Modelling the impact of vaccination on hepatitis B virus (HBV) transmission dynamics and progress towards elimination in Punjab, India

Stone J[1], McNaughton A[1], Fraser H[1], Kalogiros D[1], Lim A L[1], Grover G S[2], Govil P[3], Sond A[3], X Chan Y[3], Fernandes O[3], Peter Vickerman[1]

[1]University of Bristol, [2]State Viral Hepatitis Management Unit, Department of Health and Family Welfare, Government of Punjab, Chandigarh, Punjab, India, [3]Clinton Health Access Initiative (CHAI)

Background: India was estimated to have 32.7 million persons living with Hepatitis B virus (PLHBV) in 2016. The prevalence of chronic HBV infection (HBsAg-positive) in Punjab, India, was 1.4% in 2014 (~400,000 PLHBV). India has scaled up infant HBV vaccination to 91% coverage and timely birth dose vaccination to 56% coverage, but few receive HBV treatment. The World Health Organization (WHO) HBV elimination targets include decreasing new HBV infections by 95% over 2015-2030 and decreasing HBsAg prevalence among children under five to <0.1% by 2030. We used modelling to evaluate progress towards these targets in Punjab.

Methods: A dynamic HBV transmission model was developed, including disease progression, vertical and horizontal transmission, population growth and vaccination. The model was parameterised and calibrated in a Bayesian framework using regional estimates of chronic (HBsAg-positive) and past infection (HBcAb-positive) prevalence, Indian data on HBeAg-prevalence, demographic data, and yearly data on infant and birth dose vaccination coverage. The model was used to simulate trends in HBV transmission and evaluate the impact of ongoing vaccination.

Results: Projections suggest HBV incidence has decreased by 39.9% (95% credibility interval: 30.5-45.6) over 2015-2022, while HBV-related deaths have remained stable. In 2022, 4.5% (2.2-23.6) of new infections and 19.0% (10.8-54.0) of new chronic HBV infections (CHB) were acquired vertically, with 0.11% (0.07-0.19) of new-borns acquiring HBV infection. Model projections estimate that the annual number of new CHB infections have decreased by 31.8% (19.7-38.7) over 2015-2022 and will decrease by 50.0% (36.3-56.5) by 2030. For under-fives, we project that the HBsAg-prevalence will be 0.08% (0.05-0.15) by 2030; below WHO's target. Existing vaccinations have averted 16,200 (6,800-34,500) CHB infections over 2007-2022, resulting in 39.6% (31.6-46.3) fewer infections in 2022.

Conclusion: HBV vaccination scale-up in Punjab has had substantial impact but further strategies are needed to reach the WHO HBV elimination targets.

Disclosure of Interest Statement: None