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RESEARCH ARTICLE

Mismatch Between Vaccine Targets and Endemic HPV Genotypes in Sarawak, East Malaysia: Implications for Cervical Cancer Prevention

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ABSTRACT

Cervical cancer remains a major public health concern in Sarawak, East Malaysia, which reports the highest incidence in the country. Prophylactic human papillomavirus (HPV) vaccination programme currently uses bivalent (2 v) and quadrivalent (4 v) vaccines targeting HPV16 and 18 (and additional low-risk HPV6 and 11 for 4 v). However, the alignment of these vaccines with locally circulating high-risk HPV (hrHPV) genotypes is poorly understood. We conducted a serial cross-sectional study involving 1,108 women in Sarawak, Malaysia from 2018 to 2024. Self-collected high vaginal swabs were analyzed using the Anyplex™ II HPV HR Detection Kit for 14 hrHPV genotypes. Demographic data and vaccination status were collected. Descriptive statistics and Chi-square tests were used to evaluate associations between hrHPV positivity and demographic variables. The overall hrHPV prevalence was 10.2% (95% CI: 8.6–12.1%). Among positive cases, 87.6% had single, 10.6% dual, and 1.8% triple genotype infections. The most frequent genotypes were HPV18 (19.2%), HPV52 (16.9%), HPV39 (14.6%), and HPV51 (10.0%). Genotypes covered by the 2 v/4 v vaccines (HPV16/18) accounted for 25.4% of infections, and those included in the nonavalent (9 v) vaccine extended coverage to 56.2%. Notably, 43.8% of infections were due to non-2v/4 v/9 v vaccine genotypes. No significant associations were found between HPV positivity and age group, ethnicity, geographic division, or vaccination status. Our findings indicate a mismatch between current HPV vaccines and the prevalent hrHPV genotypes in Sarawak. While the 9 v vaccine offers improved coverage, a substantial proportion of infections are due to non-vaccine types. Strengthening molecular surveillance, improving access to screening, and addressing vaccine-derived complacency are critical to achieving cervical cancer elimination in this region.

Abbreviations: 2 v, Bivalent HPV Vaccine (Cervarix); 4 v, Quadrivalent HPV Vaccine (Gardasil); 9 v, Nonavalent HPV Vaccine (Gardasil 9); ASR, Age-Standardized Rate; CI, Confidence Interval; DNA, Deoxyribonucleic Acid; HPV, Human Papillomavirus; hrHPV, High-Risk Human Papillomavirus; IHRC, International Human Papillomavirus Reference Centre; KAP, Knowledge, Attitude, and Practice; NIP, National Immunization Programme; PBS, Phosphate-Buffered Saline; PCR, Polymerase Chain Reaction; SCCEP, Sarawak Cervical Cancer Elimination Program; UNIMAS, Universiti Malaysia Sarawak; WHO, World Health Organization.