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Cost Effectiveness of Gender-Neutral Vaccination with Gardasil 9 against HPV in Greece

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INTRODUCTION

- Since “2006 WHO held a series of consultations to develop guidelines for prophylactic human papillomavirus (HPV) vaccines”.[1] The reason being that 99% of cervical cancer events are linked with HPV infection[1] and several types of cancers are linked with HPV infection.[2]
- It is essential for decision-makers to ensure universal access to vaccination, expanding the safety-net of protection, by achieving higher vaccination rates.
- Especially for young adolescents entering a sexually active period of life, HPV vaccination is of the utmost importance since the peak incidence of HPV contraction is on the onset of sexual activity.[2]
- Nevertheless, the issues of affordability and budget constraints in the health-care sector are more prominent than ever, therefore cost-effective interventions should be identified and prioritized, when possible.

AIM

The aim of the study is to assess the public health impact and cost-effectiveness of gender-neutral vaccination (GNV) with Gardasil 9(G9) versus female only vaccination (FOV) with Gardasil 9 in Greece in the age group of 11-18 years old.

HPV-related diseases	Incidence		Mortality	
	Cases prevented		Deaths prevented	
	Female	Male	Female	Male
Cervical Cancer	2,148(6.4%)	NA	804(5.5%)	NA
CIN 1	7,003(11.9%)	NA	NA	NA
CIN 2+	10,755 (11.3%)	NA	NA	NA
Anal Cancer	61 (7.9%)	269 (17.4%)	15 (6.9%)	71 (15.8%)
Genital Warts	118,618 (13.7%)	346,328 (29.5%)	NA	NA
RRP	396 (14.9%)	801 (24.5%)	18 (13.6%)	36 (22.8%)
Penile Cancer	NA	644 (26.5%)	NA	212 (24.2%)
Head and Neck	39 (7.0%)	1,798 (18.9%)	17 (6.3%)	784 (17.7%)

Table 1: Estimated Reduction in Mortality and Incidence due to GNV with G9

Table 2: Cost Savings in Disease related costs from GNV compared to FOV

HPV-related diseases	Females only	GNV	% Reduction
Cervical Cancer	€408,626,565	€400,554,891	2.0
CIN 1	€2,149,550	€2,036,513	5.3
CIN 2	€17,054,753	€16,169,494	5.2
CIN 2/3	€48,312,671	€46,054,966	4.7
CIN 3	€31,257,926	€29,885,473	4.4
Vaginal Cancer	€3,233,652	€3,176,311	1.8
Vulvar Cancer	€3,460,035	€3,395,665	1.9
GW and HPV 6/11 related CIN1	€1,972,082	€1,862,830	5.5
Genital Warts Males	€170,799,542	€131,981,332	22.7
Genital Warts Females	€193,903,425	€173,601,477	10.5
Anal Cancer Males	€6,706,385	€6,330,835	5.6
Anal Cancer Females	€3,583,630	€3,508,082	2.1
Head & Neck Males	€76,742,465	€71,843,420	6.4
Head & Neck Females	€5,308,528	€5,208,953	1.9
Penile Cancer	€7,425,204	€6,772,140	8.8
RRP	€358,361,862	€303,949,423	15.2
Total Disease Costs	€1,338,898,274	€1,206,331,806	9.9

METHODS

Data sources-Assumption

- Greek model inputs have been used where available. However, due to lack of local data, inputs from countries with close proximity to Greece have been used instead. The data have been thereafter reviewed and validated from a panel of specialists. The time horizon of the analysis was set to 100 years. Costs were discounted at 3.5% while outcomes were discounted at 3.0%.

Description of the tool

- To assess the public health impact and the cost-effectiveness of a GNV vaccination strategy with v9HPV, a transmission dynamic model, was used .[3] This previously published and validated dynamic model, simulating the natural history of HPV infections and estimating the cost associated with HPV-related diseases in women, [3,4] has been extended to include all HPV-related diseases (i.e. cervical cancer, vaginal cancer, vulvar cancer, anal cancer, penile cancer, the associated precancerous lesions, head and neck (H&N) cancer, genital warts and juvenile- and adult-onset recurrent respiratory papillomatosis, recurrent respiratory papillomatosis (RRP), all caused by HPV genotypes 6/11/16/18/31/33/45/54/58) in both genders.

