# Use of modelling evidence for policy and programming

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Session: Fostering use of evidence

Pre-Congress for the Immunization Economics Special Interest Group at IHEA

July 8-9, 2023, Cape Town

# Vaccine Impact Modelling Consortium

VIMC is an international community of modellers providing high-quality estimates of the public health impact of vaccination, to inform and improve decision making.

# What is VIMC?

- The Vaccine Impact Modelling Consortium (VIMC) was originally established in 2016 to deliver a more sustainable, efficient, and transparent approach to generating estimates of disease burden and vaccine impact, for investments by Gavi, the Vaccine Alliance.
- The consortium includes infectious disease modelling groups from around the world. Many of these groups also have capability in health economics.
- VIMC is funded by the Bill & Melinda Gates Foundation; Gavi, the Vaccine Alliance; and from 2022 the Wellcome Trust.

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# Estimating Vaccine Impact

**Estimating the health impact of vaccination against 10 pathogens in 98 low and middle income countries from 2000 to 2030**

- Published in the Lancet 2021
- Data visualisation tool available
- Documents the first round of VIMC model estimates presenting impact by calendar year and birth cohort
- “In terms of deaths averted by calendar year, 69 million (95% CrI 52–88) deaths were estimated to be averted between 2000 and 2030, of which 37 million (30–48) were averted between 2000 and 2019.”

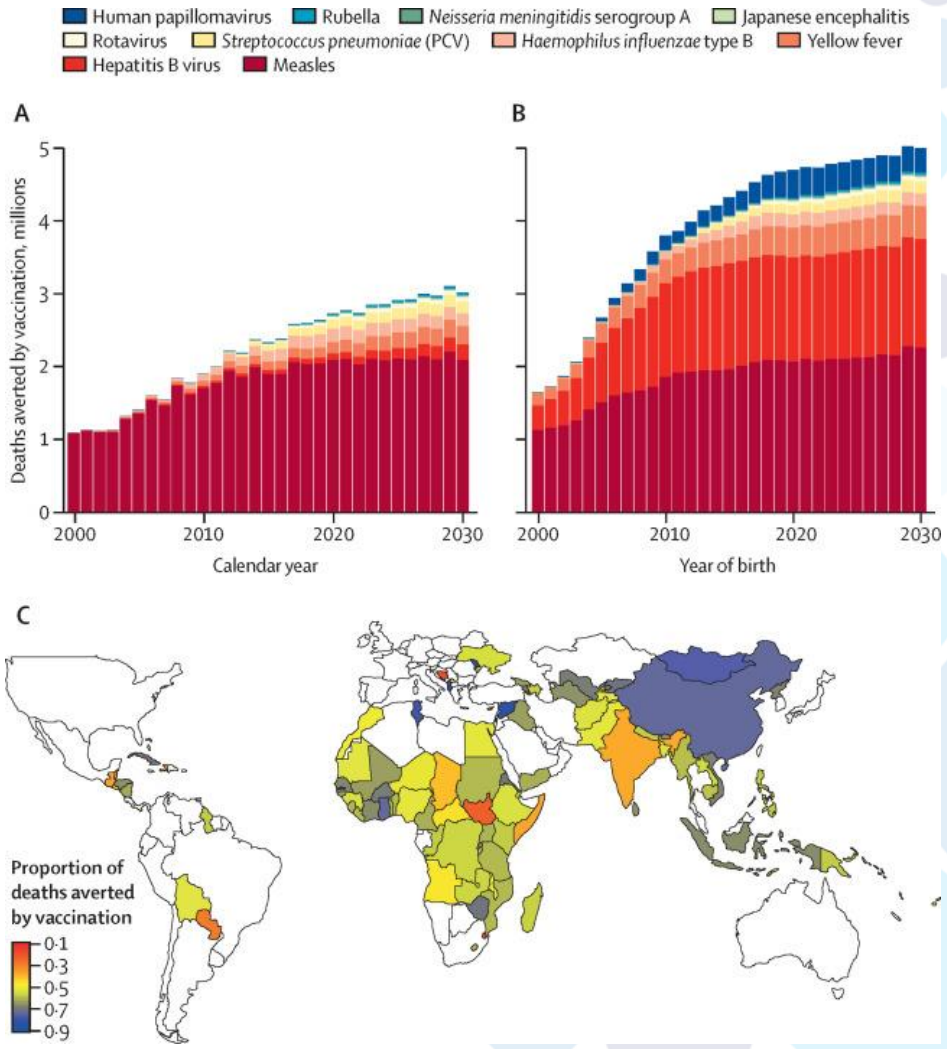


**Figure: Estimates of deaths averted by vaccination in 98 countries**

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# VIMC 2.0

By 2027, VIMC's core aims are:

