

Malaria Vaccine Model (MVM): A tool for informing policy decisions

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Malaria Vaccine Model (MVM)



MALARIA VACCINE MODEL

This modeling application was developed by the PATH Malaria Vaccine Initiative to be used in estimating malaria vaccine demand, public health impact, and financial return on investment.



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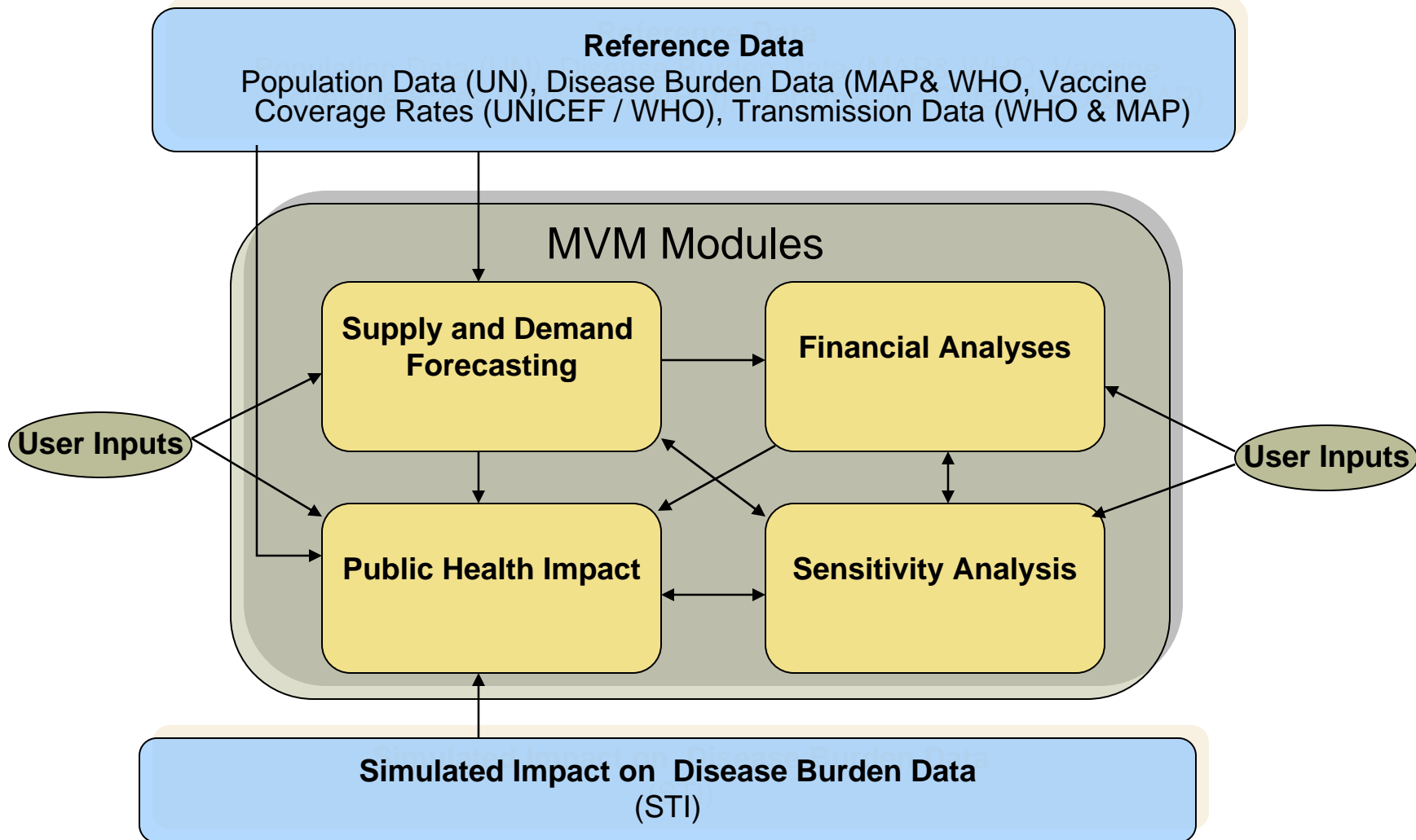
What can the model do?

