Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **27 (2020)** 351-374
 http://www.watam.org

DYNAMICAL STUDY OF SVIRB EPIDEMIC MODEL FOR WATER-BORNE DISEASE WITH SEASONAL VARIABILITY

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Abstract. Seasonal change is likely to increase water borne disease incidence worldwide according to environmental conditions. Mathematical models need to represents this seasonality to be able to make more realistic predictions about spread and control of water-borne epidemic. In this paper, we present a mathematical model to understand the transmission dynamics of water-borne disease using system of non autonomous differential equations. The model incorporates seasonal variations which is related to the disease transmission rate between pathogen to human, the growth rate of pathogen population due to environmental deterioration and decay rate of pathogen population. A threshold condition in terms of $R_C(t)$ is obtained to account for the extinction or the persistence of the disease. The relative importance of system parameters for disease transmission and prevalence is discussed using sensitivity analysis. Numerical simulation have been carried out to illustrate our analytical results and shows the effectiveness of the different control strategies.

Keywords. Water-borne disease; Seasonality; Time dependent reproduction number; Pathogen-control; Periodic steady state.

1 Introduction

Transmission of water-borne diseases are associated with seasonality, environmental deterioration, bacterial virulence, and host immunity. The increase in water-borne disease occurrence is subject to climate change and in extreme weather conditions, its severity and frequency of disease outbreaks increases further. Water-borne diseases such as cholera and other intestinal diseases may pose significant threat to the target population due to periodic seasonal growth of bacterial population. As per the World Health Organization data,