Name: Ivane Gamkrelidze

Country: United States

Affiliation: CDA Foundation

Function: Modeling

Main expertise: Disease and economic burden modeling for viral hepatitis

Modeling and validation of viral hepatitis-related hepatocellular carcinoma in the European region

Ivane Gamkrelidze

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POLARIS OBSERVATORY

CDA Foundation (CDAF) is a nonprofit organization with the goal of assisting countries in achieving WHO hepatitis elimination targets

POLARIS OBSERVATORY

Services

- HCV & HBV disease burden modeling
- HCV & HBV economic impact modeling
- HBV vertical and horizontal transmission modeling
- Cohort analysis
- Hepatitis elimination strategies
- Cost-effectiveness and ROI analyses
- Data and metrics to track progress to elimination

Guiding principles

- Validate all data/analyses with local experts
- Complement country interviews with literature searches to minimize the burden on country experts
- Facilitate objective, data-driven decisions and policy-making with consideration of each country's unique needs
- Publish key findings with local collaborators
- Function as a platform to provide data, tools and analyses with a user-friendly Microsoft Excel® interface

The Polaris Observatory maintains mathematical disease burden models for 171 countries for HBV and 118 countries for HCV

- Models are used to estimate future disease burden if current diagnosis, treatment, prophylaxes, and harm reduction programs stay in place
- Models are updated annually and can be used to monitor progress toward elimination of HBV and HCV
- Present work covers 62 countries in the European region
  - » 53 countries in the WHO European Region plus Faroe Islands, Guernsey, Gibraltar, Greenland, Isle of Man, Jersey, Liechtenstein, Holy See, and Kosovo

CDA Foundation. Polaris Database Query. Lafayette, CO: CDA Foundation, 2025. Available from https://cdafound.org/polaris/database-query (Accessed March 19, 2025)

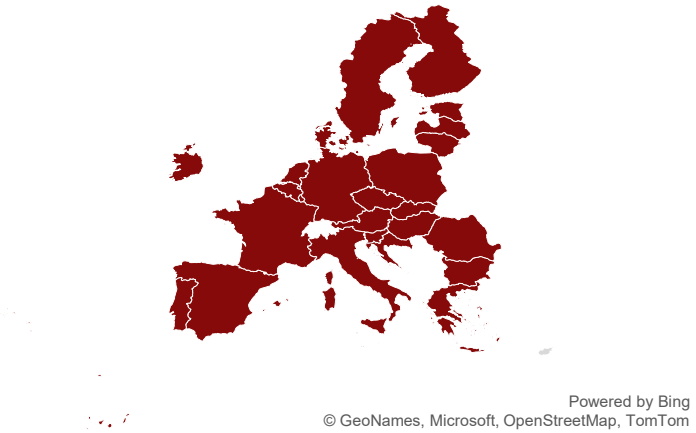
Coverage in the European region

- 34 verified, 6 extrapolated, and 6 Polaris-estimated country models for HBV, covering 99.5% of the 11.1 million HBV infections in the European region
- 38 verified and 5 Polaris-estimated country models for HCV, covering 95.2% of the 8.7 million HCV infections
- Furthermore, HBV models for 20 member states of the European Union and HCV models for 26 have been verified

Verified models (HBV or HCV) in the Polaris Observatory

European region

European Union



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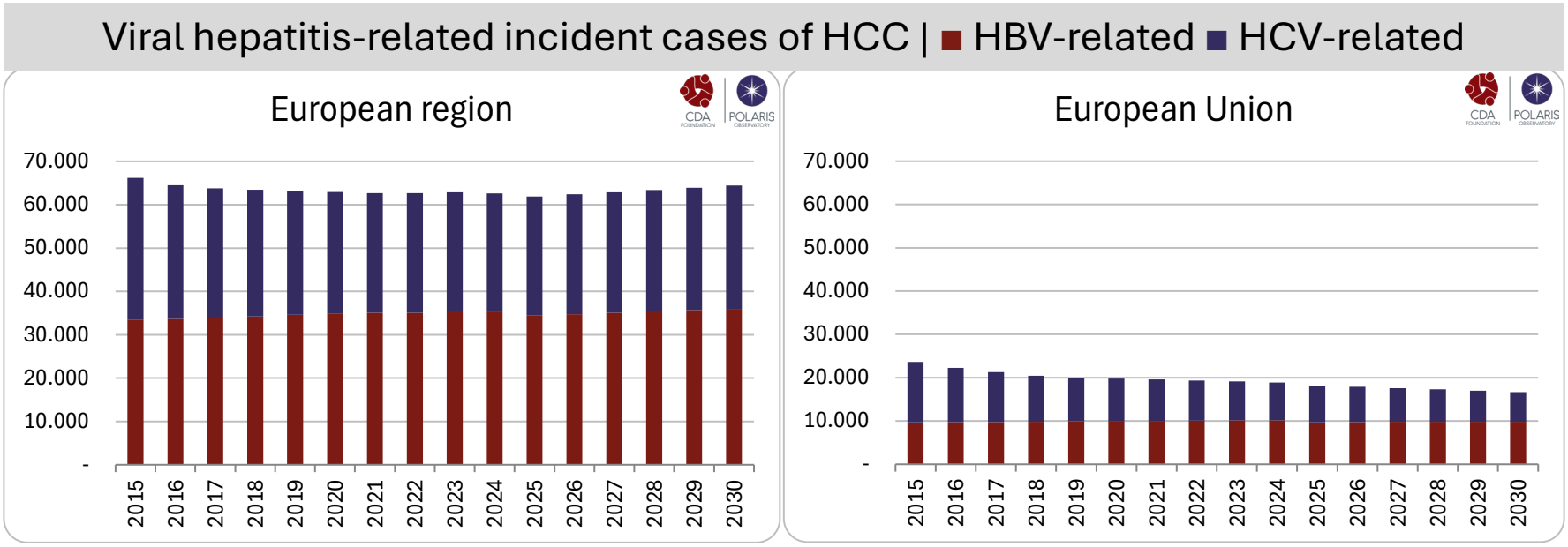
If the status quo of current prophylaxes and treatment trends holds, viral hepatitis-related cases of incident HCC would see a modest decrease from 66.2 to 64.4 thousand between 2015 and 2030 in the European region

