POSC117

ISPOR 24th Annual European Congress, 30th November - 3rd December 2021, Virtual

A Public Health and Budget IMPACT Analysis (BIA) of COVID-19 Vaccination in Austria

Matthäus Traunfellner[a], Franz Meyer[a], Evelyn Walter[a]
[a]IPF Institute for Pharmaceconomic Research, Vienna, Austria

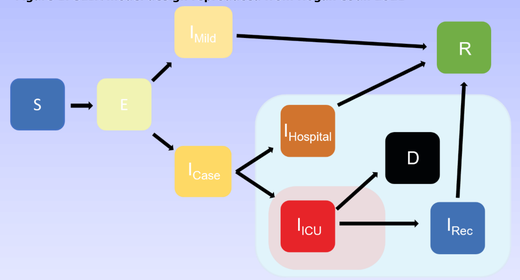
Objectives

Since 2020, the COVID-19 pandemic caused an unanticipated increase of worldwide morbidity and mortality, placing a massive financial burden on national health-care-systems and causing significant follow-up costs. By November 2021, more than 248 million people worldwide had become infected with SARS-CoV-2, including more than 800,000 cases in Austria. Vaccinations are available for adults ≥ 18 years and for children and adolescents ≥ 12 years. The aim of this BIA is to quantify the monetary-impact due to the current situation of COVID-19 vaccination, expressed as a world with vaccination, compared to a world without vaccination.

Methods

The prediction of COVID-19 cases, inpatient stays (hospital, ICU) and deaths was performed using an online SEIR model (COVID-19 Scenario Analysis Tool. MRC Centre for Global Infectious Disease Analysis, Imperial College London. www.covidsim.org, v4 accessed on June 18th 2021). The model is based on a previous age-structured deterministic SEIR-type compartmental model for SARS-CoV-2 transmission (Walker et al. 2020) that was adapted to account for the effects of vaccination (Hogan et al. 2021). The BIA used the results of the SEIR model to estimate the number and costs for hospitalizations, rehabilitation, work absences and loss of human capital in a "world with vaccination" compared to a "world without vaccination." The time horizon of the BIM is three years (2021-2023) and builds on the Austrian population. The BIA shows the resource utilization and costs for adult patients in three different age categories (18-49y, 50-65y, ≥65y).

Figure 1: SEIR model design reproduced from Hogan et al. 2021



- The flows are depicted for the unvaccinated population. Individuals in the susceptible (S), exposed (E) and recovered (R) state can be vaccinated (Hogan et al. 2021).
- The displayed model was extended to capture loss of naturally-acquired immunity by including an additional flow from the recovered state to the susceptible state.
- Vaccinated individuals move into a temporary state to capture the delay between receiving the vaccine and being protected before moving into a vaccine-protected state.

S – Susceptible, E – Exposed, I_{mild} – Mild or asymptomatic infection, I_{Case} – Infection requiring hospitalization, $I_{hospital}$ – Infection treated in the hospital (normal ward), I_{ICU} – Infection treated in the ICU, D – Death, I_{Rec} – Infection treated in the hospital (normal ward) after ICU treatment, R - Recovered

Source: Hogan et al. 2021

Epidemiological und clinical Data

The distribution of total confirmed COVID-19 cases and COVID-19 related death among the age categories considered was obtained from data of the Epidemiological Reporting System of the Austrian Agency for Health and Food Safety (AGES). The age distribution of hospitalized and ICU-treated patients was obtained from a large German registry study (Ludwig et al. 2021) and data from the Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGKP).

