

Development of a Markov model-based visualization tool of regional HPV vaccination coverage rates over time in Austria - combining data from the pharmaceutical industry and Healthcare data including the national vaccination registry

Zauner G.¹, Zechmeister M.², Rippinger C.³, Paulke-Korinek M.⁴, Popper N.⁵

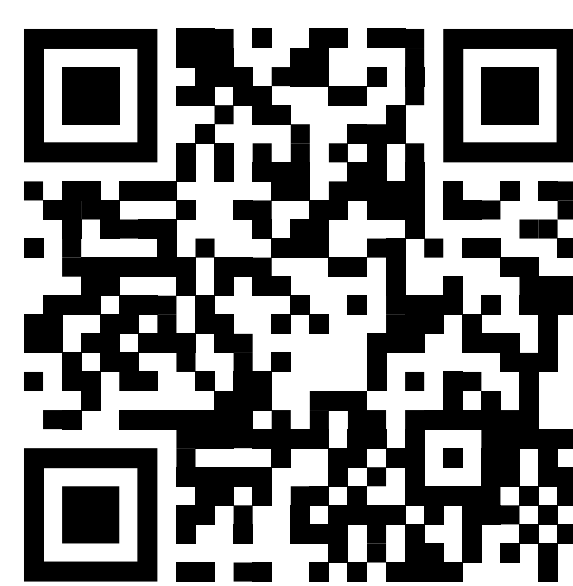
¹Lead Health Economics, dwh GmbH, Vienna, Austria, ²Institute of Statistics and Mathematical Methods in Economics, TU Wien, Vienna, Austria, ³Simulation Services, dwh GmbH, Vienna, Austria, ⁴Public Health and Healthcare System, Ministry of Social Affairs, Health, Care and Consumer Protection, Vienna, Austria, ⁵Institute of Information Systems Engineering, TU Wien, Vienna, Austria.

INTRODUCTION

Austria was the first country in Europe, that implemented a gender-neutral national immunization program for children in 2014. To monitor the vaccination program, vaccination coverage rates (VCRs) were calculated and visualized for both genders by federal state in the HPV cockpit based on data from the Ministry of Health Care and Consumer Protection and sales figures from the pharmaceutical industry. In order to monitor a vaccination program, VCRs were evaluated to better identify gaps in immunity in the population and thus better combat diseases.

The dashboard can be accessed via the QR code on the right or the following link:

<https://go.msd.com/hpvcockpit>



METHODS

The HPV vaccination rates are calculated using an R-based stochastic simulation model. The results are then visualized in MS Power BI.

The model parametrization is based on two data sources:

- **Sales data from the vaccine manufacturer:** This includes the total number of vaccine doses sold but does not provide any demographic or regional breakdown.
- **National vaccination registry:** This data is broken down by age, gender, vaccination location and dose, but it can be assumed that the total number of vaccinations is not yet complete here.

To calculate realistic VCRs, sales figures (including wastage) are distributed according to the distribution of registered vaccinations, as shown in Figure 1.

