Cost-Effectiveness, Resource Utilization, and Budget Impact Analysis of HPV Extended Versus Partial Genotyping for Cervical Cancer Screening in Indonesia

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Introduction

- Cervical cancer screening is a multifaceted challenge that requires new strategies such as HPV DNA test using extended genotyping (XGT).[1,2]
- XGT provides individual results for HPV 16, 18, 31, 45, 51, and 52, while grouping the remaining high-risk genotypes into pooled categories (HPV 33/58, 35/39/68, and 56/59/66). This detailed stratification enables risk assessment based on carcinogenic potential.[2,3]
- In contrast, partial genotyping (PGT) limits individual reporting to HPV 16 and 18 only, while pooling all remaining high-risk types into a single category.[4]
- Previous studies have evaluated the cost-effectiveness of XGT versus PGT in primary HPV screening with cytology triage.[5,6] However, in settings with limited cytology capacity, visual inspection with acetic acid (VIA) is the preferred triage method.

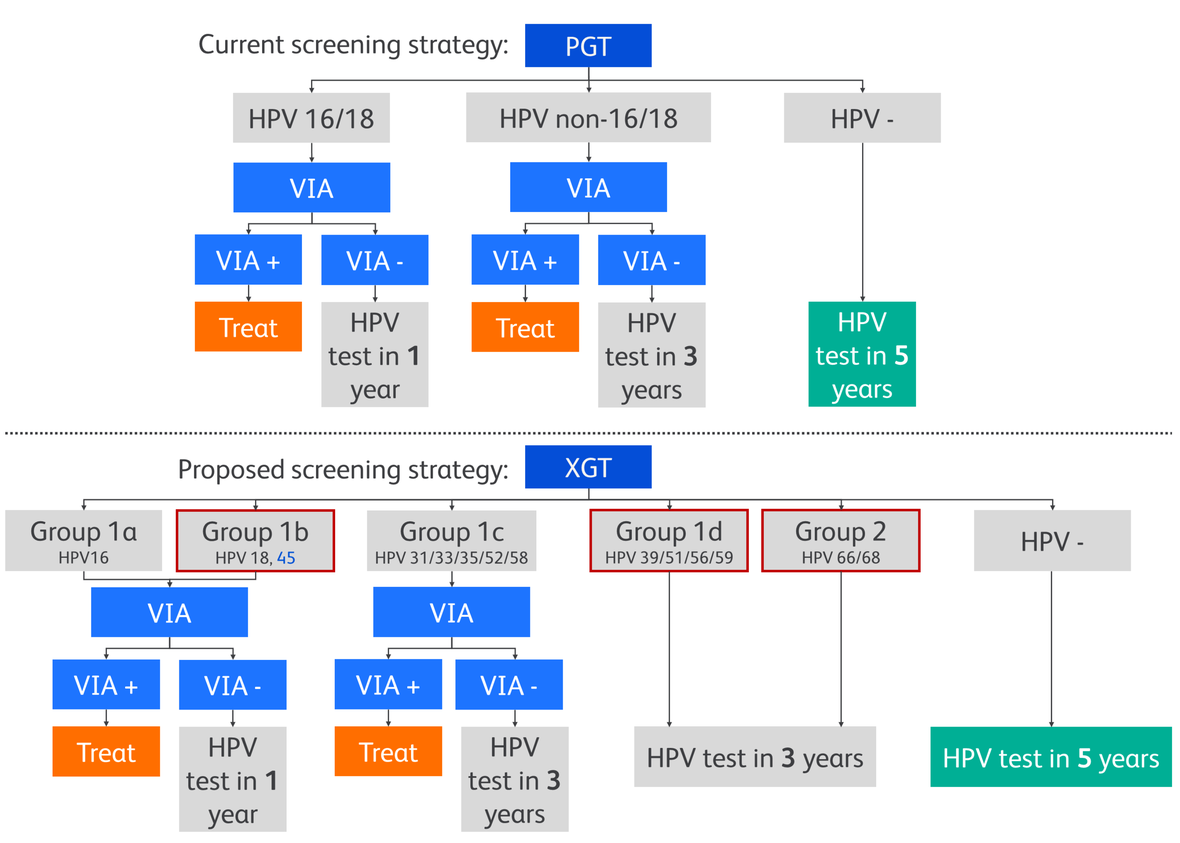
Study objective: To evaluate the clinical outcomes and economic implications of implementing XGT versus PGT within a primary HPV screening program using VIA triage in Indonesia.