- to provide reliable and accessible estimates of vaccine impact across the Gavi portfolio
- to address critical modelling-related vaccine policy questions raised by stakeholders who will be dynamically engaged in our work
- to translate the Consortium's modelling to real-world policy that improves health outcomes
- to foster a diverse international community of vaccine impact modellers, inclusive of modellers in low- and middle-income countries (LMICs)
- to provide training in infectious disease modelling and its application to vaccine-preventable diseases for both modellers and policymakers.

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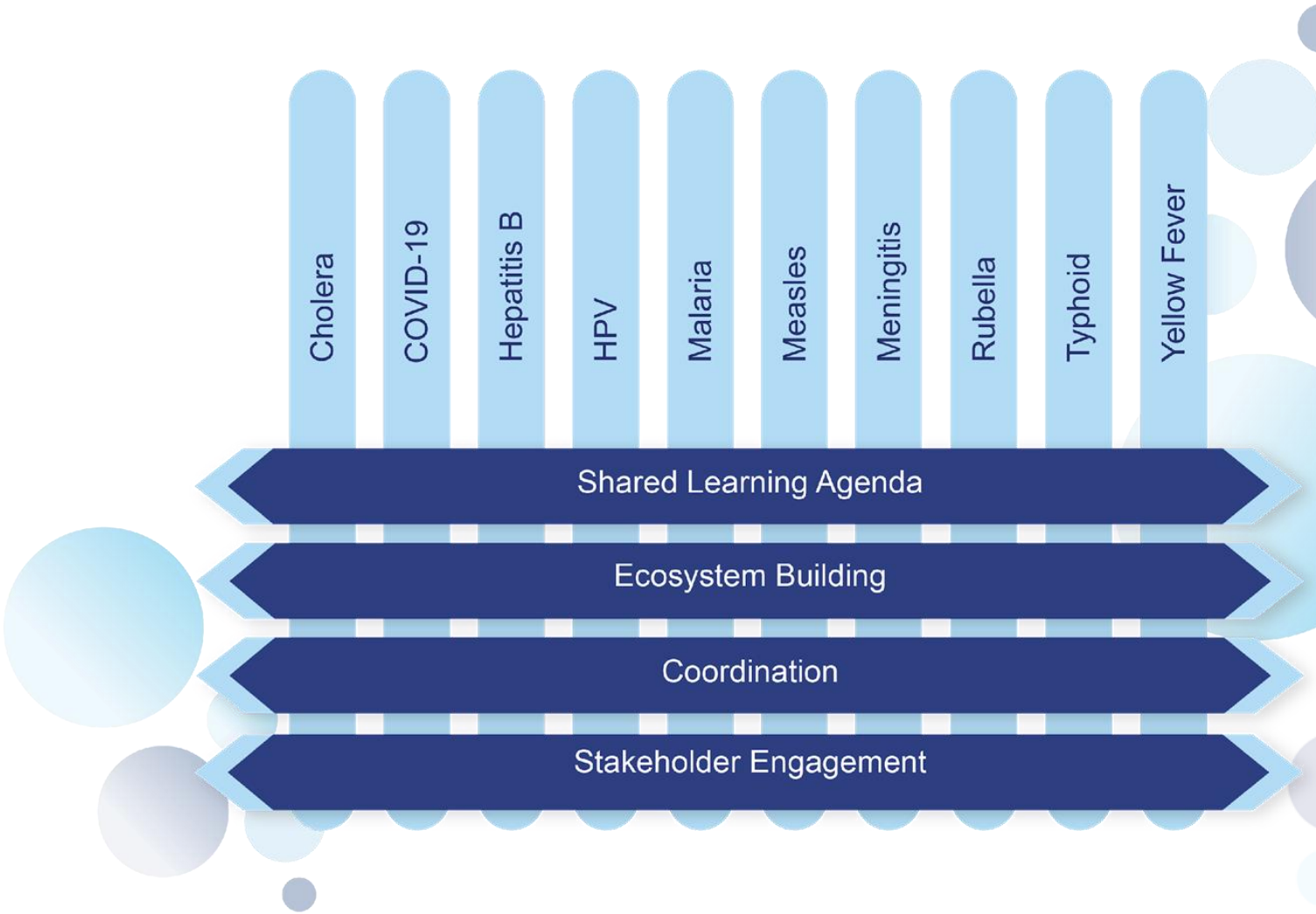


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# Climate change and vaccine-preventable diseases

- Aims:
  - to better characterise the mechanistic relationship between environment, climate and disease transmission
  - to assess implications of long-term climate change for disease burden, range and routine vaccination
  - to optimise control programmes to respond to seasonal variation in disease burden and the consequences of increasingly frequent extreme climate events.

