

## Evaluating the effectiveness of cervical cancer screening and prevention in Singapore

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Cervical cancer is the fourth most common cancer in women globally, with approximately 660,000 new cases and 350,000 deaths reported in 2022.<sup>1</sup> In Singapore, it ranks as the 11th most common cancer among women and the 5th most frequent cancer among young women aged 15–44 years, with 309 new cases and 172 deaths reported in 2023.<sup>2</sup> Worldwide, the highest incidence and mortality rates are observed in low- and middle-income countries, such as those in Africa, Melanesia and Southeast Asia, while the lowest rates are found in Western Asia, Australia-New Zealand and North America.<sup>1</sup>

The development of cervical cancer is closely linked to the human papillomavirus (HPV), a double-stranded DNA virus. To date, more than 200 genotypes have been identified, 40 of which infect the anogenital region. HPV is primarily transmitted through close contact such as sexual intercourse. Twelve high-risk HPV (hrHPV) subtypes have been identified—HPV-16, HPV-18, HPV-31, HPV-33, HPV-35, HPV-39, HPV-45, HPV-51, HPV-52, HPV-56, HPV-58 and HPV-59. hrHPV plays a crucial role in the pathogenesis of cervical dysplasia and carcinoma,<sup>3</sup> with 99% of all cervical cancers are attributable to hrHPV, with HPV-16 and HPV-18 alone accounting for 70% of all cervical cancers.<sup>4</sup>

While 85% of women will contact HPV during their lifetime, up to 90% will clear the infection through their innate immunity. Approximately 67% of women manage to clear the infection without intervention within 12 months, and more than 90% of women do so within 24 months.<sup>5</sup> Persistent hrHPV infection, however, can lead to high-grade cervical dysplasia and eventually cervical cancer, a process that takes decades in immunocompetent women. This extended precancerous phase of cervical intraepithelial neoplasia (CIN) makes cervical cancer highly preventable through close surveillance and treatment of precancerous lesions.

The approach to eliminating cervical cancer is three-pronged—cervical cancer screening, prompt treatment of high-grade CIN, and vaccination against HPV. Access to screening, treatment of preinvasive and invasive cervical disease, and HPV vaccination are the main determinants of cervical cancer incidence and mortality rates.

In 2020, the World Health Assembly adopted a global strategy to eliminate cervical cancer, defined as fewer than 4 cases per 100,000 women per year. To achieve this by the end of the 21st century, the World Health Organization set the 90–70–90 targets for 2030: 90% of girls fully vaccinated with the HPV vaccine by age 15, 70% of women screened with a high-performance test by ages 35 and 45, and 90% of women identified with cervical disease receiving treatment.

As of 2022, only approximately 10 countries—all in the eastern Mediterranean region—have estimated incidence rates below the threshold.<sup>1</sup> Australia and the Nordic countries such as Norway and Sweden, are leading the effort to eliminate cervical cancer, with nationwide registries for cervical cancer screening and call-and-recall systems to monitor attendance. To improve access and inclusivity, these countries have integrated HPV self-sampling, which has proven to be as sensitive in detecting high-grade CIN as physician-collected samples.<sup>6,7</sup>

In Singapore, cervical cancer screening with cytology, more commonly known as the Papanicolaou (PAP) test, was first introduced in the 1960s. Government-led initiatives and public health campaigns, such as CervicalScreen Singapore, helped to promote cervical cancer screening uptake among women. HPV DNA testing was incorporated into screening protocols in the 2000s due to its improved sensitivity in detecting high-grade CIN<sup>8</sup> and greater protection against invasive cervical carcinomas compared to cytology.<sup>9</sup> In 2019, HPV testing replaced cytology as the primary screening method for women aged 30 and older.

HPV testing via clinician-collected samples is the mainstay of screening in Singapore. While HPV self-sampling is not yet widely performed, a study of 300 women in Singapore showed that most participants found self-sampling easy and believed that it would increase their likelihood of participating in screening.<sup>10</sup> The Society for Colposcopy and Cervical Pathology of Singapore recently supported the adoption of HPV self-testing based on current evidence.<sup>11</sup>

HPV and PAP tests are available at various healthcare institutions and clinics in Singapore,

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with subsidies through MediSave and Community Health Assist Scheme programme, making screening affordable and accessible. Initiatives like the “Healthier SG” and “Screen for Life” offer fully subsidised cervical cancer screening for enrolled Singaporeans at selected clinics.

Despite these efforts, the National Population Health Survey 2022 revealed that among Singapore female residents aged 25 to 74 years, 89.9% were aware of the PAP test and 54.6% were aware of the HPV test.<sup>12</sup> However, only 43.1% of female residents in this age group participated in cervical cancer screening, a significant decline from 57.9% in 2007. This downward trend was statistically significant ( $P<0.05$ ). The most commonly cited reason for not participating in screening was a belief that it was unnecessary if they were healthy.

