Assessing the Impact of Two-Dose Varicella Vaccination on Varicella and Herpes Zoster Incidences in the Republic of Korea

Jiyeon Suh\textsuperscript{1}, Sun Hee Park\textsuperscript{2} and Jeehyun Lee\textsuperscript{3}

1) School of Mathematics and Computing (Computational Science and Engineering), Yonsei University, Seoul 03722, KOREA
2) Division of Infectious Diseases, Department of Internal Medicine, College of Medicine, The Catholic University of Korea, Seoul 06591, KOREA
3) School of Mathematics and Computing (Mathematics), Yonsei University, Seoul 03722, KOREA

Corresponding Author: Jeehyun Lee, ezhyun@yonsei.ac.kr

ABSTRACT

Varicella-zoster virus (VZV) causes two different diseases, varicella and herpes zoster (HZ), known as chickenpox and shingles, respectively. At the first infection, VZV develops varicella which commonly occurs in childhood. After the primary infection, VZV becomes latent and can reactivate, resulting in HZ as the immunity weakens with age. One-dose varicella vaccination was introduced in the national immunity program of Korea in 2005, and it has significantly reduced varicella incidence. However, the varicella outbreak constantly occurs in the group of children who has been vaccinated.\textsuperscript{[1]} Therefore, a two-dose schedule is under consideration, but there is a concern that the additional vaccination can lead to an increase in HZ incidence by reducing the exogenous boosting.\textsuperscript{[2]} In this study, we developed a dynamic compartmental model of VZV and assessed the impact of two-dose varicella vaccination on varicella and HZ disease burden.

The model was stratified into age and the WAIFW (who-acquired-infection-from-who) matrix was estimated using the POLYMOD survey and Korean VZV seroprevalence data in 2008.\textsuperscript{[3,4]} We then incorporated dynamically changing population structure into the model using population projection data between 1960–2065 and estimated the reactivation rate of HZ using the HZ incidence data between 2013–2015.

Under four different assumptions on the effectiveness of varicella vaccination (base, moderate, worst, and best), the introduction of second dose vaccination reduced the cumulative varicella incidence over 45 years by a minimum of 3.71% and a maximum of 64.3% compared to the one-dose scenario. Meanwhile, the cumulative HZ incidence was slightly increased after the second dose of vaccination, but within 30 years, it started to decline and reduced by a minimum of 0.22% and a maximum of 2.55% over 45 years.

The results showed that the two-dose varicella vaccination significantly reduced varicella incidence and the increase in HZ incidence due to the reduced exogenous boosting was relatively small. Moreover, in the long term, the HZ incidence was also declined. Therefore, the two-dose varicella vaccination can effectively reduce both varicella and HZ disease burden.
REFERENCES


