

Human papilloma virus (HPV) vaccination: financial impact and recommendations

Evelyn Walter^a, Marco Voit^a, Gerald Eichhofer^a

^aIPF Institute for Pharmacoeconomic Research, Vienna, Austria

Objectives

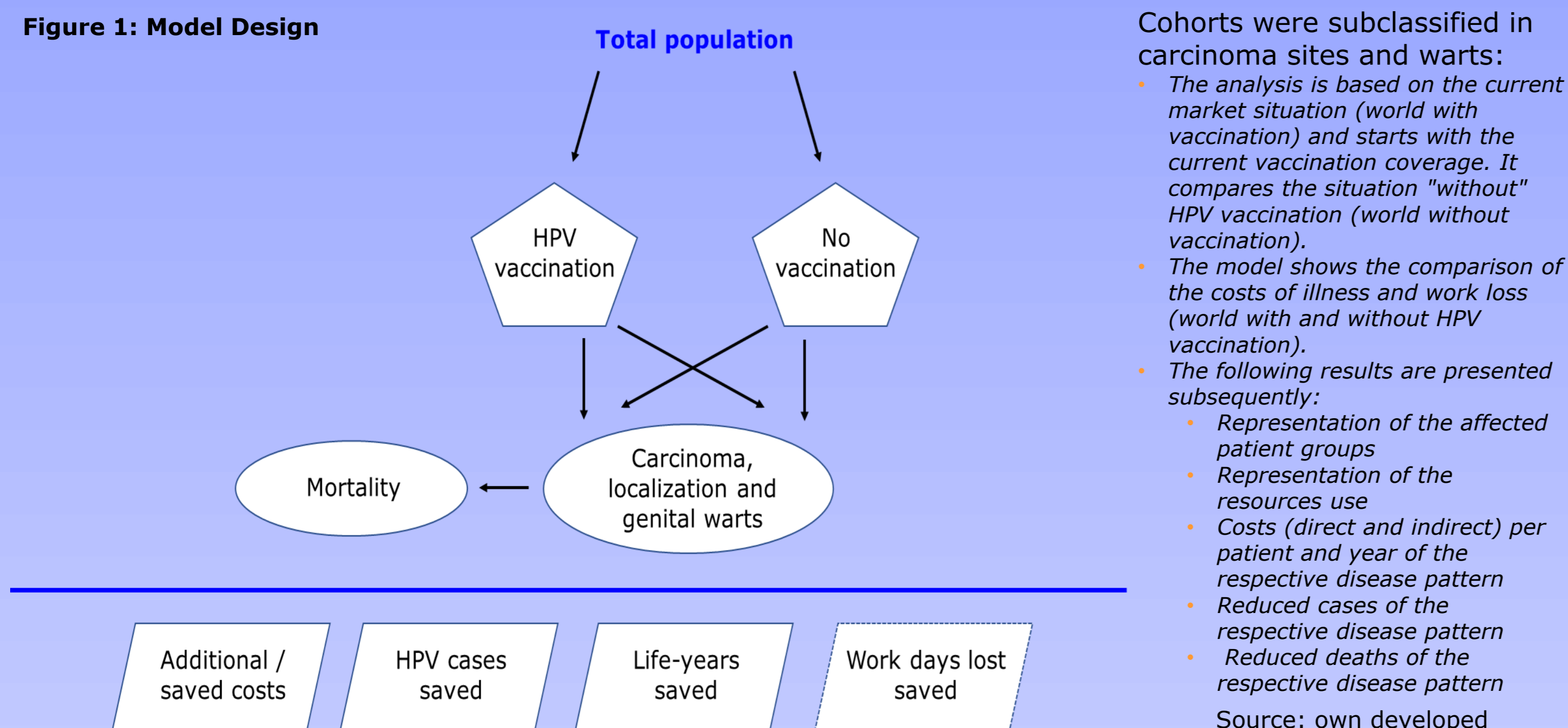
In 2020, the 73rd World-Health-Assembly adopted the Global Strategy for Cervical Cancer Elimination. Accordingly, all Member States are called upon to achieve a cervical cancer incidence-rate of less than 4 per 100,000 women (2019: 7/100,000).

