 e validamos os dados de janeiro a dezembro de 2009. **Resultados:** O modelo SARIMA (2,1,2)(1,1,1)₁₂ foi o modelo com o melhor ajuste. Este modelo indica que o número de casos de dengue em um dado mês pode ser estimado pelo número de casos ocorridos há um, dois e doze meses. Os valores previstos para 2009 são relativamente próximos aos valores observados. **Conclusões:** Os resultados deste artigo indicam que os modelos SARIMA são ferramentas úteis para o monitoramento da incidência da dengue. Observamos ainda que o modelo SARIMA é capaz de representar com relativa precisão o número de casos de dengue em um ano consecutivo a partir de dados de um ano anterior.

Palavras-chaves: Dengue. SARIMA. Análise de séries temporais. Estatística.

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