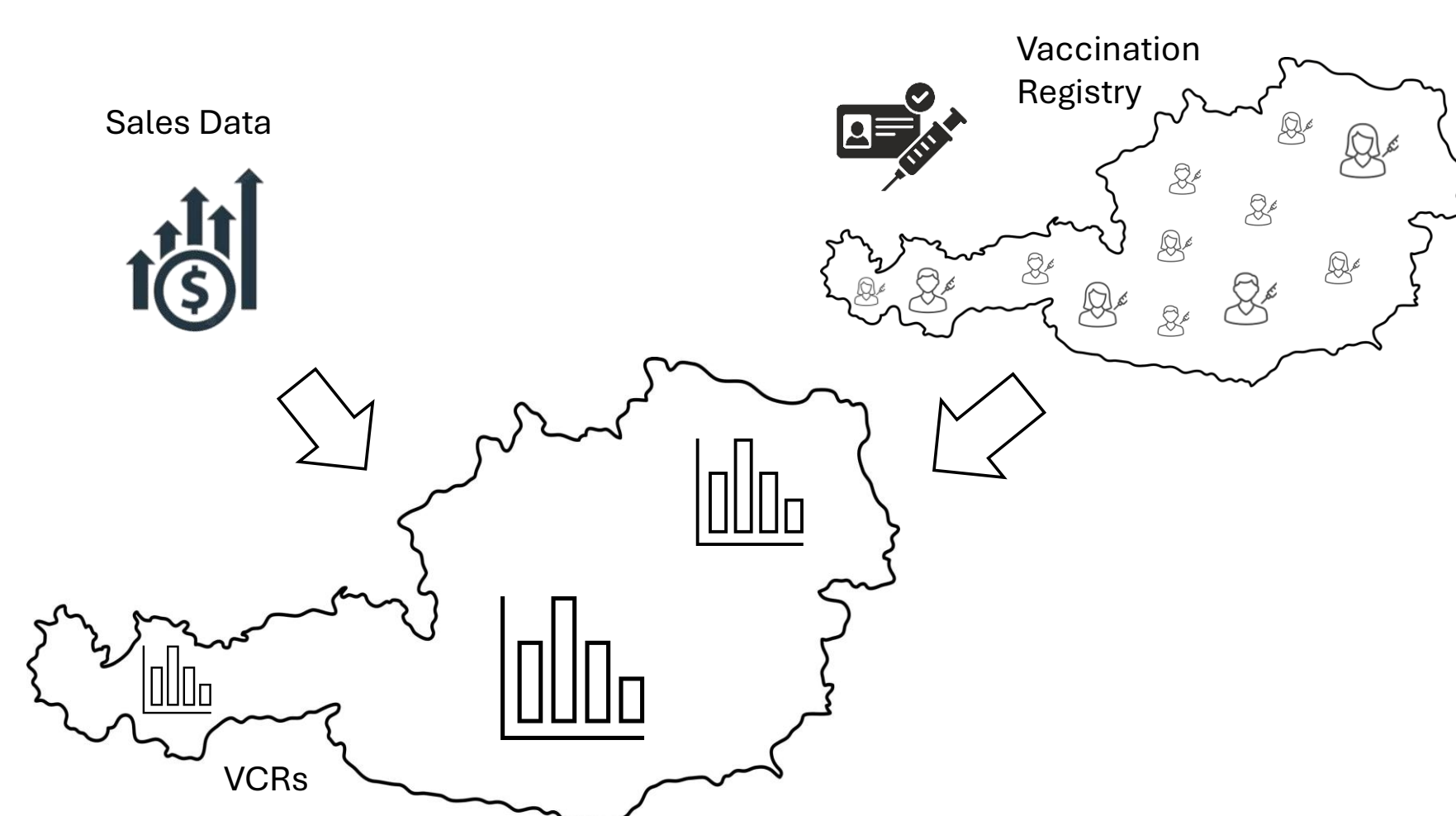


Figure 1: Calculation of VCRs

This is done in several steps: first, the total annual number of vaccinations is determined. These vaccinations are then distributed among the individual doses or groups of people (age, federal state, gender). Finally, the VCRs within these groups of people are calculated.

CONCLUSION

By linking sales figures from the vaccine manufacturer and vaccination figures from the healthcare sector, the dashboard provides a good picture of the current situation and makes it possible to highlight weaknesses. The dashboard provides a good basis for decision-makers. Next steps on more detailed regional calculations will optimize the usability.

RESULTS

To provide the most up-to-date data possible, the dashboard is updated monthly. Data from the previous month is usually available in the middle of the following month.

VCRs vary widely between the federal states, ranging from 76% (Vienna) to 29% (Salzburg) among 14-year-olds (Figure 2).

