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Cost-utility and budget impact analyses of cervical cancer screening using self-collected sample kit for HPV DNA testing in Thailand

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Introduction

Cervical cancer is the third most common cancer in Thai women. The success of cervical cancer screening policy is restrained due to various factors that minimize the screening rate. Self-screening could reduce barriers to screening in Thai women. This study aimed to evaluate the cost-utility and budget impact of cervical cancer screening using a self-collected sample kit for HPV DNA testing in Thailand.

Material and methods

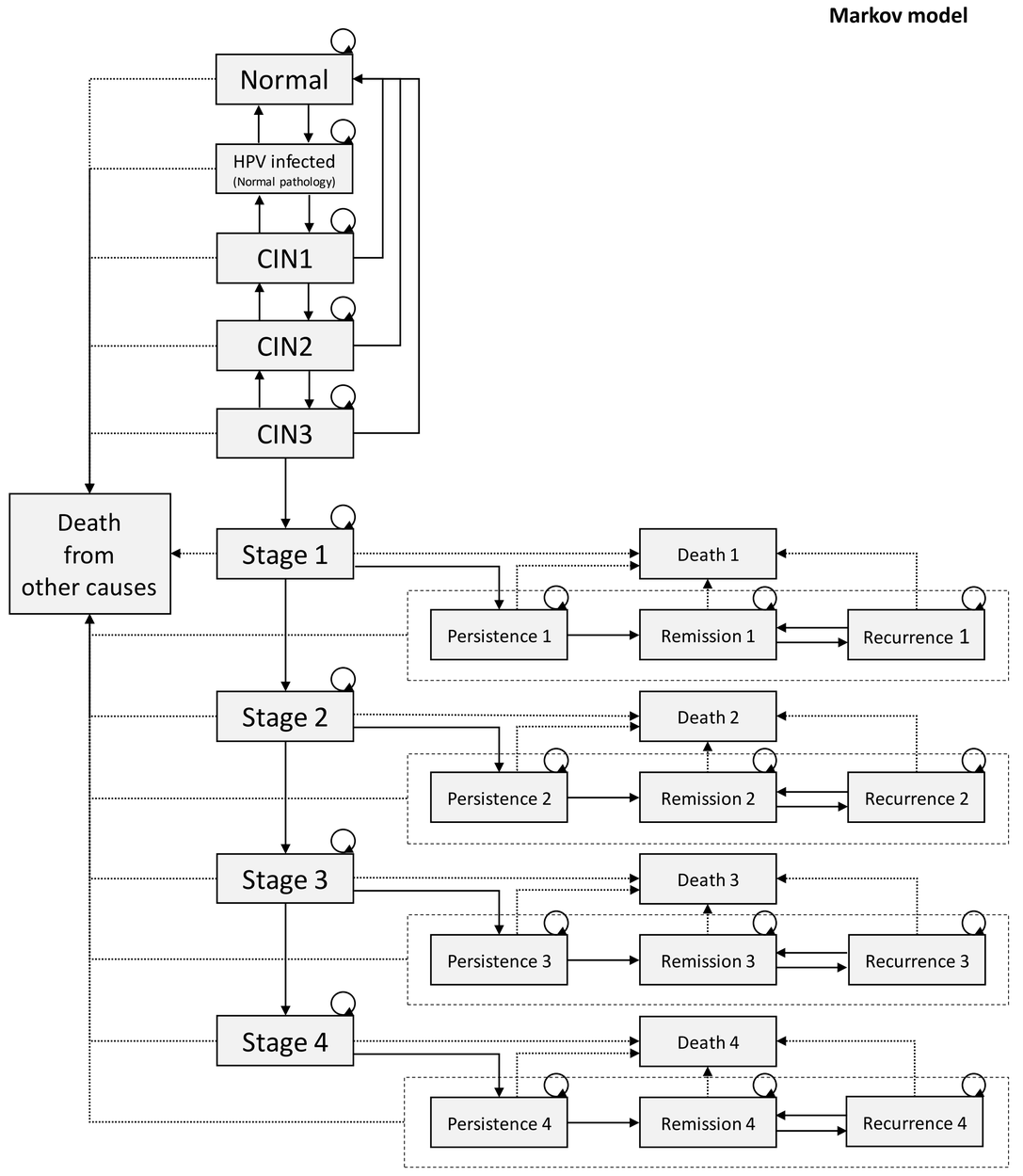
A decision tree coupled with Markov model was used to estimate lifetime costs and health benefits of adding self-screening policy to the national list of health benefit coverage for women aged 25-65 years. This analysis was performed from a societal perspective. We compared the costs and outcomes of three options including (1) additional self-screening, (2) clinician screening only, and (3) no screening. All costs were reported in 2022 USD (1 USD = 35.1 Thai baht). Sensitivity analyses were conducted to assess robustness of the model. The 5- and 10-year budget impacts of the additional policy were calculated.