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# Project working groups

- Policy relevant modelling question proposed to VIMC
- If appropriate for VIMC to address, a project working group is set up
- Group should consist of VIMC modellers, key stakeholders and others
- Key aims are to:
  - Refine question(s)
  - Discuss and agree on model inputs and key assumptions
  - Provide feedback and help to interpret modelling results, iterate as needed
  - Disseminate findings

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**Mechanism for proposing questions established**
At regular intervals (e.g. before each SG) the VIMC secretariat will solicit research questions from modelling groups, the SG and the broader vaccine impact modelling consumer community. These will be filtered by the central science & policy team to ensure that they fall within VIMC's scope.

**SG discusses questions to be answered**
Prioritization based on suitability for VIMC's remit, capability within the consortium and the broader modelling landscape, availability of data to inform models and the potential for impact (in terms of providing evidence for a policy change/ to inform programmatic discussions and the impact on lives saved / costs saved). Time sensitive questions may be rapidly evaluated by email.

**Project Working Group (PWG) set up to address each question**
SG to advise on PWG members from SG and wider stakeholders; VIMC secretariat to advise on / invite relevant VIMC modellers and science & policy team members. For priority questions that fall outside of existing capability, RfPs will be issued.

**Project Working Group to refine questions**
(iterative process with wider SG if necessary)

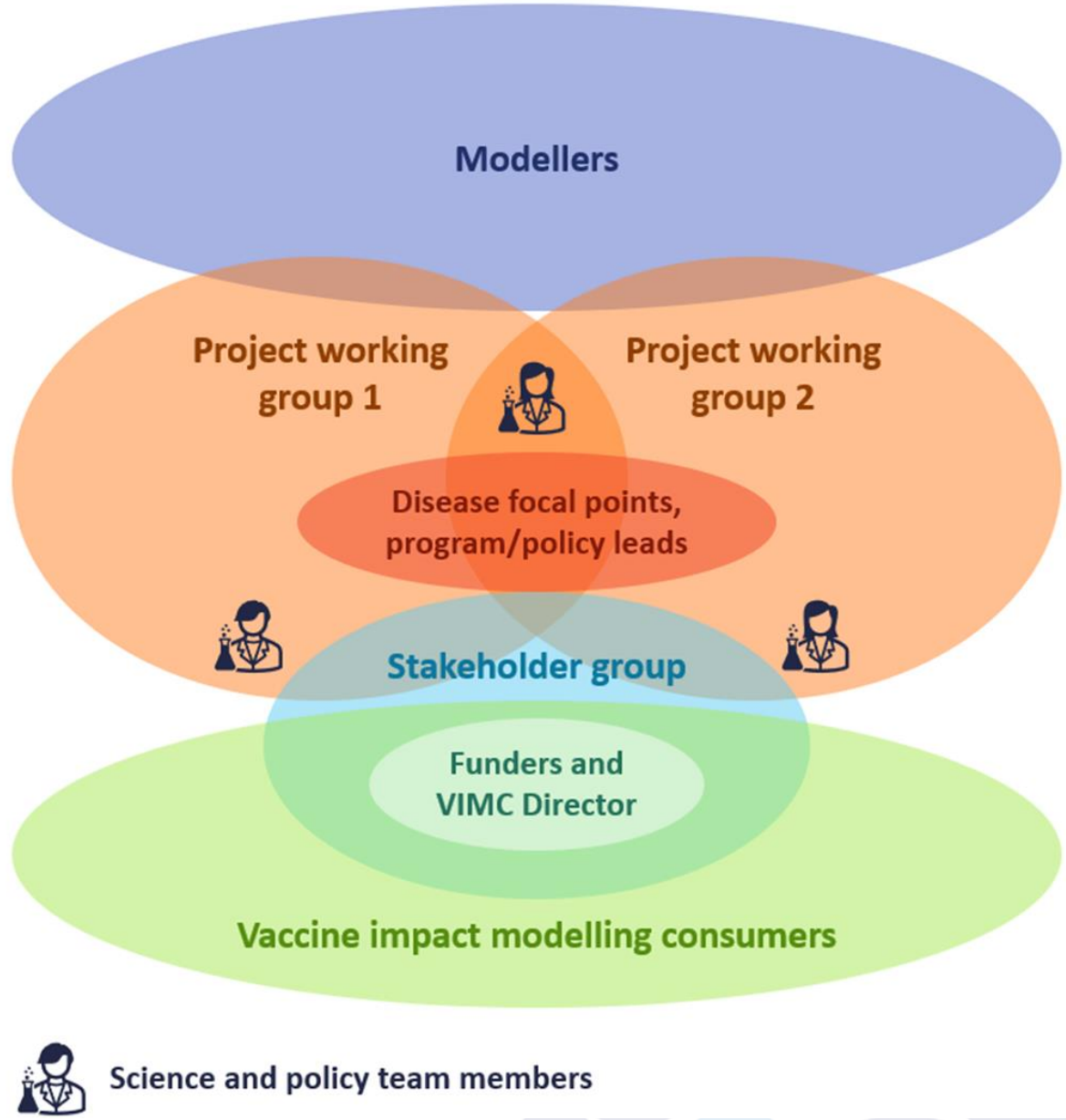
**Project Working Group to carry out modelling and presents results to SG**
(results also shared with other PWGs)

