Further evidence: Mathematical Assessment of the Roles of Vaccination and Pap Screening on the Burden of HPV and Related Cancers in Korea

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This study is based on using a novel sex-structured mathematical model to assess the effectiveness of vaccination and Pap screening against HPV and related cancers in South Korea. In addition to its disease-free equilibrium (DFE) being locally-asymptotically stable when the associated control reproduction number is less than one, the model could have one or three endemic equilibria, for a special case with negligible disease-induced mortality, if the reproduction number exceeds one. It's shown, using a Krasnoselskii sublinearity argument, that this special case has a unique and locally-asymptotically stable endemic equilibrium, when the reproduction number is larger than one, if, additionally, the HPV vaccine is assumed to be perfect. The DFE of a simplified version of the model, which is calibrated using HPV-related cancer data in Korea, is globally-asymptotically stable when its reproduction number is less than one. Simulations of the full model showed that, although vaccine-derived herd immunity (needed for HPV elimination) cannot be achieved in Korea under the current vaccination coverage of females (of 88%), it can be achieved if, additionally, at least 65% of males are vaccinated at steady-state. While the current combined vaccination-screening strategy (termed Strategy A) will fail to eliminate HPV, extended strategies that include increased coverage of female vaccination (termed Strategy B) or additionally vaccinating boys (termed Strategy C) could lead to such elimination in Korea. The implementation of boys-only vaccination strategy induces a significant spillover benefit in reducing cervical cancer burden, which exceeds the corresponding spillover benefit achieved by implementing a girls-only vaccination strategy.

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