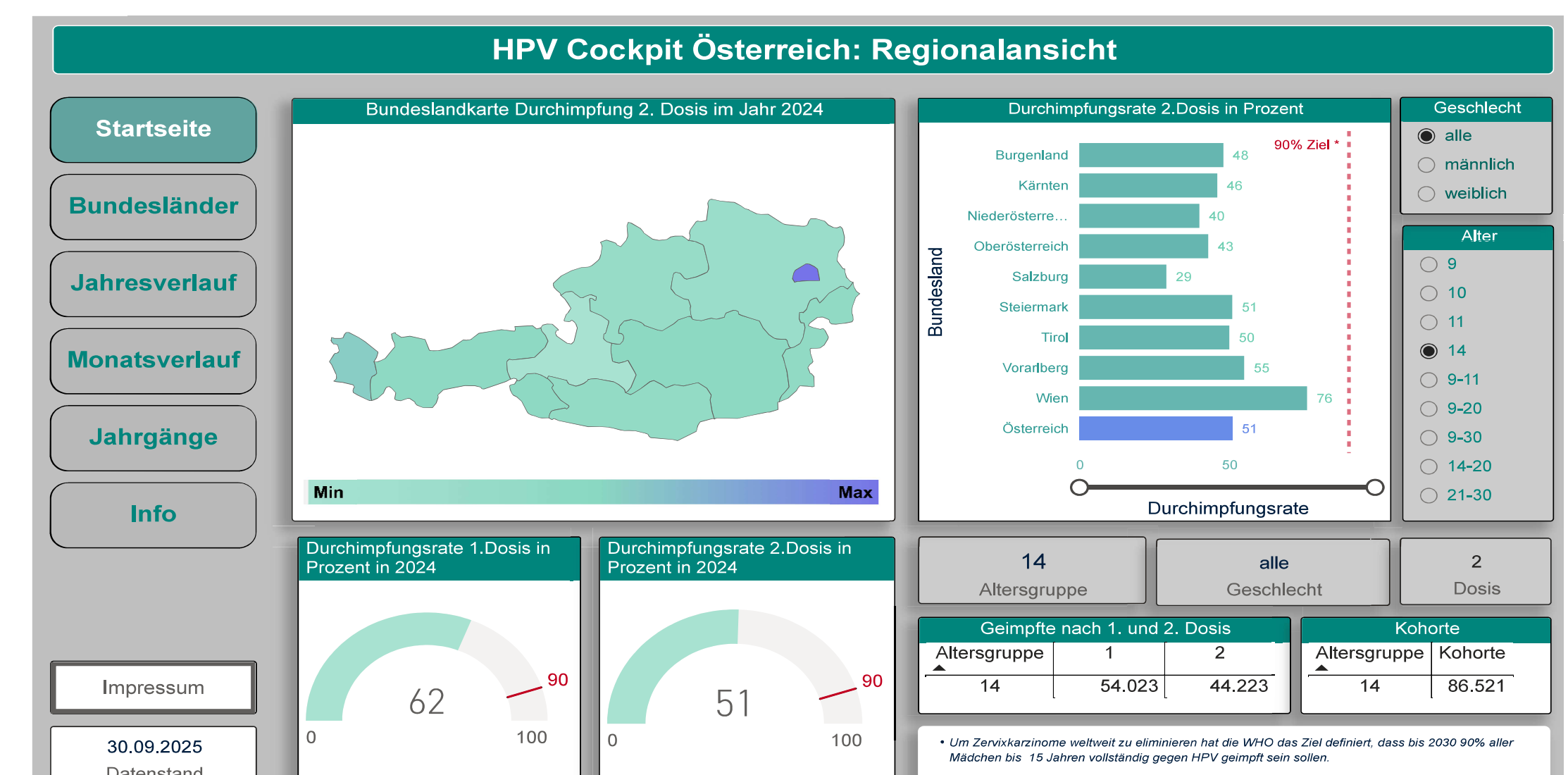


Figure 2: Start screen of the Cockpit

By breaking down the data by month, a significant increase in first vaccinations of 9-year-olds in some federal states in October clearly shows the school vaccination programme (Figure 3).

