GLOBAL STABILITY OF A 9-DIMENSIONAL
HSV-2 EPIDEMIC MODEL

Dedicated to Professor Freedman on the Occasion of his 70th Birthday

ZHILAN FENG, ZHIPENG QIU AND ZI SANG

ABSTRACT. This paper focuses on the global stability of a 9-dimensional epidemiological model for the transmission dynamics of HSV-2. The model incorporates heterosexual interactions in which a single male population and two groups of female populations with different activity levels are considered. The method of global Lyapunov functions as well as the LaSalle Invariance Principle are used to show that the basic reproduction number provides a sharp threshold which completely determines the global dynamics of the model. That is, in the case when the production number is less than or equal to one, the disease-free equilibrium is globally asymptotically stable; whereas in the case when the reproduction number is greater than one, a unique endemic equilibrium is globally asymptotically stable in the interior of the feasible region and the disease will persist at the endemic equilibrium if it is initially present.

1 Introduction HSV-2 is a double-stranded DNA virus that almost exclusively infects the genital region, and has been recognized as the most common cause of genital ulcer disease [2]. An estimated 16.2%, or about one out of six Americans 14 to 49 years of age have genital HSV-2 infection [5]. In developing countries, the prevalence of infection is as high as 40–60% [3]. Due to the facts that the virus has a very high transmission rates and that a lifelong infection of its host is very common, the prevalence of HSV-2 infections has had a great impact on human health globally [5]. More significantly, studies have suggested that the genital HSV-2 infection may facilitate HIV transmission [8, 9, 29]. This has motivated an extensive use of mathematical models for understanding the transmission dynamics of HSV-2 ([3, 8, 23, 24] and references

This work was supported by NSFC grants (Nos. 61174038 and 61104064),

Keywords: HSV-2, global stability, Lyapunov functions, LaSalle Invariance Principle.

Copyright ©Applied Mathematics Institute, University of Alberta.