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Web-Based Decision Support System for Diagnosis of Ebola Virus Disease Using Bayesian Networks

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ABSTRACT

The recent epidemic of the Ebola Virus Disease (EVD) left many dead in West Africa and in other parts of the world. A major problem faced was late diagnosis or diagnostic error of the disease; this was due to largely unavailability of medical professionals familiar with the disease and low doctor to patient ratio. An accessible method for reliable diagnosis is required to offset the low ratio of doctors to population. This paper presents the application of Bayesian networks for diagnosis of EVD. A general procedure for implementing a Bayesian network model is proposed; thereafter we demonstrate how the resulting Bayesian network can be applied in a medical diagnostic decision support system. The system uses the questionnaire method to elicit symptoms and is accessible through web browsers over the internet and mobile phones to potential patients and medical practitioners. The system developed is able to provide diagnosis in the form of probabilities, for the presence or absence of EVD in an individual. The probability of an individual infected by the disease depends on present or absent of particular symptoms according to the gathered disease pathology. The system was successfully developed, and had a diagnostic accuracy of 77% when compared to the World Health Organization (WHO) algorithm, but refinements of the conditional probability distribution would provide the most accurate sensitivity to symptoms and also improve the accuracy of diagnosis. Finally, web functionality, performance and usability test on the developed web application is carried out by simulating various load patterns and the result was generally acceptable.

Keywords: Artificial Intelligence, Bayesian network, Expert systems, Diagnosis, Ebola Virus disease

Aims Research Journal Reference Format:
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1. INTRODUCTION

EVD is a severe, often fatal illness in humans, with a fatality rate of 90% for all infected. Since it was first discovered and named after a river in the Democratic Republic of Congo (formerly Zaire) in 1976, there has been regular outbreaks of the various Ebola strains which were conferred to a particular geographical area, but the 2014 epidemic was the most devastating covering many West African countries, US and Europe (Centers for Disease Control and Prevention, 2015). This was mainly due to easier human movement within and across borders to other countries. The virus is the most virulent and belongs to the family Filoviridae which was responsible for the recent epidemic in West Africa (Centers for Disease Control and Prevention, 2015). The first outbreaks of Ebola is reported to have occurred in remote villages in Central Africa, in regions where tropical rainforests are present and it infected over 318 people in Zaire, with a mortality rate of 88%.