A Tool to Measure the Impact of Inaction Towards Elimination of Hepatitis C Virus: A Case Study in Germany

THU-107

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BACKGROUND

- Chronic infection with hepatitis C virus (HCV) and its sequelae presents a significant source of human, clinical, economic, and societal burden
- As new therapies for HCV emerge with cure rates greater than 95%, elimination of HCV is attainable provided planning and action is taken to screen and diagnose patients, ensure linkage to care, and provide access to HCV treatment
- The World Health Organization (WHO) has given an elimination target of 2030 for HCV.[1] Therefore, it is important to provide policymakers with data comparing the clinical and economic impact of inaction vs immediate implementation of screening and linkage to care actions vs delaying such interventions

OBJECTIVE

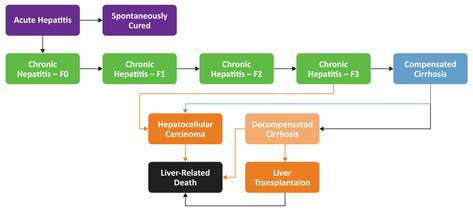
- To develop a predictive model scalable at national, regional, or local levels to assess the clinical and economic impact of implementing screening and treatment policies towards HCV elimination
- Germany was used as a pilot case study since it is one of just nine countries in the world on track to achieve the WHO elimination targets[2]

METHODS

MARKOV MODEL OF HCV DISEASE PROGRESSION (FIGURE 1)

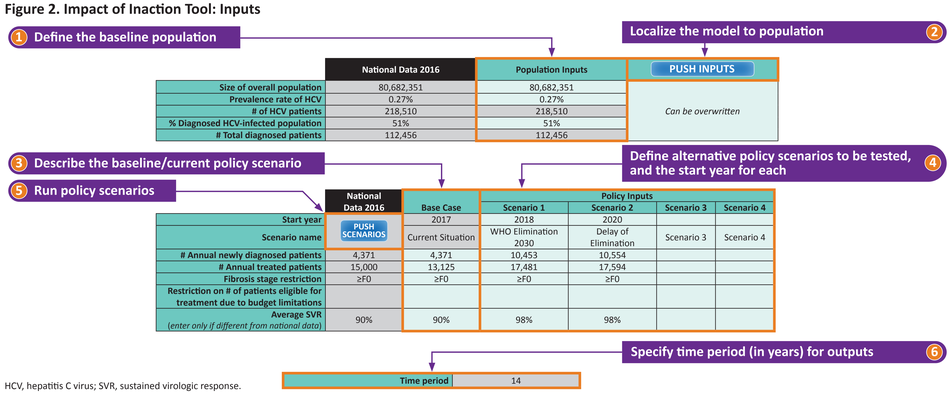
- **Impact of Inaction Tool**
  - Markov disease progression model calibrated to match the size of overall population, prevalence of HCV, and diagnosis coverage
  - Future diagnosis and treatment interventions were specified as policy scenarios

Figure 1. Disease Progression Model



- **Model inputs**
  - Annual population and all-cause mortality rate by sex and age group
    - Mortality rates were standardized for risk factors present in HCV-infected population
  - HCV genotype distribution
  - Disease progression rates by liver disease stage, sex, and age group
  - Annual number of newly diagnosed patients
  - Historic rate of annual liver transplantations due to HCV infection
  - Annual number of antiviral treatments with corresponding sustained virologic response (SVR) rates and liver fibrosis restrictions

Figure 2. Impact of Inaction Tool: Inputs



HCV, hepatitis C virus; SVR, sustained virologic response.

- **Data sources**
  - Overall prevalence estimate for 2012 based on an expert review of the literature[3]
  - Viremic rate for 2012 based on the German health interview and examination survey for adults (DEGS1)[4]
  - Prevalence by sex and age based on national survey (DEGS1) and Robert Koch Institute (RKI) monitoring data[4,5]
  - Genotype distribution based on observational cohort study[6]
  - Diagnosis figures based on RKI monitoring data[5,7]
- Data entered into the Impact of Inaction tool for the German case study shown in **Figure 2**
- **Model calibration**
  - Historical incident cases of HCV were calibrated to match modeled prevalence of HCV by sex and age group to to reported prevalence in a given year
  - The modeled diagnosed cases were calibrated to match the total diagnosed cases reported by the national registry
  - Sex and age distributions of the general and HCV-infected populations were assumed to equal the national-level sex and age distributions
- **Primary model outcomes**
  - Annual future incident and prevalent cases of HCV by disease stage, sex, and age
    - Prevalent cases also reported as diagnosed and treatment-eligible subpopulations
    - Future incidence of HCV assumed to be a linear function of HCV prevalence
  - Annual deaths among HCV-infected population by disease stage, sex, and age
- Outputs from the tool are shown in **Figure 3**

