COST - EFFECTIVENESS ANALYSIS OF CERVICAL CANCER VACCINATION STRATEGIES IN SPAIN

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Introduction

- Cervical cancer (CC) is one of the most frequent and lethal malignancies in women worldwide. It is the second most common cancer among women, with an estimated 530,000 new cases and 275,000 deaths in 2008[1].
- Human papillomavirus (HPV) infection is now a well-established cause of cervical cancer[2] and immunization with HPV vaccines is an effective tool to prevent precancerous lesions and cervical cancer development.
- Early detection, through systematic screening, and prevention through HPV vaccination programs represent the current tools to reduce the burden of cervical cancer.
- In Spain, adolescents' systematic vaccination was introduced in 2007 and opportunistic screening by Pap smear test every 3 years is implemented for women from 25 to 65 years old.

Objective

Cost-Effectiveness analysis of vaccination with HPV 16/18 AS04-adjuvanted vaccine added to screening programs in cervical cancer prevention, from the National Healthcare System perspective.

Methods

Model structure:

- A Markov cohort model **(Figure 1)**, with transition probabilities in 1-year cycles between different health states reproducing the natural history of HPV infection, cervical intraepithelial neoplasia (CIN) and cervical cancer development and the effects of screening programs and vaccination on cervical cancer prevention.
- The age cohort of girls aged 11 years is entered into the model, and transits every year between 12 different, mutually exclusive health states over time.
- The model also tested a 7 years campaign of vaccinating both 11 & 18 years old versus vaccination only 11 years old cohorts.
- Time horizon considered is during women's lifetime and the Healthcare System perspective is used.
- A discount rate of 3% is applied for both costs and health outcomes.

Input data: **Table 1** lists the inputs and sources used for populating the model

Outcomes:

- The model projects the number of CC cases, CC deaths, QALYs and costs for two strategies: screening alone vs. vaccination + screening.
- Comparison of the difference in costs with the difference in QALYs gained between the two strategies.

Sensitivity analysis:

A one-way deterministic sensitivity analysis is conducted to assess the effect of uncertainty around key input values on the model output.
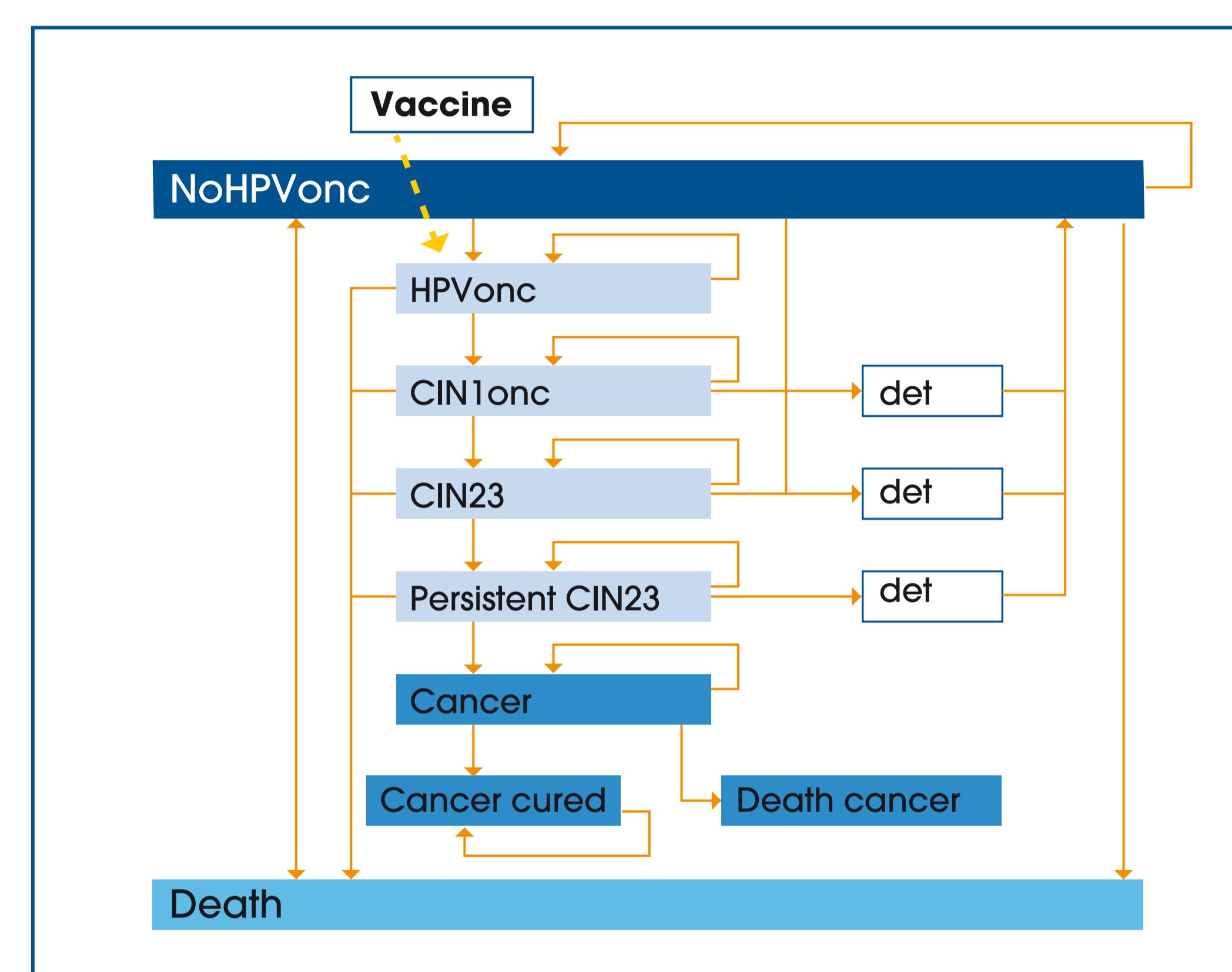