To reach this WHO target by 2030, 90% of all girls by the age of 15 should be vaccinated against HPV. Austria has committed to pursuing this goal, whereby the free vaccination program is administered to all genders to age of 21. Currently, around 51% are vaccinated by the age of 15. To quantify the positive impact of the HPV-vaccination program, a budget-impact-analysis (BIA) was conducted.

Methods

A multi-cohort, population-based model was developed over a 5-year time-horizon to compare a world with to a world without HPV-vaccination. The population estimate is based on the recently published HPV-report from the Federal Ministry of Social Affairs, Health, Care and Consumer Protection. The model considers the HPV associated cancer types of both gender and included the following states: cervical, anal, vulvar, vaginal, penis, head and neck cancer, genital warts, related disease and mortality. In the world with vaccination the percentage of immunized individuals increases from 7.4% 1st-year to 9.3% 5th-year in the total population; from 38%-48% for those under 21 (51%-56% by the age of 15). Results were presented from the societal and health-care-systems perspective.

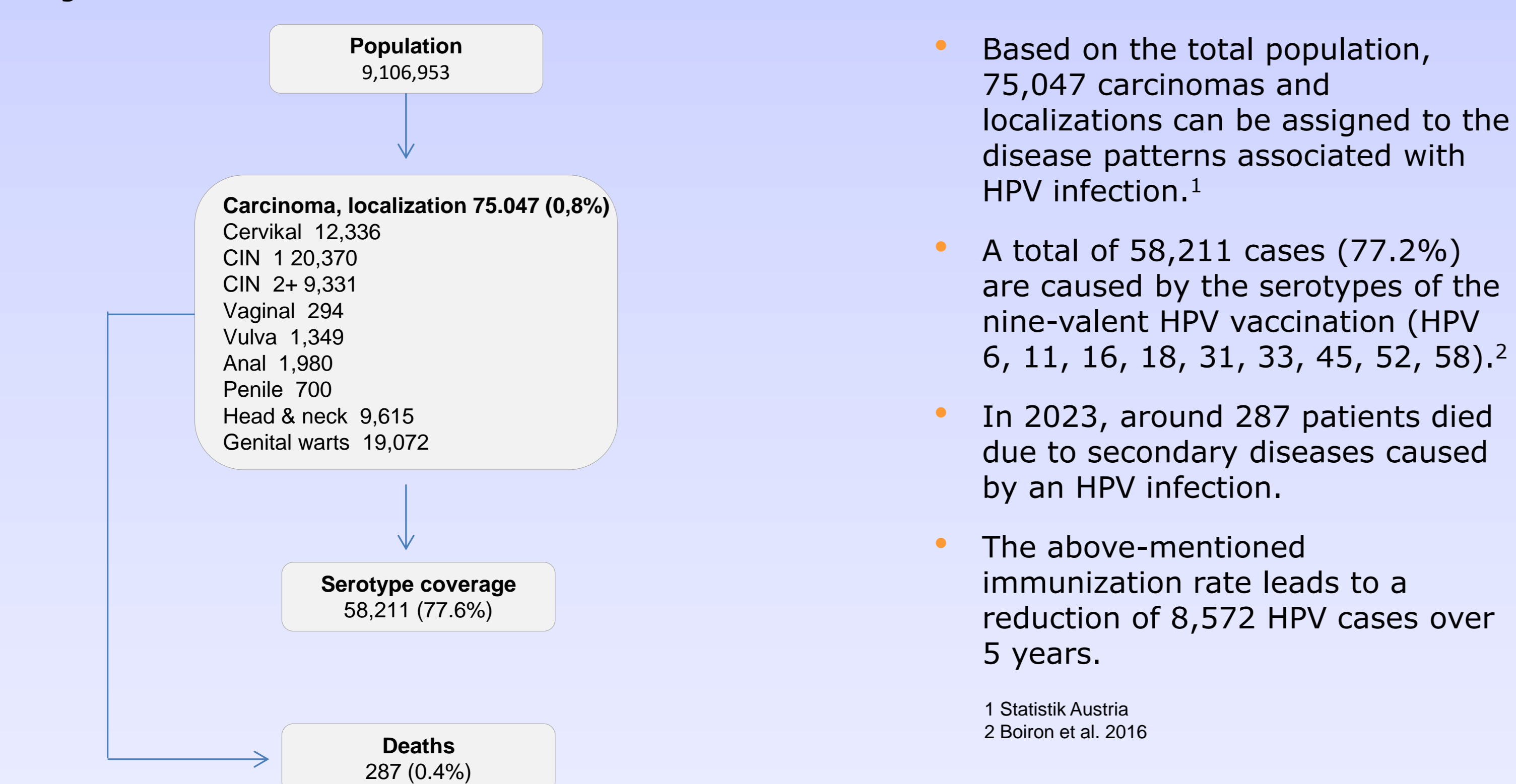
Figure 1: Model Design



Epidemiological

Due to HPV, the events shown in the figure 2 occur annually:

