

## OPTIMAL CONTROL MODEL FOR BLINDNESS DUE TO DEFICIENCY OF VITAMIN-A

Nita H. Shah<sup>1</sup>, Bijal M. Yeolekar<sup>2</sup>, Zalak A. Patel<sup>3</sup>

<sup>1</sup>Department of Mathematics  
Gujarat University, Ahmedabad, 380009, Gujarat, India

<sup>2</sup>Department of Mathematics and Humanities  
Nirma University, Ahmedabad, 380009, Gujarat, India

<sup>3</sup>Department of Mathematics  
L. D. College of Engineering, Ahmedabad, 380015, Gujarat, India

**Abstract.** Blindness is diminishing of optical ability to see. It is due to damage in some portion of eye, optical nerve and the core area of mind responsible for visualisation. The main cause of blindness is deficiency of vitamin-A in an individual. Many prevention programmes are organized worldwide to control the blindness. The non-linear mathematical model is formulated with the relation between three compartments viz. Healthy, vitamin-A deficiency and blind individual in the population. Two conflicted controls for optimization of the model are discussed. On one hand, increasing the consumption of vitamin-A in the deceased decreases the treatment and complaining for blind people on the other side in the society. The basic reproduction number is calculated to see the epidemic behavior of the model. The stability analysis is carried out. We optimize model with maximize consumption of vitamin-A to minimize the blindness. The maxmin- criteria is used for optimal controls which are functions of time. Numerical simulation and analysis support the analytical results for optimal control in the model.

**Keywords.** Dynamical system, Vitamin-A deficiency, Blindness, Basic reproduction number, Stability, Optimum control

## 1 Introduction

Blindness is the most dangerous disease on the globe. Blindness is visual impairment in the people. The visual impairment may cause individual complications with normal daily activities such as reading, writing, driving, socializing, and walking. There are many causes for blindness like deficiency of vitamin-A, uncorrected refractive errors, cataracts, glaucoma, accidents, injuries in eye, blockage of blood vessel and complication in pre - matured birth etc. [5] discussed on the global prevalence of blindness in children and control priorities of it. 1.8 billion children are blind in the world due to deficiency of vitamin-A and measles. The world health organization report [12] said that 285 million people who were visually damaged of which 246 million had low visualization and 39 million were blind in the world