SCREENING AND TREATMENT SCENARIOS

- In this case study of Germany, we look at the following scenarios:
  - **Base case:** Maintaining the current policies for screening, treatment, and fibrosis restrictions
  - **Scenario 1:** Immediate adoption of WHO targets for elimination of HCV by 2030
  - **Scenario 2:** Delaying elimination intervention by 2 years

Figure 3. Impact of Inaction Tool: Outputs

Clinical Burden

Cumulative New Cases (2017–2030)	National Data	Current Situation Base Case	WHO Elimination 2030 Scenario 1	Delay of Elimination Scenario 2	Scenario 3	Scenario 4
Decompensated Cirrhosis	3,404	2,374	1,077	1,395		
HCC	4,388	3,216	1,515	1,940		
Liver Transplant	68	533	214	283		
Total ESLD Averted (vs base case)			3,317	2,505		
Deaths	5,956	2,679	1,237	1,586		
Total Deaths Averted (vs base case)			1,442	1,093		

Social Burden

Cumulative Incident Cases (2017–2030)	National Data	Current Situation Base Case	WHO Elimination 2030 Scenario 1	Delay of Elimination Scenario 2	Scenario 3	Scenario 4
Incident Cases	62,869	56,865	45,798	48,898		
Incident Cases Averted			11,066	7,966		

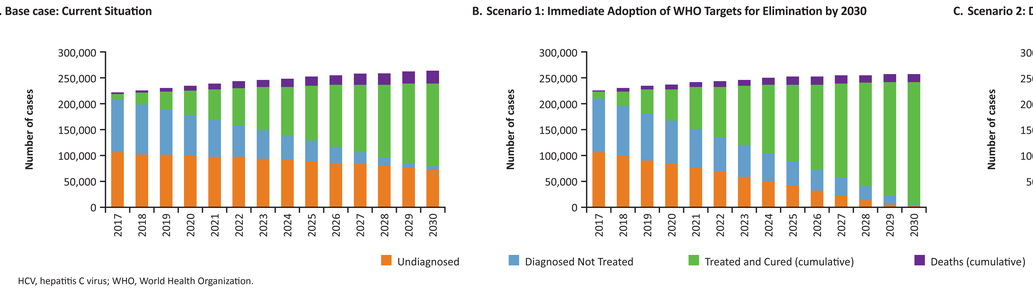
Economic Burden[a]

Cumulative Costs - EUR (2017–2030)	National Data	Current Situation Base Case	WHO Elimination 2030 Scenario 1	Delay of Elimination Scenario 2
Total Spending on Liver-Related Complications				
Total Spending on Extra-Hepatic Complications				
Total Spending on HCV Treatment and Laboratory Costs				
Total Spending on HCV Screening				
Other Spending Related to HCV Treatment				
Total Spending on HCV				
Total Costs Saved (vs base case)				

[a]The Impact of Inaction tool is capable of generating economic outcomes, although they were not considered for the purposes of the current study. ESLD, end-stage liver disease; HCC, hepatocellular carcinoma; HCV, hepatitis C virus; WHO, World Health Organization.

RESULTS

Figure 4. HCV Patient Care Status



HCV, hepatitis C virus; WHO, World Health Organization.

CARE STATUS TRENDS

- Adopting WHO targets now would reduce the number of undiagnosed HCV patients to 444 by 2030, however if this intervention is delayed by 2 years, then 5,215 HCV patients would remain undiagnosed (**Figure 4**)

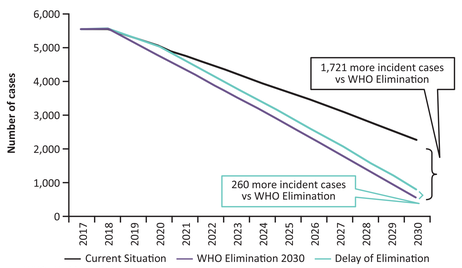
SOCIETAL BURDEN

- Adopting WHO targets now would avert 1,721 new HCV cases in 2030 vs the current situation (**Figure 5**); postponing this intervention by 2 years would fail to avert 260 new HCV cases in 2030