Figure 2: Patientflow WITHOUT HPV vaccine

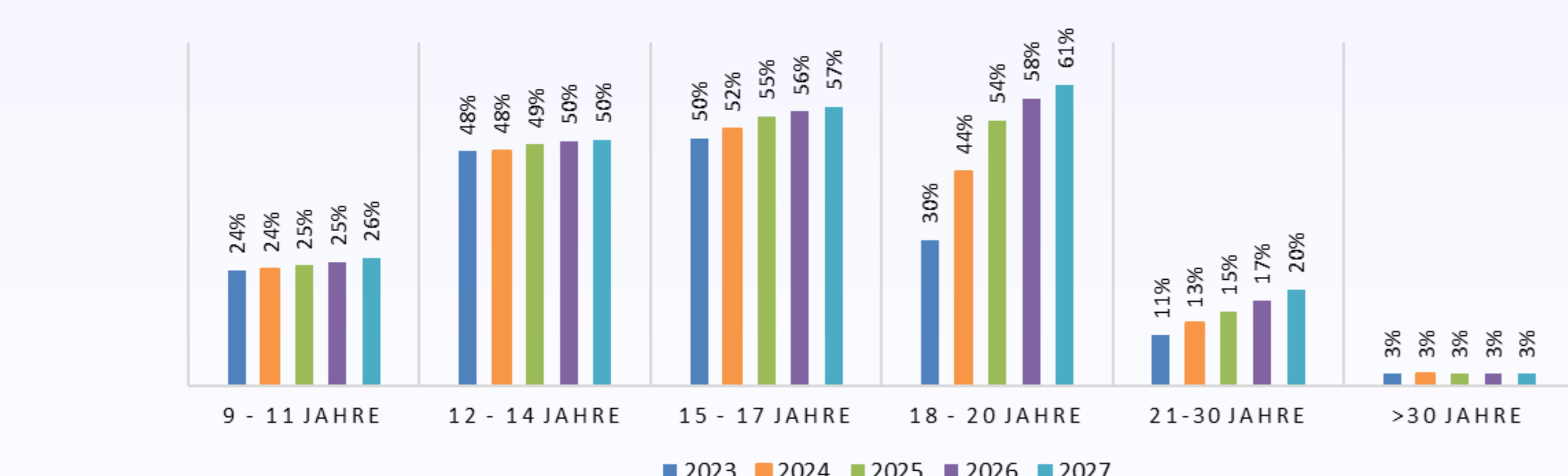


Vaccination recommendation and vaccination coverage

The 9-valent vaccination against human papillomaviruses (HPV9, Gardasil 9) is available in the free vaccination program for girls and boys from the age of 9 to the age of 21 and is vaccinated according to the 1+1 scheme: 2nd dose 6-12 months after the 1st dose. Vaccination is also carried out as part of school vaccinations (preferably in the 4th grade).³

The vaccination rate is an extrapolation of a simulation model (TU Vienna), which combined data from the childhood vaccination program, HPV catch-up vaccination and the private market as well as population data. The results for the years 2014 to 2021 were presented in the HPV report.⁴ Based on the extrapolation for the years 2023-2027 with free access up to the age of 21, vaccination coverage is as follows:

Figure 3: Vaccination coverage of age groups



Source: own calculations

Efficacy of HPV vaccination

The "efficacy" of the vaccination (9-fold vaccination) is considered according to gender and HPV 16 and HPV 18 and HPV 31, 33, 45, 52 and 58 (weighted). The link between vaccination coverage and serotype coverage and efficacy results in the reduced cases (e.g. for 2023, with a vaccination coverage of 7.4%, 73,601 cases instead of 75,047 cases without vaccination).