**Project Working Group refines its work**
(iterative process with wider SG if necessary)

**SG advises on wider dissemination and any new questions to be tackled**

**Wider dissemination of results**
E.g. briefings to policymakers, blog posts, research publications

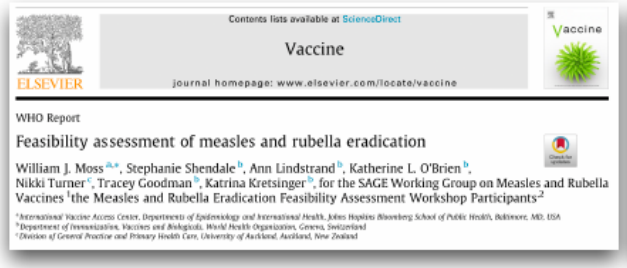
**Response to wider dissemination assessed by SG**
(May lead to further questions to be answered)



# Examples of VIMC collaborative work

# Measles rubella elimination in South-East Asia

This group conducted similar work for the WHO in 2018/2019


Contents lists available at ScienceDirect

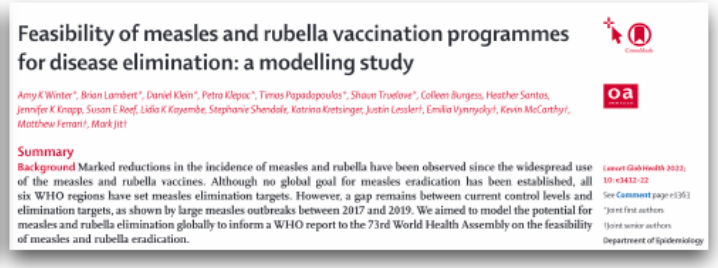
Vaccine

journal homepage: www.elsevier.com/locate/vaccine

WHO Report

Feasibility assessment of measles and rubella eradication

William J. Moss [a,*], Stephanie Shendale [b], Ann Lindstrand [b], Katherine L. O'Brien [b], Nikki Turner [c], Tracey Goodman [b], Katrina Kretsinger [b], for the SAGE Working Group on Measles and Rubella Vaccines [1]the Measles and Rubella Eradication Feasibility Assessment Workshop Participants [2]


Feasibility of measles and rubella vaccination programmes for disease elimination: a modelling study