Figure 1. Markov model framework

Input	Source
Transition probabilities	Literature
HPV and cervical lesions prevalence	**www.who.int/hpvcentre**
Population	National Statistic Institute
Screening characteristics	Spanish Society of Gynaecology
Vaccine efficacy	(3)
Vaccination coverage	Ministry of Health. Coverage data 2009
Utilities	Literature
Costs	Healthcare costs national database (E-salud)

Table 1.   Main input data

Results

- In the base case scenario, vaccination plus screening would avoid 817 CC cases and 188 CC deaths versus screening alone and generate 1,018 additional QALYs, resulting in an ICER of € 29.295/QALY.
- Vaccination of the cohorts aged 11 & 18 would avoid 2,448 CC cases and 602 CC deaths compared with vaccination of only the 11 year cohort, and represents an ICER of 28,931€/QALY. **(Table 2)**
- Sensitivity analysis shows that discount rate was the most influential parameter **(Table 3)**

	Additional CC avoided	Additional CC deaths avoided	Additional QALYs	ICER
11 years old cohort	817	188	1,018	29,295 €/QALY
11 + 18 years old cohorts	2,448	602	3,154	28,931 €/QALY

Table 2.   Outcomes of vaccination + screening vs. screening alone

Parameter	Input used in model	Ranges used in SA	Source
Discount rate	3%	0% - 5%	National HTA recommendations
Transition probability HPV to No HPV	0,5	0,4 – 0,6	Experts opinion
Cross-protection	68%	35% - 85%	RCT[(3)] CI 95%
Screening coverage	73%	69% - 76%	National data
Costs	-	+20% / -20%	-
CC utility	0,72	+20% / -20%	-
HPV 16/18 in CIN1	19,9%	14% - 37%	ICO 2010[4] CI 95%
HPV 16/18 in CIN2/3	65,1%	47% - 83%	ICO 2010[4] CI 95%
HPV 16/18 in CC	70,3%	68,3% - 72,3%	ICO 2010[4] CI 95%
Sensitivity detection CIN1	58%	+20% / -20%	Experts opinion
Sensitivity detection CIN2/3	61%	+20% / -20%	Experts opinion
CIN1 detected and treated		20% - 30%	Experts opinion