Direct costs

The BIA includes costs of inpatient and outpatient HPV treatment, including medication and the inpatient and outpatient treatment of the carcinoma sites and genital warts. Costs were presented from the payer perspective. The vaccination costs are partly borne by the population and partly represent private health expenditure. The cost of vaccination was evaluated using list prices. These are 129.00€ (manufacturing price) for the free vaccination program and 192.50€ (selling price) in the case of self-payment.

Indirect costs

The costs of work loss associated with HPV are classified as indirect costs. Indirect costs are calculated on the basis of the employment rate by age group (proportion of the population in employment). The duration of work loss is calculated for each disease associated with HPV infection. Costs were presented from the societal perspective.

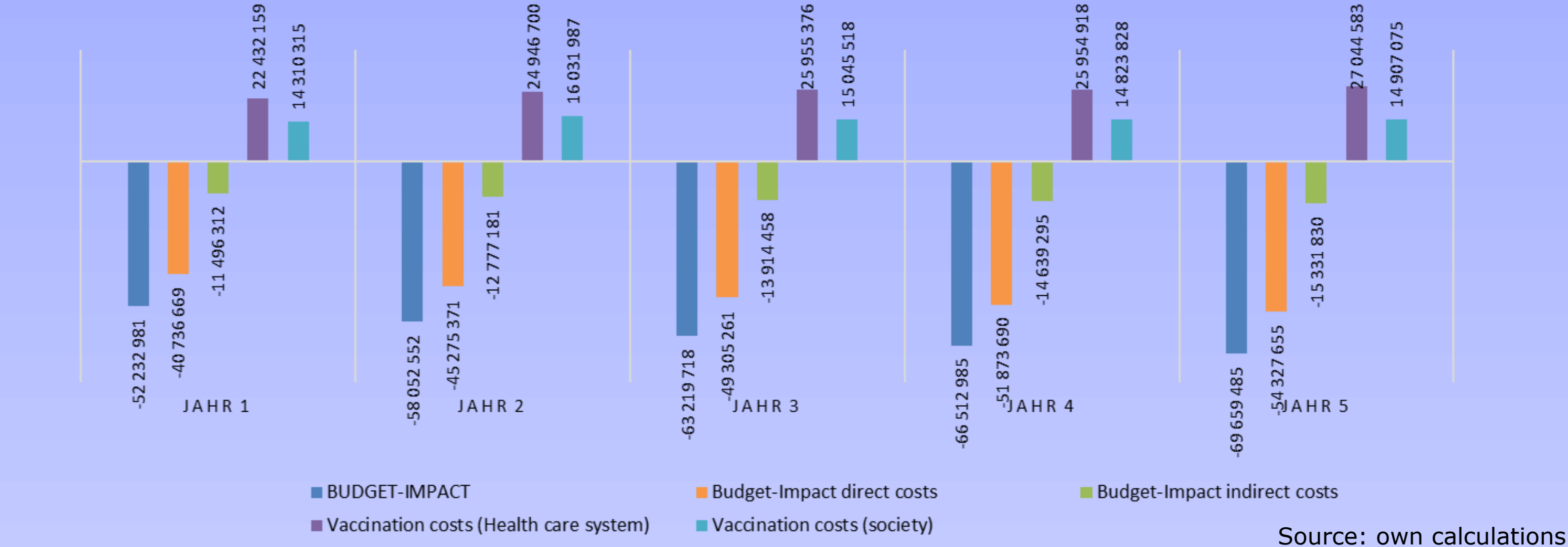
Results

Assuming the mentioned growth of vaccination coverage rate, annual savings account for 52.2 million € (m€) (1st-year) to 69.7 m€ (5th-year) [total: 309.7 m€ over 5-years]. Direct costs contributed between 40.7 m€ (1st-year) to 54.3 m€ (5th-year) [total: 241.5 m€] to total saving.

Multiplier effects:

- 1€ invested in the HPV vaccine relieves the society by -4.14€
- 1€ invested in the HPV vaccine saves -1.91€ within the health care system

Figure 4: Total budget-impact



With the current vaccination coverage, vaccination results in annual cases of disease prevented of 1,446 (2023) to 1,928 (2027) or a total of 8,572 over 5 years.

- Of these, 6,093 are prevented carcinomas and
- 2,479 localizations prevented.

The deaths prevented range from 10 (2023) to 14 (2027) or contribute to the savings with 62 (5 years).