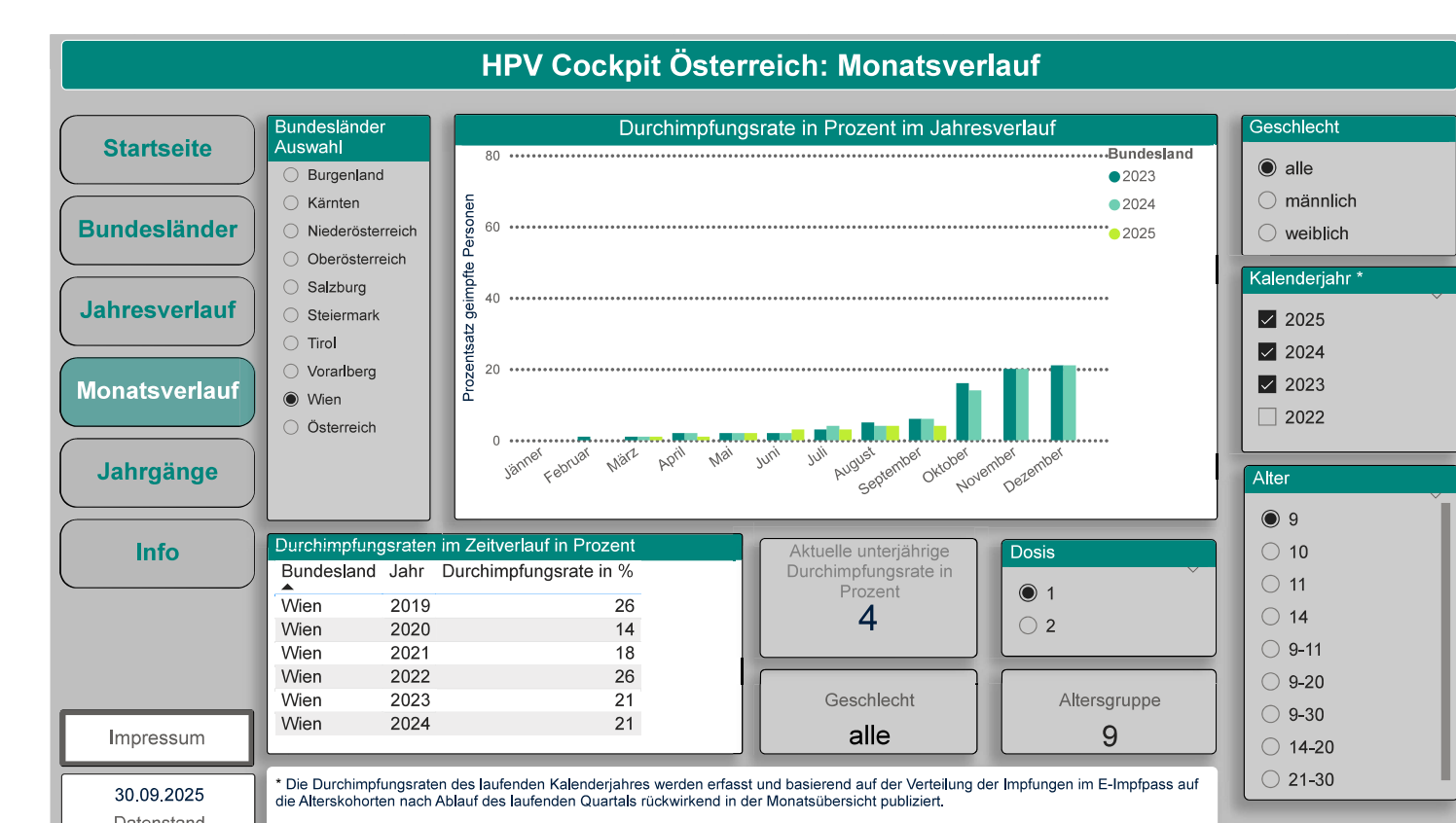


Figure 3: VCRs of 9-year-olds in Vienna

In July 2024, a catch-up campaign with free HPV-vaccinations up to the age of 30 was initiated. This leads to a jump in the vaccination coverage rate from 12% to 36% in the corresponding age cohort (June 2024 - September 2025) as can be seen in Figure 4.

