RESOURCE ALLOCATION FOR HEPATITIS C ELIMINATION: AN ANALYTICAL MODELING FRAMEWORK

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Background:
More than 70 million people are chronically infected with hepatitis C virus (HCV) globally. The World Health Organization (WHO) recently set targets to eliminate HCV as a public health threat by 2030. Although elimination is theoretically feasible with therapeutic and diagnostic tools that are currently available, the challenges persist due to ongoing transmission, high unawareness rates, expensive treatment, and limited resources. Our objective was to develop an analytical modeling framework to optimize screening and treatment interventions to meet WHO targets under limited resources.

Methods:
We developed a compartment model to represent the dynamics of HCV transmission. We then formulated two optimal epidemic control problems: (1) to minimize the total screening and treatment costs while achieving HCV prevalence target by 2030, and (2) to minimize total disease burden under limited budget for HCV interventions. Optimal screening and treatment policies were examined analytically for qualitative policy structures, and solved numerically for policy recommendations using the optimal control theory. We demonstrated our modeling framework with a case study based on HCV epidemic in India.

Results:
In our case study, to reduce the prevalence by 65% by 2030, the annual screening rate should be at least 7.4% and all diagnosed patients should be provided with timely direct-acting antiviral treatment. When the budget is limited, to minimize the total disease burden, the optimal policy is to first prioritize treatment, and then to allocate the remaining budget to screening undiagnosed patients. On the other hand, if the transmission rate could be decreased by improving awareness of HCV infection through harm reduction programs, the optimal policy would be to first prioritize screening to prevent future transmission in the beginning periods.

Conclusions:
Our modeling framework can be used as decision support tool to guide policymakers in identifying policies to achieve HCV elimination targets in different countries.