- Over 2015–2030, HBV-related HCC incidence would rise by 7.5%
- Over the same period, HCV-related HCC incidence would fall by 13.2%
  - » Share of HCV-related cases of incident HCC would fall from 49% to 44%
- Among member states of the European Union, combined incident cases would fall from 23.6 to 16.7 thousand



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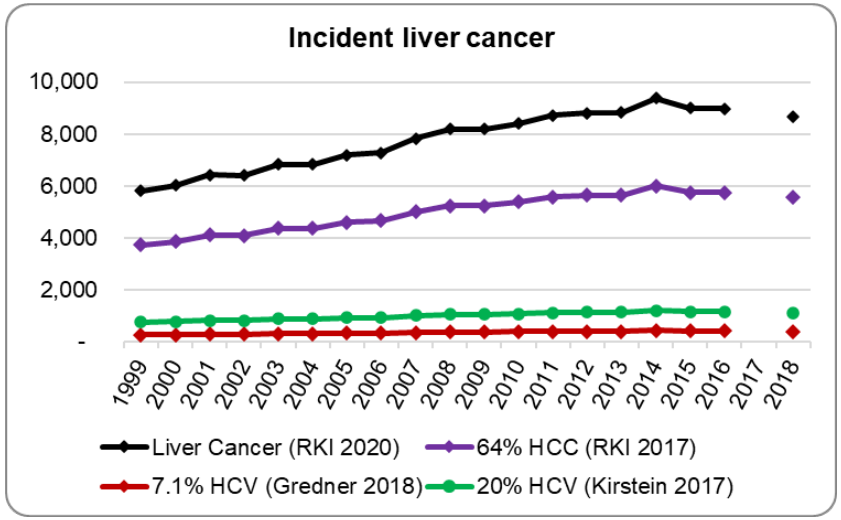
Model validation

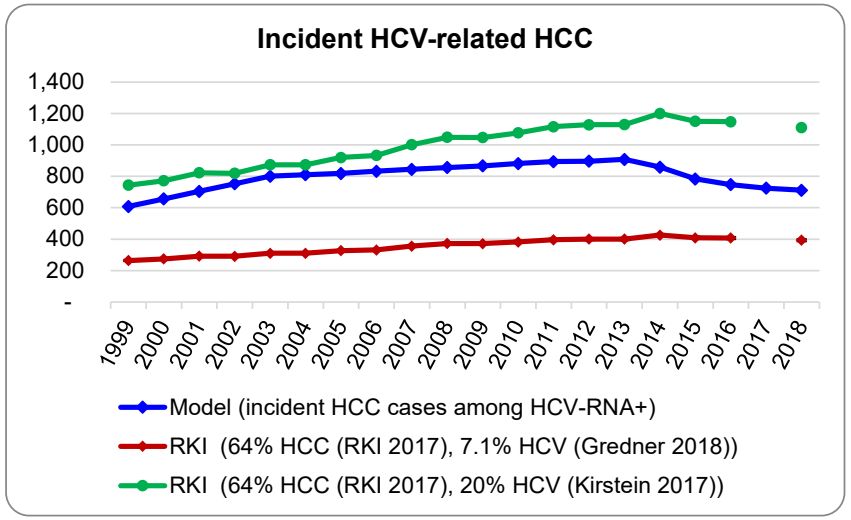
- HCC incidence data from national cancer registries can serve as a validation point for HBV and HCV models, but limitations regarding the robustness of data apply
- Our models are regularly published and validated against reported data across several outcomes — incident cases of HCC are one of them, where available
  - » Incident HCC data is collected from national cancer registries
  - » Retrieved data is adjusted for
    - Type (HCC)
    - Etiology (HBV or HCV)
    - Underreporting