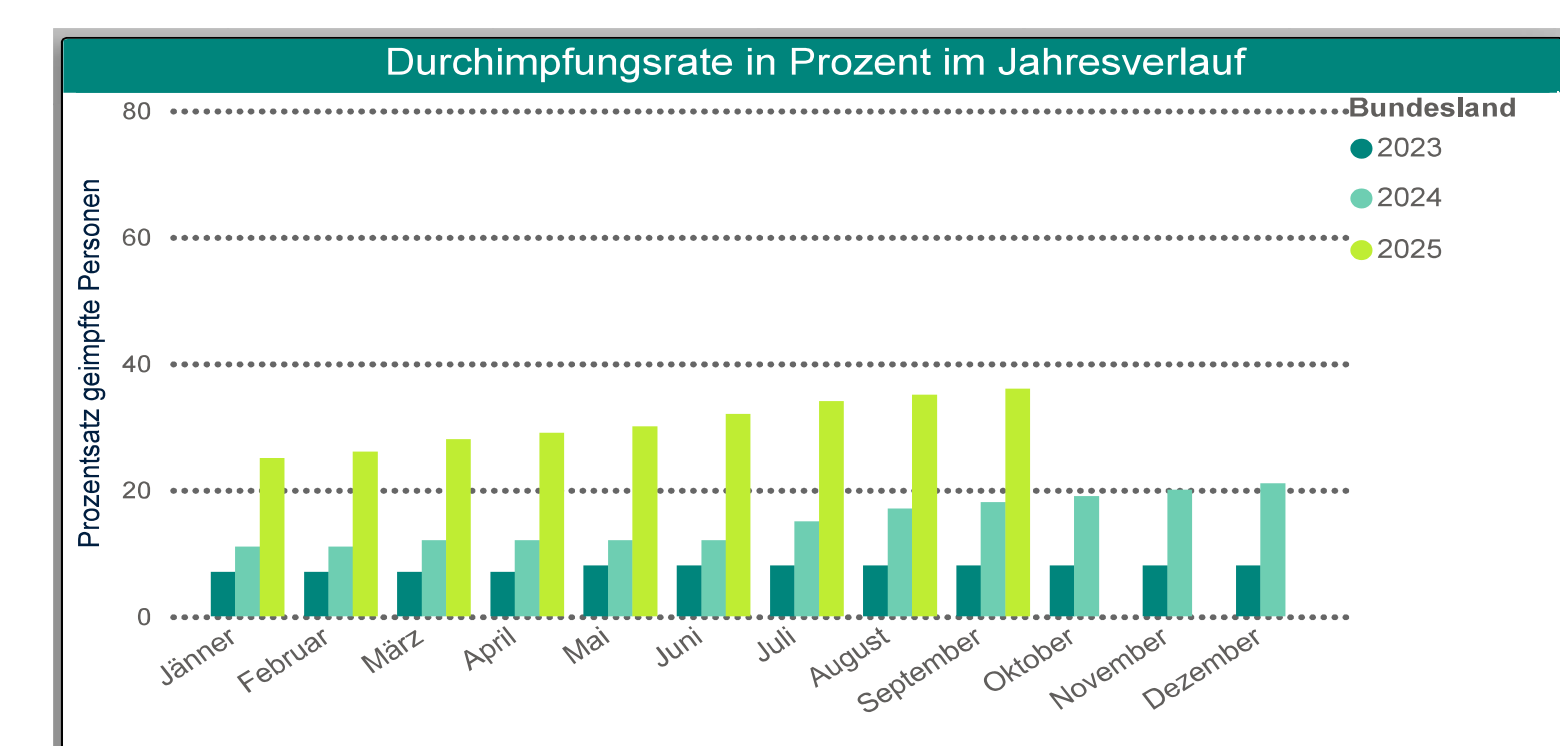


Figure 4: VCRs of 21-30-year-olds by month

In the presentation of the cohorts, individual cohorts can be tracked and compared over several years. This allows, for example, the success of the childhood vaccination program to be compared in different years (Figure 5).