Summary

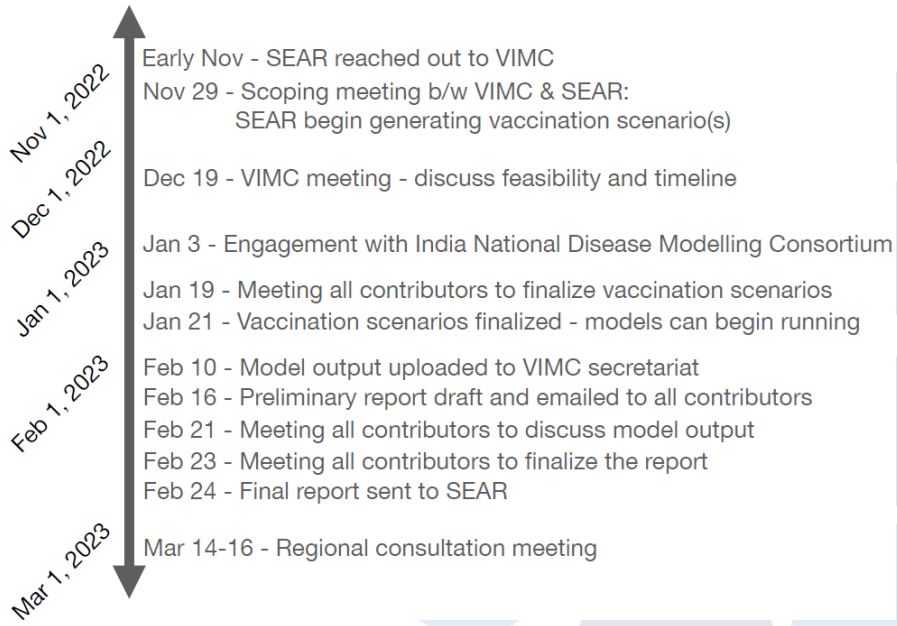
Background Marked reductions in the incidence of measles and rubella have been observed since the widespread use of the measles and rubella vaccines. Although no global goal for measles eradication has been established, all six WHO regions have set measles elimination targets. However, a gap remains between current control levels and elimination targets, as shown by large measles outbreaks between 2017 and 2019. We aimed to model the potential for measles and rubella elimination globally to inform a WHO report to the 73rd World Health Assembly on the feasibility of measles and rubella eradication.

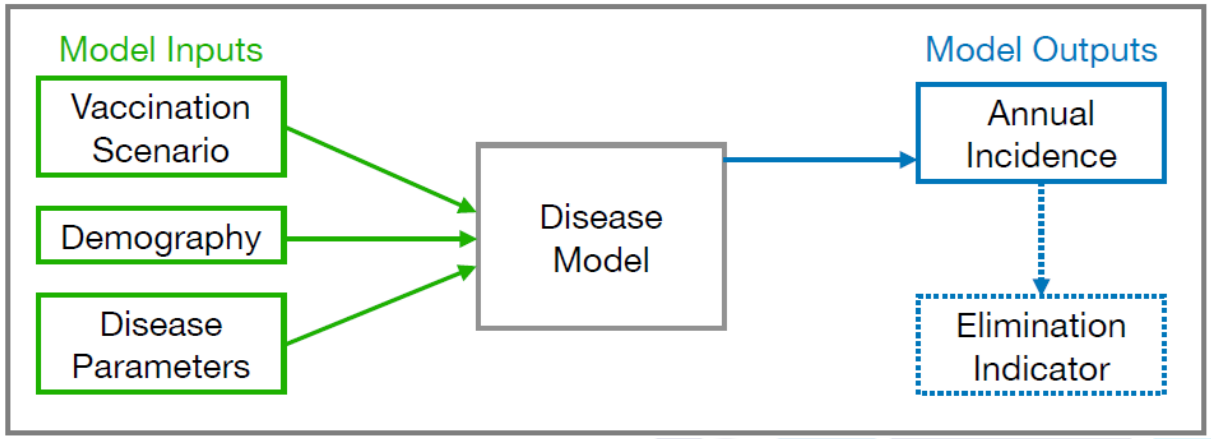
Vaccine Impact Modelling Consortium (VIMC)

- Measles: Pennsylvania State University (PSU)
- Measles: Dynamic Measles Immunisation Calculation Engine (DynaMICE)
- Rubella: University of Georgia (UGA)
- Rubella: UK Health Security Agency (UKHSA)

(Moss et al, 2020)
(Winter at al, 2022)

