



A mathematical model of hepatitis E virus transmission and its application for vaccination strategy in a displaced persons camp in Uganda

Hossein Kheiri Ph.D.

University of Tabriz

Morteza Zereh Poush *

University of Tabriz

Parvaneh Agha Mohammad Zadeh

University of Tabriz

Abstract

Hepatitis E virus is an enterically transmitted disease that mainly effects people in developing countries. The dynamics and the factors causing outbreaks of these diseases can be better understood using mathematical models, which are fit to data. Here we investigate the dynamics of a Hepatitis E outbreak in internally displaced persons (IDP) camps in Sudan and Uganda during 2007 to 2009. We use the data to determine that R_0 is approximately 2.25 for the outbreak. Secondly, we use a model to estimate that the critical level of latrine and bore hole coverages needed to eradicate the epidemic is at least 16% and 17% respectively. Lastly, we further investigate the relationship between the co-infection factor for Malaria and Hepatitis E on the value of R_0 for Hepatitis E. Taken together, these results provide us with a better understanding of the dynamics and possible causes of Hepatitis E outbreaks.

Keywords: Mechanistic models, Dynamic models, Reproduction number

Mathematics Subject Classification [2010]: 37N25, 92B05

1 Introduction

HEV is classified in the genus Hepevirus of the family Hepeviridae. Outbreaks of diseases such as Avian Influenza, SARS and West Nile Virus have alerted us to the potentially grave public health threat from emerging and re-emerging pathogens [2, 3]. The recent outbreak of Hepatitis E in northern Uganda, has left many dead and a number of infectives that continue to spread the infection. Hepatitis E is caused by infection with the Hepatitis E virus (HEV) which has a fecal-oral transmission route. The Kitgum outbreak, which we study here, has been linked to contaminated water or food supplies. Another possible factor that could be implicated in the outbreak of Hepatitis E is its possible relationship with Malaria. Malaria has been shown to disarm the immune system and increase susceptibility to viral infections such as HIV. Recently, in a 3-month follow-up study the pattern of co-infection of Plasmodium falciparum Malaria and acute Hepatitis

*Speaker