CONTACT:
Matthäus Traunfellner, MSc.
IPF Institute for Pharmaceconomic Research
Wolfengasse 4/7
1010 Vienna, Austria
Phone: +43-1-5132007-13
Fax: +43-1-5132007-15
Email: m.traunfellner@ipf-ac.at
Web: www.ipf-ac.at

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

Table 1: Age distribution of total registered COVID-19 cases

Age group	Share of cases (%)
18 – 49y	59%
50 – 64y	25%
≥ 65y	16%

Table 2: Age distribution of COVID-19-related deaths

Age group	Share of cases (%)
18 – 49y	1%
50 – 64y	7%
≥ 65y	92%

Table 3: Age distribution of hospitalized COVID-19 cases

Age group	Share of cases
18 – 49y	25%
50 – 64y	29%
≥ 65y	46%

Table 4: Age distribution of ICU-treated COVID-19 cases

Age group	Share of cases (%)
18 – 49y	11%
50 – 64y	30%
≥ 65y	59%

Source: Epidemiological Reporting System of the Austrian Agency for Health and Food Safety (AGES), Ludwig et al. 2021, Federal Ministry of Social Affairs, Health, Care and Consumer Protection (BMSGKP), own calculations.

The efficacy of COVID-19 vaccination, against symptomatic infections, was calculated as the mean of the published efficacies (EMA EPAR) of the four EMA-approved vaccines, weighted by the number of doses per agent administered in Austria until November 2021.

Table 5: Vaccine efficacy against symptomatic infection

Vaccine	Efficacy (%)
Comirnaty®	95%
Spikevax®	94%
Vaxzevria®	60%
COVID-19 Vaccine Janssen®	67%

Source: EPAR Comirnaty®, EPAR Spikevax®, EPAR Vaxzevria®, EPAR Covid-19 Vaccine Janssen®

Table 6: Patient share of EMA-approved vaccines in Austria

Vaccine	Administered doses (%)
Comirnaty®	72%
Spikevax®	9%
Vaxzevria®	14%
COVID-19 Vaccine Janssen®	5%

Source: Austrian COVID-19 Open Data Information Portal – accessed on November 3rd 2021

Vaccination rate

The assumption of vaccination rate per age group is based on data from the Austrian COVID-19 Open Data Information Portal and surveys conducted by the Austrian Corona Panel Project (ACCP). The immunization rate by the end of 2021 was suspected to be 80% of the population that can be vaccinated (≥ 12y). EMA vaccine approval for 5-11 year olds is suspected to begin in 2022.

Table 7: Vaccination rate over 3 years

Age group	Estimated vaccination rate (%)	Total number of vaccinated individuals (n)		
		2021	2022	2023
5-11y	36%	0	218,345	220,375
12-17y	46%	238,873	239,088	239,524
18-49y	80%	2,952,404	2,940,922	2,933,130
50-64y	80%	1,586,406	1,593,940	1,596,669
≥ 65y	90%	1,549,519	1,580,618	1,612,819

Source: Statistics Austria 2021, Austrian Corona Panel Project (ACCP), Austrian COVID-19 Open Data accessed on November 3rd 2021

Direct costs

The BIA includes costs of hospitalization and ICU treatment, rehabilitation and COVID-19 related death of adult patients ≥ 18y. Costs were presented from the payer's perspective and are presented stratified according to age groups (18-49y, 50-64y, ≥65y). The length of stay for hospitalization and ICU treatment is based on information from the Robert Koch Institute (RKI) and the proportion of hospitalized and ICU-treated patients requiring rehabilitation is informed by the National Institute for Health Research (NIHR). Direct costs for children and adolescents (5-17y) are estimated to be negligible compared to adults.

Indirect costs

Indirect costs include sick leaves due to quarantine, hospital or ICU treatment and loss of human capital from deaths. Indirect costs are calculated based on the employment rate by age group (share of the working-age population). The duration of quarantine and sick leaves after hospital and ICU treatment is based on information from Robert Koch Institute (RKI). Indirect costs for children and adolescents (5-17y) are not considered.