CLINICAL BURDEN

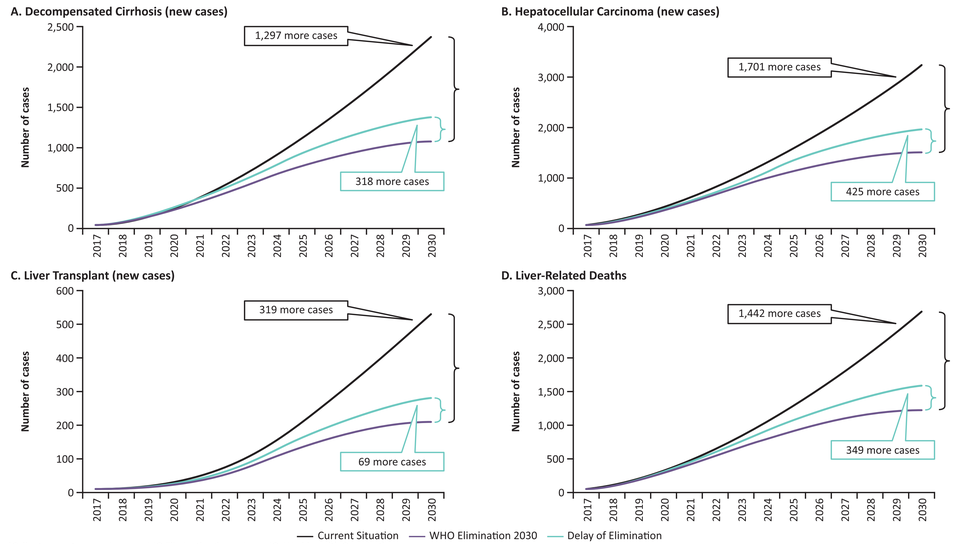
- HCV elimination would substantially reduce new cases of HCV-related complications (**Figure 6**); postponing this intervention by 2 years would fail to avert 318 new cases of decompensated cirrhosis, 425 new cases of hepatocellular carcinoma, 69 liver transplants, and 349 liver-related deaths by 2030

Figure 5. Annual Incident Cases



WHO, World Health Organization.

Figure 6. Cumulative Clinical Outcomes*



*Callouts report comparison vs WHO Elimination Scenario. WHO, World Health Organization.

DISCUSSION

MODEL STRENGTHS

- A Delphi process was used to verify model inputs. HCV prevalence and genotype data used to build and calibrate each model were scored by quality (in terms of generalizability, sample size, and year of analysis)
- Microsoft Excel was used as a modeling platform due to its transparency and widespread availability
- Model is customizable at national, regional, and local levels. Each country model is standardized to utilize a set of previously published disease progression rates

LIMITATIONS

- Prevalence figures were obtained from the best available estimates in the literature; actual values may vary across settings and patient subgroups
- The predicted outcomes of the model may not reflect observed results
- This case study did not generate economic outcomes due to limited availability of cost inputs in Germany, although the tool is able to generate them

CONCLUSIONS

- This tool can inform physicians, payers, and policymakers on the impact of screening and treatment interventions, and assess whether countries, regions, and cities are on track to achieve WHO targets for HCV elimination
- The Impact of Inaction tool is a simple and customizable tool for national, regional, and local use, down to the level of individual clinics and other settings
- In this example for Germany, adopting the WHO strategy of HCV elimination now will have important clinical and social benefits vs maintaining the status quo. These benefits would be substantially reduced if HCV elimination is delayed by just 2 years

DISCLOSURES

Design, study conduct, and financial support for the study were provided by AbbVie Inc. AbbVie Inc. participated in the interpretation of data and review and approval of the poster.
All authors contributed to the development of the publication and maintained control over the final content.
Markus Cornberg is an employee of Medizinische Hochschule Hannover and is a consultant for AbbVie Inc. He is also a consultant/speaker for Gilead, MSD Sharp & Dohme, Bristol-Myers Squibb, Biogen, and Roche, and his research group has received research support from Roche. **Yuri Sanchez Gonzalez** and **Andreas Pangerl** are employees of AbbVie Inc. and may own AbbVie stock or stock options. **Homie Razavi** is an employee of Center for Disease Analysis. The Center for Disease Analysis has received funding from AbbVie Inc. for this project.

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