- Estimate the forecasted supply & demand for a range of malaria vaccine profiles
- Estimate the health and social impacts of various types of malaria vaccines
- Explore what are the key variable that impact the outcomes of interest

A bit of history

- 2003-2005: STI developed a model of the potential impact of malaria vaccines on clinical epidemiology of *Plasmodium falciparum*
- 2005: MVI developed a first malaria vaccine demand forecasting model
- 2008–09: MVI developed a new version of the model

MVM structure



Three sources of resource

- Publicly available reference data
 - Country-specific malaria burden data attributable to *Plasmodium falciparum* (World Malaria Report 2008)
 - Country-specific estimates of *Plasmodium falciparum* prevalence (Malaria Atlas Project, MAP)
- MVM-specific reference data (algorithms used to merge publicly available reference data)
 - Baseline Disease Burden (WHO and UN Population Division)
 - Malaria Transmission intensity (WHO and MAP)
- STI simulated impact on disease burden data

MVM scope: input variables for analysis (1)

- Six vaccine types all targeting *Plasmodium falciparum*, for a use in public sector only
 - PEV (Pre-erythrocytic vaccines)
 - BSV (Blood-stage vaccines)
 - PEV+BSV
 - PEV+TBV (Mosquito-stage transmission-blocking vaccines)
 - BSV+TBV
 - PEV+BSV+TBV
- Year of vaccine adoption
- National vaccine coverage rates
- Different predictions of effectiveness against clinical disease
 - 35%, 50%, 60%, 75%, 85%

MVM scope: input variables for analysis (2)

- **Multiple vaccine profiles**
 - Various durations of efficacy
 - 2, 4 & 10 years
 - Number of doses required
 - 3 doses or 4 doses (not counting boost)
 - Option for a single boost (2 years after initial vaccination series)
- **Vaccination strategies**
 - 11 vaccination strategies combining routine, catch-up and campaign vaccination components, across four target populations within and outside EPI
- **Costs**
 - Price per dose
 - Delivery

MVM scope: input variables for analysis (3)

- Other malaria-control interventions
 - User-determined assumptions on impact of non-vaccine interventions
 - LLINs, IRS, etc.
- Strategies
 - Single or multiple interventions
- Different malaria transmission levels of intensity (as noted previously)
 - EIR and parasite prevalence rates derived from WHO population at risk and Malaria Atlas Project data:
 - 5 categories of malaria transmission levels

Outputs generated by parameters

- **Module on demand and supply estimates**
 - Forecasted demand and supply
- **Module on public health impact**
 - Cases averted
 - Severe cases averted
 - DALYs averted
 - Deaths averted
 - \$ per event averted
- **Sensitivity analysis**
 - Assess the importance of specific input variable on the outcomes

Impact on events averted (illustrative)

Inputs Outputs

Public Health Impact

Vx Strategy Simulation

Health Impact

Disease Burden Impact

Vaccine Demand

Vaccine Supply

Countries

Donors

Public Health Impact

Input Summary

Sensitivity Analysis

Health Impact

Products/Suppliers Scenario

Unsuccessful

>

<

Successful

Product 1/Supplier A

Product/Supplier	Exits?	Exit Date
Product 1/Supplier A	<input type="checkbox"/>	

Financing Scenario: Base Case Malaria Financing Scenario

Country Transmission Scenario: WHO Based Transmission Scenario - MVI

Vaccination Strategy: **Routine births only**

Vaccination Strategy Impact successfully computed.

Country-Specific
 All Countries in Analysis

Cases Averted in Population age 0 - 4 yo

Cases

Year	Cases Averted (M People)
2009	0.1
2010	0.2
2011	0.3
2012	0.4
2013	0.5
2014	0.6
2015	0.8
2016	1.0
2017	1.2
2018	1.4
2019	1.6
2020	1.8
2021	2.0
2022	2.2
2023	2.4
2024	2.6
2025	2.8
2026	3.0
2027	3.2
2028	3.4
2029	3.6
2030	3.8

Create Report

Who might use MVM outputs?

- **Countries**
 - Impact estimates for various implementation strategies
 - Financing requirements
- **Global level**
 - Informing malaria vaccine research and development activities
 - Demand forecast
 - Impact estimates
 - Financing requirements

Next steps

- **Country level**
 - Analyses available through the decision-making framework described earlier
 - Countries may request specific analyses based on individual interests
- **Global level**
 - Series of consultations in the future on the model and outputs
 - Partners may request specific analyses based on their organizational interests
 - Dissemination through publication of various simulation results
- **MVI internally**
 - Use the MVM to inform research & development process

Conclusions

MVM is a tool that merges forecasting with epidemiological and economic analyses for malaria vaccines in order to inform country- and global-level planning

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Thank you

www.malariavaccine.org

www.path.org