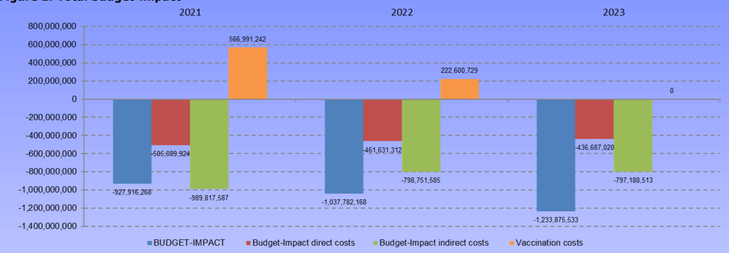
Vaccination costs

Vaccination costs include, patient share weighted, costs for vaccines per vaccination series (two vaccinations) and physician fees for the first and second vaccination per vaccination series. The assumed number of vaccination series follow the recommendations of the Austrian National Immunization Panel (NIG). After first vaccinations with COVID-19 Vaccine Janssen, second vaccinations are performed with mRNA vaccines (Cominarty®, Spikevax®). In 2021, one vaccination series for individuals aged ≥ 12-64 years and one vaccination series and one booster vaccination for adults aged 65 years and older are considered. In 2022, one booster vaccination for adults 18-64 years of age and one vaccination series for children and adolescents 5-11 years of age are scheduled.

Results

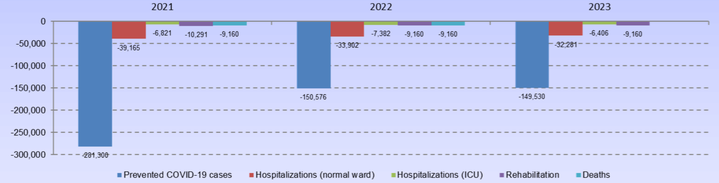
Based on the assumed vaccination coverage annual savings of 927.9 million € (1st year) to 1.2 billion € (3rd year) [total: 3.2 billion € over 3 years] could be achieved. Direct costs contributed between 436.7 million € (3rd year) to 505.1 million € (1st year) [total: 1.4 billion €] to total saving. The society is relieved due to a vaccination strategy. The savings in indirect costs range from 797.2 million € (3rd year) to 989.8 million € (1st year) [total: 2.6 billion €]. The costs of the vaccination, paid by the national health system, range from of 0 € (3rd year) to 567.0 million € (1st year) [total: 789.6 million €].

Figure 2: Total budget-impact



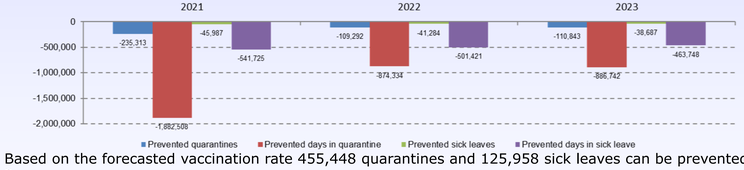
- Multiplicator: 1 € invested in COVID-19 vaccines saves 4.05 € within society and 1.78 € in the health care system over 3 years.

Figure 3: Prevented cases, hospitalizations, rehabilitation and deaths



- With the predicted vaccination coverage 581,406 COVID-19 cases, 105,348 hospitalizations, 20,610 ICU admission, 28,611 rehabilitations and 28,611 deaths can be averted in 3 years.

Figure 4: Prevented quarantines and sick leaves



- Based on the forecasted vaccination rate 455,448 quarantines and 125,958 sick leaves can be prevented in 3 years.

Source: own calculations

Conclusion

1 € invested in COVID-19 vaccines saves 4.05 € within society and 1.78 € in the health care system over 3 years.

References

Hogan, Alexandra B., et al. "Within-country age-based prioritisation, global allocation, and public health impact of a vaccine against SARS-CoV-2: a mathematical modelling analysis." Vaccine 39.22 (2021): 2995-3006.
Walker, Patrick GT, et al. "The impact of COVID-19 and strategies for mitigation and suppression in low-and middle-income countries." Science 369.6502 (2020): 413-422.

Additional Literature with the author