Project Timeline



# HPV vaccination impact in Kenya

Vaccine 41 (2023) 4228–4238

Contents lists available at ScienceDirect

Vaccine

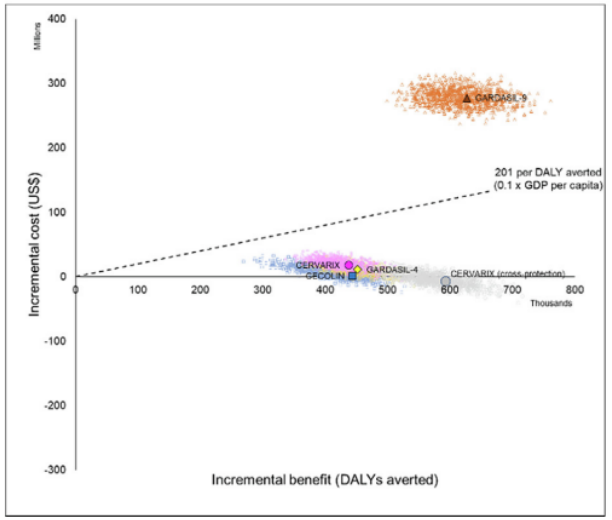
journal homepage: www.elsevier.com/locate/vaccine

## Impact, cost-effectiveness, and budget implications of HPV vaccination in Kenya: A modelling study

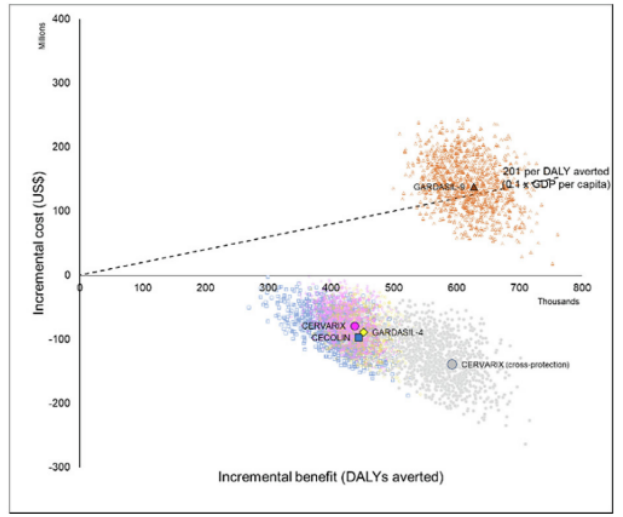
Valerian Mwenda [a,*], Rose Jalang'o [b], Christine Miano [b], Joan-Paula Bor [a], Mary Nyangasi [a], Lucy Mecca [b], Vincent Were [c], Edward Kariithi [d], Clint Pecenka [e], Anne Schuind [e], Kaja Abbas [f], Andrew Clark [f]

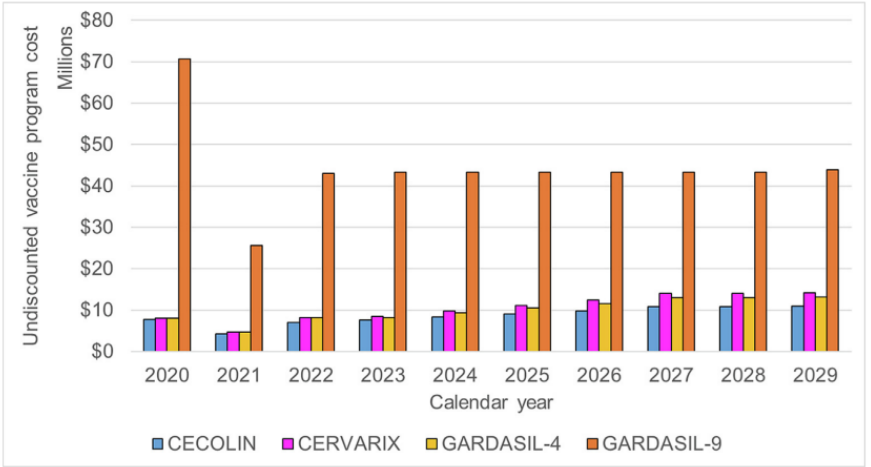
[a] National Cancer Control Program, Ministry of Health, Nairobi, Kenya
[b] National Vaccines and Immunization Program, Ministry of Health, Nairobi, Kenya
[c] Kenya Medical Research Institute, Nairobi, Kenya
[d] PATH, Nairobi, Kenya
[e] PATH, Seattle, WA, USA
[f] London School of Hygiene and Tropical Medicine, London, UK

**Government perspective**




**Societal perspective**

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(Mwenda et al, 2023)

# COVID-19 disruption to childhood vaccination

**Routine childhood immunisation during the COVID-19 pandemic in Africa: a benefit–risk analysis of health benefits versus excess risk of SARS-CoV-2 infection**