  …using published literature, local databases, and expert input data
- By default, our models do not incorporate the impact of immigration, which we model on a case-by-case basis

HCV-related HCC validation in Germany[1]

- Annual incident liver cancer cases were available from RKI for 1999–2016[2]
  - » Approximately 64% of liver cancer cases are hepatocellular carcinomas[3]
  - » Between 7.1%[4] and 20%[5] of HCC cases have been reported to be HCV-related, with the higher end serving as the likelier estimate based on published data





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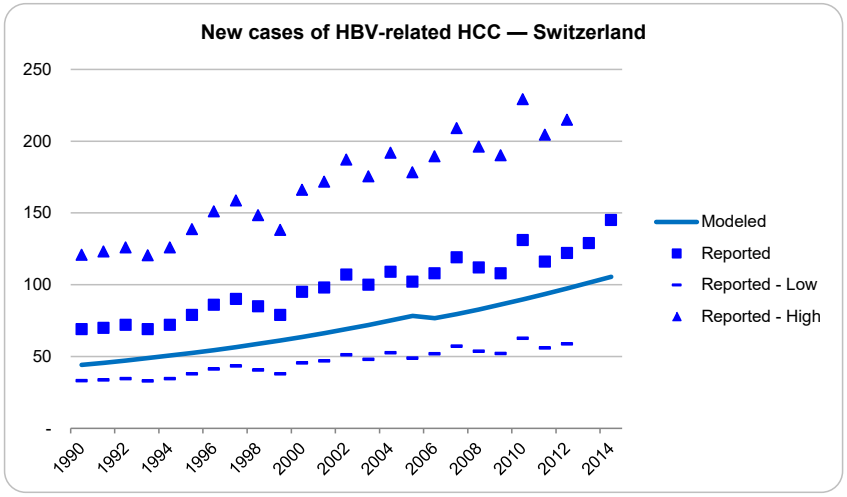
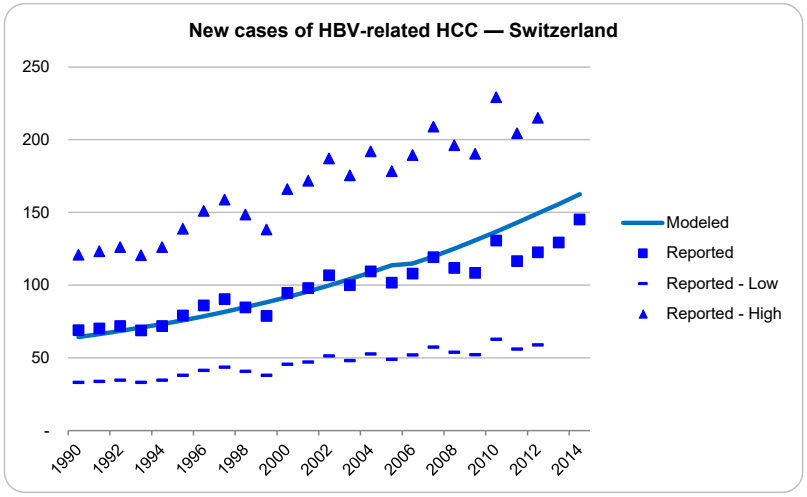
5. Kirstein MM, Schweitzer N, Winter T, Lappas K, Graen N, Kunstmann I et al. Patterns and challenges of treatment sequencing in patients with hepatocellular carcinoma: Experience from a German referral center. *J Gastroenterol Hepatol*. 2017;**32**(10):1730–8. doi:10.1111/jgh.13761.

HBV-related HCC validation in Switzerland[1]

- Liver cancer data from NICER was available annually for 1990–2013
  - » NICER did not include all cantons and was thus an underestimate of countrywide total
- It was assumed that 91% of all liver cancer cases in Switzerland were HCC, and 17.8% of all HCC cases were HBV-related[2]
- Modeled HBV-related HCC incidence was compared to the reported data
- Model was further refined in consultation with an expert panel to include impact of immigration





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Conclusions

- Given the status quo of diagnosis, treatment, and prophylaxes coverage for viral hepatitis in the European region, annual cases of incident HCC would remain relatively stable over 2015–2030
  - » A reduction in HCV-related HCC thanks to curative therapies offset by a rising trend in HBV-related HCC
- National cancer registries are critical in validating viral hepatitis models against real-life data
  - » Several limitations regarding classification of liver cancer cases and underreporting levels exist

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