Parameters	Values	SE	References
Prevalence			
HPV infection at age 25-30 years	11.7%	1.9%	Tangjitgamol, 2022
HPV infected, but normal pathology	56.7%	3.4%	Phoolcharoen, 2017
CIN2+ (included cervical cancer)	1.7%	0.3%	Phoolcharoen, 2017
Cervical cancer (per 100,000 women)	68.6	8.3	Globocan, 2020
Incidence of high-risk HPV infection	0.0051	0.0005	Shama, 2012
Test performance for CIN2+			Arbyn, 2014
Self screening: sensitivity	76%	4%	
Self screening: specificity	86%	2%	
Clinician screening: sensitivity	91%	2%	
Clinician screening: specificity	88%	2%	
Treatment effectiveness	88%	9%	Campos, 2020
Proportion of women retaining an HPV infection following treatment	15%	-	Campos, 2020

Costs (2022 USD per visit)	Values	Ranges	References
Human papilloma Virus (HPV): DNA detection	8	3-29	Companies
Pelvic examination	3	2-4	HITAP Standard Cost List, 2009
Self-sampled HPV DNA testing (included PCR)	8	6-10	Companies
Clinician-sampled HPV DNA testing	3	2-4	Assumption
Colposcopy	11	10-29	HITAP Standard Cost List, 2009
Biopsy and pathological test	6	5-8	HITAP Standard Cost List, 2009
Food	2	1-2	HITAP Standard Cost List, 2009
Postal service fee	1	1-3	HITAP Standard Cost List, 2009
Travel - primary care	2	1-2	HITAP Standard Cost List, 2009
Travel - hospital	4	3-5	HITAP Standard Cost List, 2009

Health states	OPD			IPD		(REF: Siriraj database, n=1423)
	# of visit per year	Median cost per visit (USD)	SE	# of visit per year	Median cost per visit (USD)	SE
CIN1	2	8	4	1	962	260
CIN2	4	23	5	1	747	711
CIN3	5	26	6	1	1122	133
Stage 1	10	61	3	1	1894	80
Stage 2	16	104	4	2	716	117
Stage 3	19	112	5	2	745	118
Stage 4	24	94	9	4	796	158

Markov model



Parameters		Clinician screening[a]	Self screening[b]	References
Age-specific screening rate	25-29 years	30.0%	50.0%	Termrungruanglert, 2021
	30-34 years	28.3%	51.7%	
	35-40 years	38.2%	41.8%	
	41-44 years	40.5%	39.5%	
	45-49 years	42.7%	37.3%	
	50-54 years	40.2%	39.8%	
	55-59 years	33.9%	46.1%	
	60-65 years	15.0%	46.1%	
HPV screening interval	Negative result	5 years	5 years	RTCOG, 2021
	Positive result	1 years		
Follow-up colposcopy		68.0%		Termrungruanglert, 2021
% biopsy at colposcopy		100.0%		Expert

[a] Assumed = screening rate of cytology test
[b] Assumed total screening rate = 80.0%