Methods

A multi-state Markov model was developed to simulate the progression of HPV infection and cervical diseases among 1,000,000 women aged 30–59 years in Indonesia over a 20-year time horizon.

- The model included six health states: no HPV, HPV infection, pre-cancer (CIN 2/3), cancer stage I, cancer stages II–IV and death.
- Two screening strategies were compared: XGT versus PGT (Figure 1).
- Under the XGT strategy, HPV infections were categorized into five risk groups, as per WHO latest guideline.[7]
- The model used annual cycles, applying costs and utilities to each health state in annualized form, with a 3% discount rate.
- Analysis was conducted from the healthcare payer perspective.
- Cost and HPV prevalence inputs were obtained from health technology assessment reports and local peer-reviewed literature.[4,5,7–19]
- Outcomes evaluated included incremental cost-effectiveness ratio (ICER), pre-cancer and cancer cases, and resource utilization.

Figure 1: Screening algorithms

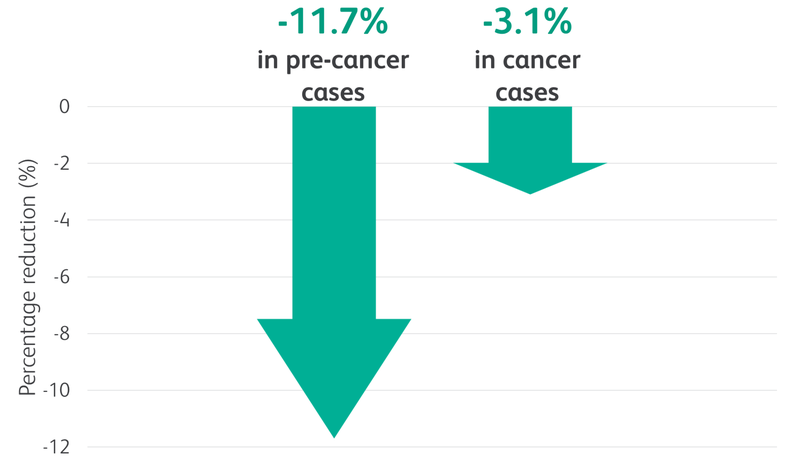


- The model assumed that HPV groups do not transit from one to another.
- Transition probabilities were defined separately for progression and clearance pathways, with rates averaged across all genotypes within each HPV group. However, transition probability from pre-cancer to cancer is not stratified by genotype.

Results & Discussion

- Compared to PGT, XGT was dominant with estimated cost saving of USD 1,601 per QALY over a 20-year period.
- XGT averted 11.7% pre-cancer and 3.1% cancer cases (Figure 2). This translated to cost savings of USD 9 per pre-cancer case and USD 3,974 per cancer case, respectively.

Figure 2: Clinical outcomes of XGT over a 20-year period



- Adopting XGT resulted in reduced number of VIAs and referrals by 26% (Table 1).

Table 1: Impact of XGT on resource utilization

	Difference between PGT and XGT
Number of HPV tests	+2.5%
VIA performed	-26.0%
Unnecessary pre-cancer referrals	-26.0%
Unnecessary procedures	-26.0%
Unnecessary cancer referrals	-26.0%

- The impact on clinical outcomes and resource utilisation translated into a potential cost savings of USD 620,775,566 (3.1%) per 1,000,000 women over a 20-year period.

*Table 2: **Overall cost impact of adopting XGT***

Cost item	Difference between PGT and XGT
HPV testing costs	+10.7%
VIA costs	-26.0%
Pre-cancer treatment costs	-11.7%
Cancer treatment costs	-3.1%
Other testing costs	-42.4%
TOTAL	-3.1%

- By averting pre-cancer and cancer cases, implementation of XGT in cervical cancer screening could lead to a measurable reduction in cervical cancer incidence and mortality at the population level.
- Cost savings associated with XGT can support broader access to screening services, especially in under-resourced areas.
- The model did not account for HPV infections involving multiple genotypes, which might underestimate the complexity of disease progression.
- HPV persistence was not modeled due to limited data, but would likely yield additional cost savings through closer monitoring of high-risk women.

Conclusion

- Cervical cancer screening with HPV XGT could result in potential cost savings to the healthcare system through more efficient clinical management which focuses resources on high-risk patients.
- This could facilitate national screening programs to achieve better outcomes and aid in cervical cancer elimination efforts.

References
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