Model Structure

- The transmission in the population-based model is set on three building blocks:
- A demographic module which defines birth, ageing, death, and sexual behavior of the population and describes how persons enter, age within, and exit the model.
- An epidemiological module which simulates the spread of HPV infection and resulting HPV-related diseases: cervical, vaginal, vulvar, anal, H&N, penile cancers, precancerous lesions, genital warts, and RRP.
- A cost-effectiveness module which can compare two or more prevention strategies, assess their impact on costs (including screening, vaccination and management of the disease costs) and quality of life.

RESULTS

Epidemiological Results

The results show a significant decrease in the incidence and mortality of many types of cancers over 100 years’ time. According to the calculations of the model, **2,148 cases of cervical cancer are expected to be prevented which is equal to a 6.4% reduction in cervical cancer incidence**, while **804 women are expected to be prevented from dying from cervical cancer which is equivalent to a 5.5 % drop in mortality**. For CIN1, 7,003 cases will be prevented which shows an 11.9% decrease, while for H&N cancers a 7% (39 cases prevented) decrease is shown in the incidence(of H&N) for women and a 18.9% decrease for men (1,798 cases prevented). The decrease in mortality related to H&N is also significant and results in 801 lives saved for H&N cancer related deaths-according to the model. More details of HPV-related disease cases and deaths prevented by switching from FOV to GNV with 9vHPV vaccine are present(Table 1 shows all the results)

Economic Results

Table 2 shows the economic results for the base-case analysis, which includes vaccinating girls only in the 11-18 years age range vs. gender neutral vaccination in the same age range. The results show reductions in the direct medical costs in all categories explored with the uptake of gender-neutral vaccination. The most significant reductions are observed in the RRP-related costs (-22.7%) and the genital warts (men) costs (-15.2%). Overall, **the cost saving in HPV-related disease costs is anticipated to be around 9.9% in direct medical costs with the switch to gender-neutral vaccination in the 11-18 years old age bracket.**

Incremental Cost Effectiveness Ratio-Deterministic Analysis

GNV vaccination versus FOV with Gardasil 9 was found to be cost-effective. **The outcomes show a cost-effectiveness relation with the average incremental cost per person being €23.76 and incremental QALY’s being 0.00235 per person on average, which results in an ICER of € 11,137 per QALY**. The ICER is significantly under the unofficial acceptability threshold of 52770 €(x3 GDP).[5] The Deterministic sensitivity analyses run to test the parameters with the biggest impact on the ICER are shown in Table 3.

Table 3:DSA Results

Scenario	ICER (€/QALY)
Discount rates (applied to both costs and effect)	
0%	€3,509
6%	€32,896
Utilities	
+10%	€16,705
-10%	€8,332
Vaccination coverage rate (VCR)	
40% girls and 30% boys	€9,981
65% both genders	€14,577
Incidence of genital warts	
+10%	€10,473
-10%	€11,824
Incidence of cervical cancer	
+10%	€10,899
-10%	€11,355
Incidence of head and neck cancer	
+10%	€10,696
-10%	€11,586
Incidence of Anal Cancer	
+10%	€11,106
-10%	€11,164
Costs	
+20%	€10,103
-20%	€12,172
Annual Screening Rate	
70%	€10,898
30%	€11,408
Sexual Behaviour Categories	
10% less in medium and high risk groups	€11,338
10% more in medium and high risk groups	€10,945

CONCLUSIONS

- GNV vaccination is a cost-effective public health intervention, with the results potentially underestimating the overall value of the intervention given that indirect costs were not considered in this analysis.
- HPV immunization should be **a public health priority** and **significant catch-up vaccination initiatives are essential to reverse the deficit created by the pandemic and prevent long-term public health and economic consequences, because as displayed in this analysis it could cost human lives.**

REFERENCES

1. WHO, available(ave.) at:Immunizing against HPV (who.int),2022;
2. WHO, ave. at: Human Papillomavirus (HPV) (who.int), 2022;
3. Elbasha et al., Emerg Infect Dis. 2007;
4. Elbasha et al.,Vaccine, 2010
5. Eurostat, Available at: Statistics | Eurostat (europa.eu) ,2022;