Table 1: Prevented cases due to HPV vaccination

Prevented cases	Year 1	Year 2	Year 3	Year 4	Year 5
Localizations	-418	-465	-506	-532	-558
Carcinomas	-1,028	-1,142	-1,244	-1,309	-1,371
Deaths	-10	-12	-13	-13	-14

Source: own calculations

With the current vaccination rate, vaccination results in annual absences from work of 592 (2023) to 789 (2027) or a total of 3,507 over 5 years.

The number of days lost from work is reduced between 37,766 (2023) and 50,366 (2023) or 223,905 days over 5 years.

Table 2: Prevented work absenteeism

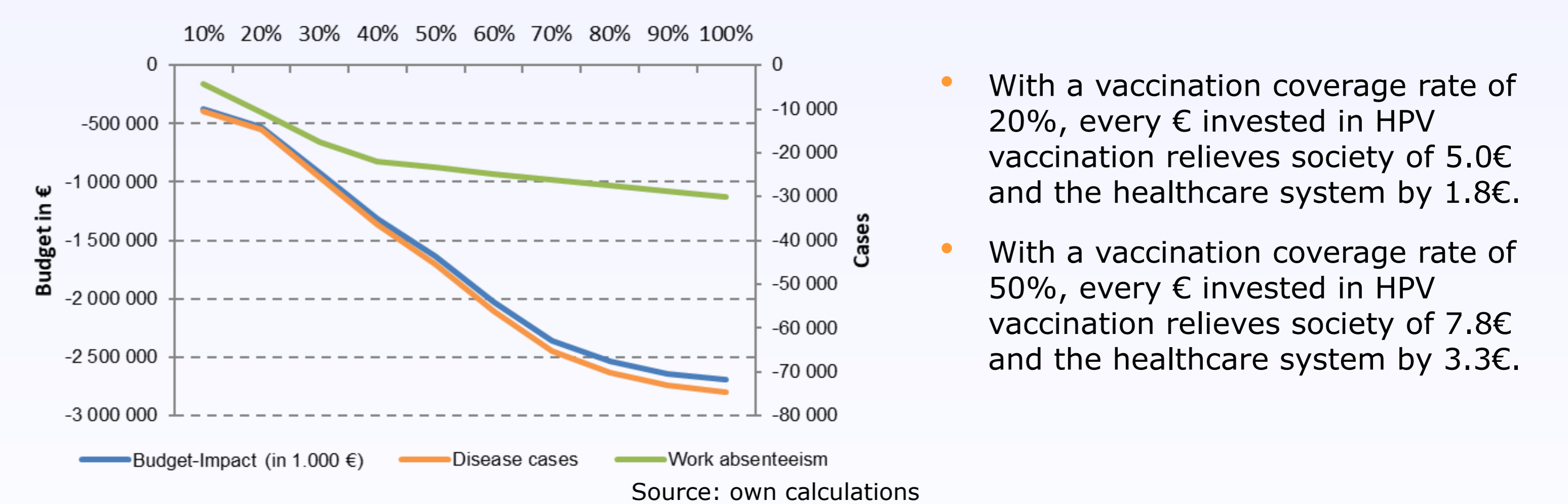
Prevented cases	Year 1	Year 2	Year 3	Year 4	Year 5
Work absenteeism cases	-592	-657	-716	-753	-789
Work absenteeism days	-37,766	-41,973	-45,709	-48,091	-50,366

Source: own calculations

Sensitivity Analysis

With a vaccination coverage rate of 20%, the total budget impact increase from 309.7 m€ over 5 years to 532.2 m€; with a vaccination coverage rate of 50%, there is a further increase to 1,640.1 m€.

Figure 5: Sensitivity analysis



Conclusion

1€ invested in the HPV-vaccine relieves the society with 4.1€ and saves 1.9€ in health-care-system. The cervical cancer incidence-rate would decrease to 5.1/100,000 women in 2027.

References

Boiron L, Joura E, Largeron N, Prager B, Uhart M. Estimating the cost-effectiveness profile of a universal vaccination programme with a nine-valent HPV vaccine in Austria. BMC Infect Dis. 2016;16:153. DOI: 10.1186/s12879-016-1483-5. Federal Ministry of Labour, Social Affairs, Health and Consumer Protection. Austrian vaccination scheme 2020. Vienna, Austria. 2019.

Additional literature with the author

Funding: This study was funded by a grant from ÖVIH - Austrian Association of Vaccine Manufacturers