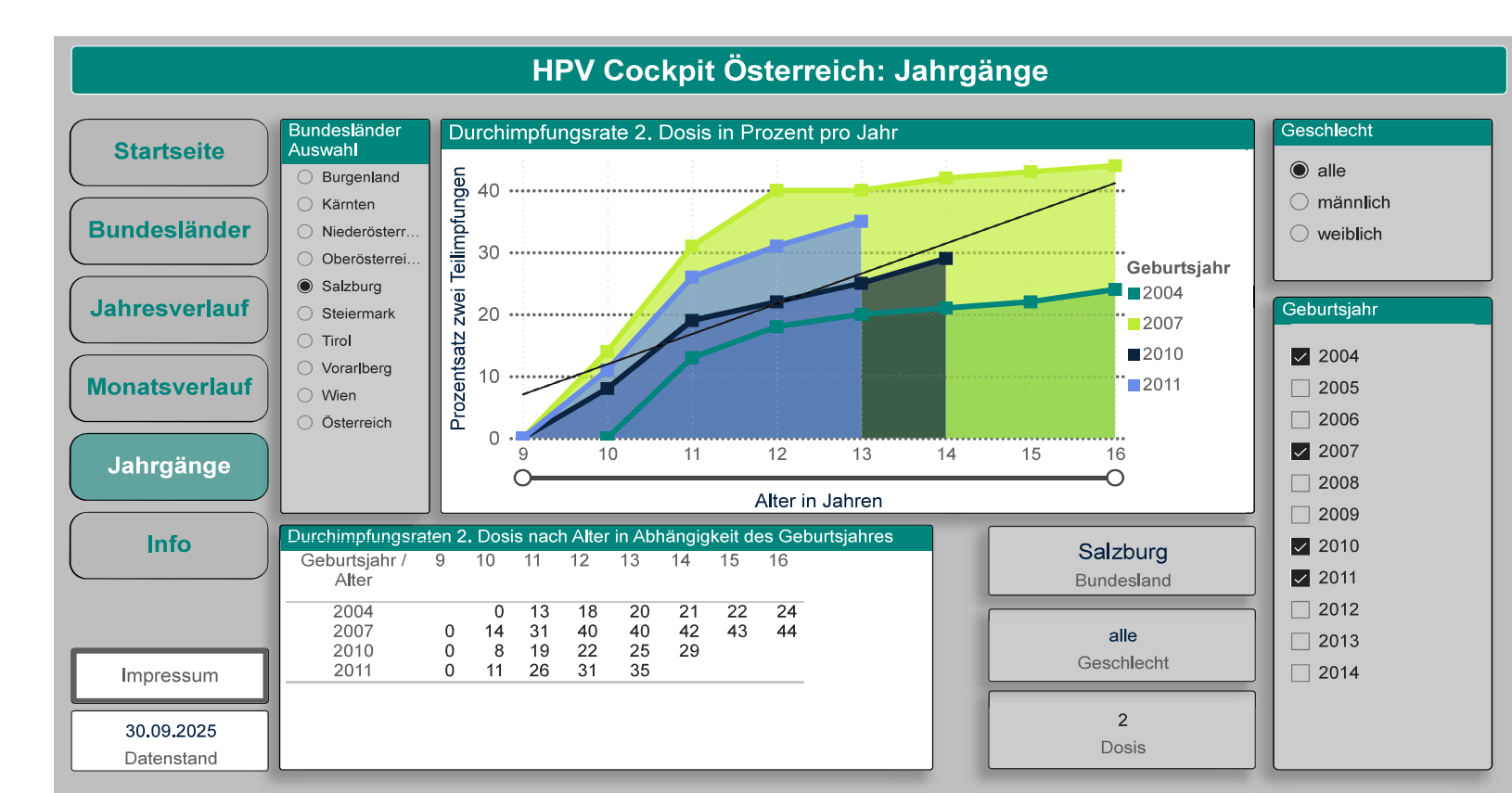


Figure 5: VCRs of certain age cohorts in Salzburg

DISCLAIMER/CONTACT

The data is provided by the Austrian Ministry of Social Affairs, Health, Care and Consumer Protection resp. MSD and processed exclusively by TU Vienna and dwh GmbH. MSD covers the costs of implementing and maintaining the dashboard.

Further Information: guenther.zauner@dwh.at