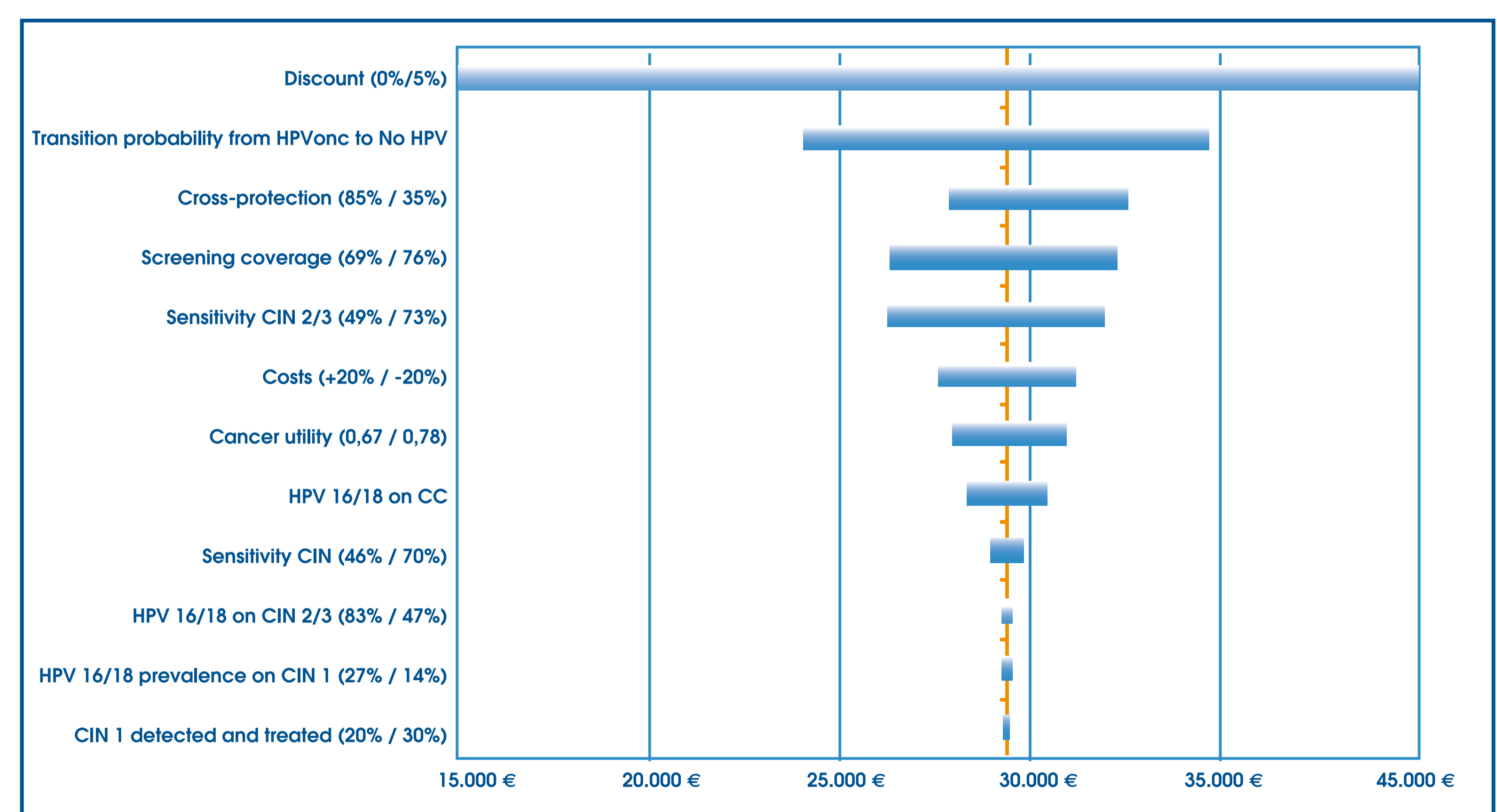Table 3.   Sensitivity analysis input

Figure 2. Sensitivity analysis results (Tornado diagram)

Conclusions

- Cervical cancer prevention with HPV 16/18 AS04-adjuvanted vaccine added to the current screening programs in Spain is a cost-effective strategy.

- More favourable cost-effectiveness ratio may be obtained by expanding recommendations to the vaccination of young women.

References

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2. Trottier H, Franco EL (2006) The epidemiology of genital human papillomavirus infection. Vaccine 24(Suppl 1):S1–S15.
3. Paavonen J. et al. Efficacy of human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine against cervical infection and precancer caused by oncogenic HPV types (PATRICIA): final analysis of a double-blind, randomised study in young women. Lancet Volume 374, Issue 9686, July 2009, 301-314
4. Human Papillomavirus and related cancers. Summary Report Update. June 22, 2010. WHO/ICO HPV information centre