Tay’s study found that even with an abnormal HPV test result, only 28.2% of patients returned for follow-up after 12 months.<sup>13</sup> The overall follow-up attendance rate was 42.8% over 5 years. The reluctance to return for surveillance significantly increases the risk of detecting high-grade CIN in persistent HPV infection.<sup>13</sup> Understanding the reasons behind non-attendance—whether due to cost, lack of a national registry, or the absence of a call-recall system—is crucial.

HPV vaccination was introduced in Singapore in 2006, with MediSave funding available to defray the costs for the bi- and quadrivalent vaccines. The bivalent Cervarix vaccine (GlaxoSmithKline) and the nonavalent Gardasil vaccine (Merck Sharp & Dohme) are currently available in Singapore. The quadrivalent Gardasil vaccine has been phased out.

Since 2010, HPV vaccination has been part of the National Childhood Immunisation Programme, offered free-of-charge to all female students in Secondary 1. A 2014 study found that only 13.6% of women aged 18 to 26 years were immunised.<sup>14</sup> However, the inclusion of HPV vaccination in the National Adult Immunisation Schedule in 2017 and the introduction of a school-based programme significantly increased vaccination rates to over 90%.<sup>15</sup> While it may take decades to see the full impact of HPV vaccination, the promising school-based vaccination rates indicate positive progress.

Cervical cancer has long been considered the most preventable gynaecological cancer. However, with a cervical cancer incidence rate of 6.8 per 100,000 women in Singapore,<sup>12</sup> suboptimal screening uptake, and a relatively new HPV vaccination programme, more concerted efforts are needed from all stakeholders to eliminate cervical cancer. Recognising that a death from cervical cancer is death from neglect is imperative as we work towards a future where no woman is left behind.

## Declaration

No conflict of interest is declared by the author.

**Keywords:** cancer prevention, cervical cancer, HPV vaccination, human papilloma virus, public health, screening

## REFERENCES

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2024;74:229-63.
2. Bruni L, Albero G, Serrano B, et al. ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre). Human Papilloma-virus and Related Diseases in Singapore. Summary Report, 10 March 2023. <https://hpvcentre.net/statistics/reports/SGP.pdf>. Accessed 11 May 2024.
3. Franco EL, Duarte-Franco E, Ferenczy A. Cervical cancer: epidemiology, prevention and the role of human papillomavirus infection. *CMAJ* 2001;164:1017-25.
4. Smith JS, Lindsay L, Hoots B, et al. Human papillomavirus type distribution in invasive cervical cancer and high-grade cervical lesions: A meta-analysis update. *Int J Cancer* 2007;121:621-32.
5. Veldhuijzen NJ, Snijders PJ, Reiss P, et al. Factors affecting transmission of mucosal human papillomavirus. *Lancet Infect Dis* 2010;10:862-74.
6. Petignat P, Faltin DL, Bruchim I, et al. Are self-collected samples comparable to physician-collected cervical specimens for human papillomavirus DNA testing? A systematic review and meta-analysis. *Gynecol Oncol* 2007;105:530-5.
7. Arbyn M, Smith SB, Temin S, et al. Detecting cervical precancer and reaching underscreened women by using HPV testing on self samples: updated meta- analyses. *BMJ* 2018;363:k4823.
8. Wright TC, Stoler MH, Behrens CM, et al. Primary cervical cancer screening with human papillomavirus: end of study results from the ATHENA study using HPV as the first-line screening test. *Gynecol Oncol* 2015;136:189-97.
9. Ronco G, Dillner J, Elfström KM, et al. International HPV screening working group. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomised controlled trials. *Lancet* 2014;383:524-32.
10. Lim LM, Chan MFG, Win PPT, et al. Self-sampling HPV DNA test for cervical cancer screening in Singapore: A prospective study. *Ann Acad Med Singap* 2022;51:733-5.
11. The Society for Colposcopy & Cervical Pathology of Singapore. SCCPS Scientific Committee Position Paper on HPV Self-sampling Test, March 2024. [https://sccps.org/wp-content/uploads/2024/03/SCCPS-combined-paper\\_V2.pdf](https://sccps.org/wp-content/uploads/2024/03/SCCPS-combined-paper_V2.pdf). Accessed 26 June 2024.
12. Ministry of Health, Singapore. National Population Health Survey 2022. <https://www.moh.gov.sg/resources-statistics/reports/national-population-health-survey-2022>. Accessed 13 May 2024.
13. Tay SK. Improving the effectiveness of cervical cancer screening: Managing positive high-risk human papillomavirus results. *Ann Acad Med Singap* 2024;53:342-51.
14. Chirayil EI, Thompson CL, Burney S. Predicting human papilloma virus vaccination and Pap smear screening intentions among young Singaporean women using the theory of planned behavior. *Sage Open* 2014;4:1-10.
15. Vijayalakshmi K, Goei AHY. Improved population coverage of the human papillomavirus vaccine after implementation of a school-based vaccination programme: the Singapore experience. *Singapore Med J* 2023;64:294-301.