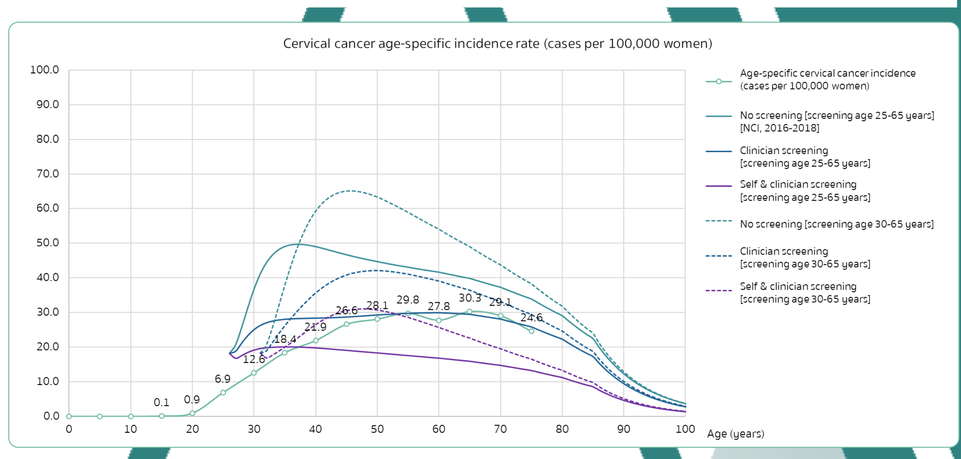
Outcomes	No screening	Clinician screening[a]	Self & clinician screenings[b]
Life expectancy (years)	57.0	57.2	57.3
Total lifetime cost (THB)	$ 1359	$ 1108	$ 950
Total lifetime QALYs	23.49	23.55	23.58
Incremental costs (THB)		$ -251	$ -158
QALY gained		0.05	0.03
ICERs (THB per QALY gained)		Dominant[a]	Dominant[b]

[a] Compared to no screening
[b] Compared to clinician screening only policy

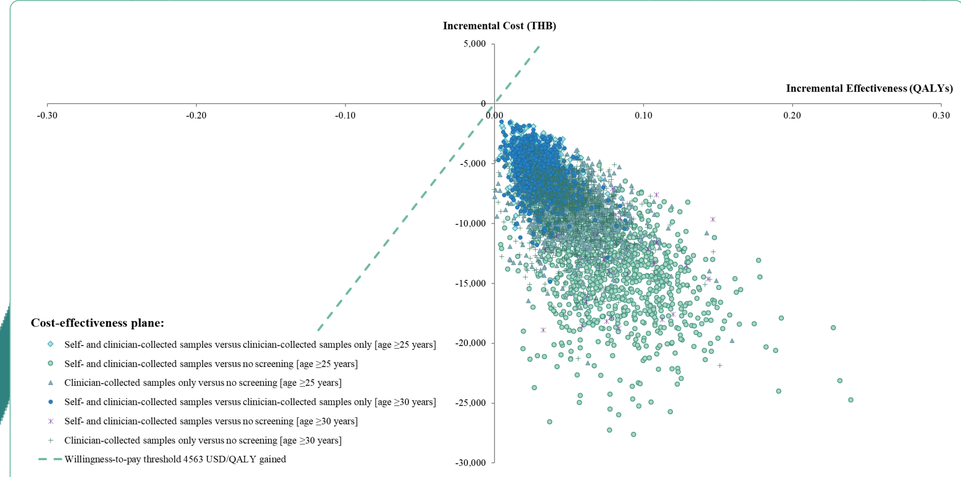
Cost-saving | Cost-saving

Results

Both additional self-screening and clinician screening only policies were cost-saving, compared to no screening. When compared between the two screening policies, additional self-screening was a dominant strategy. The incremental cervical cancer prevention benefit of adding self-screening into the heath benefit coverage was observed at any additional rate of screening that was expected to be gained by using self-collected sample kit. The sensitivity analyses give the same favorable results of the screening policies. Average budget impact per year of additional self-screening policy was $20.6 million. This budget would potentially grant more than 10 million women to undergo cervical cancer screening.



Real-life scenario [Self-screening] -- payer's perspective									
BIA	# of women eligible for screening	# of women screened	% self-screened	# of T- women	# of T+ women	# of total screening	% of TAH	Total BIA (million USD)	Avg. per year (million USD)
Screening age 25-65 years									
5 years	14,369,809	9,497,893	43.9%	8,067,658	1,430,234	10,726,540	3.3%	$ 100.6	$ 20.1
10 years	15,673,782	10,359,769	43.9%	8,799,750	1,560,019	21,987,916	6.4%	$ 206.3	$ 20.6



Conclusions

The additional self-collection and clinician-collection-only policies are cost-saving compared to the no-screening policy. The policy involving self-collected samples for HPV DNA testing is the most advantageous option, as it will effectively increase the screening rate. The additional benefits resulting from having dual-collection policies (self-collection and clinician-collection) in a cervical cancer screening program outweigh the incremental costs of the dual program when compared to a clinician-collection-only approach. While screening younger women will incur higher upfront screening budgets, it will reduce overall cancer prevention and treatment costs in the long term. Policymakers should consider this evidence during the process of optimizing policies in Thailand.