Mathematical Modelling of Cervical Cancer Incorporating Protection Against Infection

Jacinta M. Mutwiwa
Department of Mathematics Kibabii University, Kenya

Abstract:

Cervical cancer caused by human papillomavirus (HPV) has attracted more attention due to its social economic ramifications and its complex behavior. Even with the introduction of routine screening programs and vaccination, the disease prevalence remains high especially in Sub-saharan Africa. However, Cervical cancer is a major preventable public health problem. Due to the high cost of treatment, protection against the infection may be preferable in scarce resource settings. In this paper a deterministic mathematical model for cervical cancer incorporating protection is considered. Specifically the model considers maximum protection against the infection. The model is shown to be positively invariant as well as bounded. The endemic states are shown to exist provided that the reproduction number is greater than unity $R0 > 1$. By use of Routh-Hurwitz criterion and suitable Lyapunov functions, the endemic states are shown to be locally and globally asymptotically stable respectively. This implies that disease transmission levels can be kept quite low or manageable with minimal deaths at the peak times of the re-occurrences. Numerical simulations indicate that enhanced protection against the disease lowers new incidences and hence low disease prevalence rates. Therefore, public awareness campaign efforts on protective measures against cervical cancer should be enhanced.

Keywords:

Protection, cervical cancer, Human papilloma Virus, Reproduction Number.