*Kaja Abbas*, Simon R Procter*, Kevin van Zandvoort, Andrew Clark, Sebastian Funk, Tewodaj Mengistu, Dan Hogan, Emily Dansereau, Mark Jit, Stefan Flasche, LSHTM CMMID COVID-19 Working Group†*

SARS-CoV-2 infection risk during delivery of childhood vaccination campaigns: a modelling study

Check for updates

Simon R. Procter[1*], Kaja Abbas[1], Stefan Flasche[1], Ulla Griffiths[2], Brittany Hagedorn[3], Kathleen M. O'Reilly[1], CMMID COVID-19 Working Group and Mark Jit[1]

**Impact of COVID-19-related disruptions to measles, meningococcal A, and yellow fever vaccination in 10 countries**

**Katy AM Gaythorpe[1‡], Kaja Abbas[2‡], John Huber[3‡], Andromachi Karachaliou[4‡], Niket Thakkar[5‡], Kim Woodruff[1], Xiang Li[1], Susy Echeverria-Londono[1], VIMC Working Group on COVID-19 Impact on Vaccine Preventable Disease, Matthew Ferrari[6†], Michael L Jackson[7†], Kevin McCarthy[5†], T Alex Perkins[3†], Caroline Trotter[4†], Mark Jit[2,8†*]**

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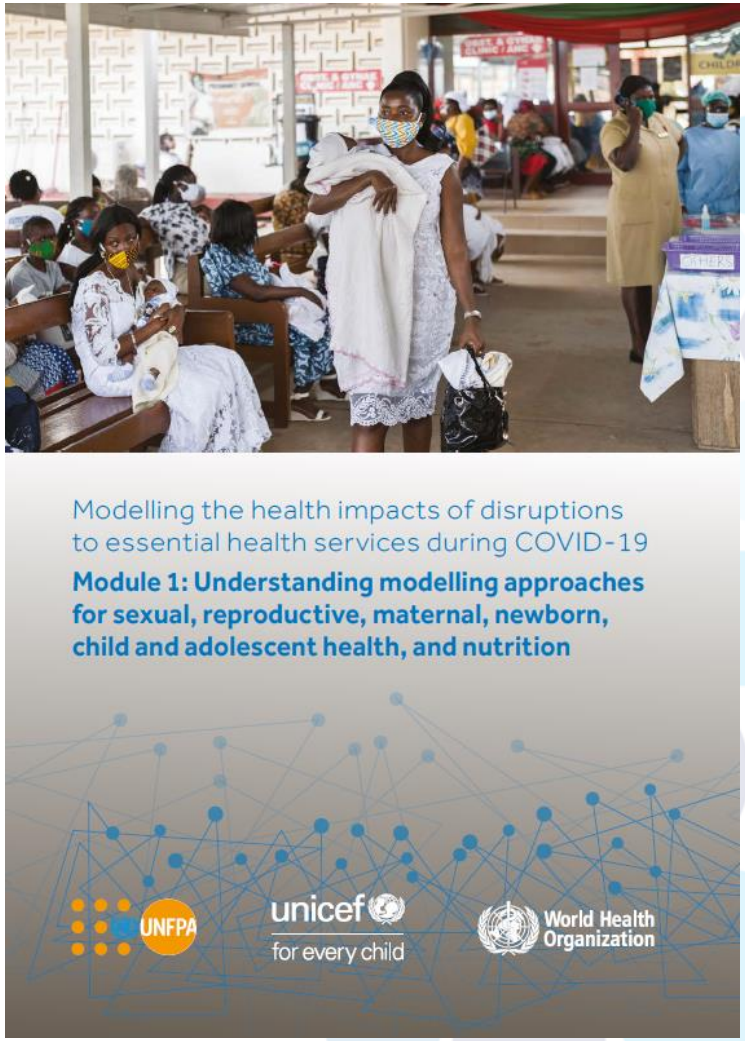
(Abbas et al, 2020)
(Procter at al, 2021)
(Gaythorpe et al, 2021)




(UNFPA, UNICEF, WHO, 2021)
(Weissman et al, 2022)
Spreadsheet-based decision-support tool

# Vaccine impact methodology

## (vaccine impact metrics by calendar year, birth year, & vaccination year)

Echeverria-Londono *et al. BMC Public Health* (2021) 21:2049
https://doi.org/10.1186/s12889-021-12040-9

BMC Public Health

RESEARCH Open Access

How can the public health impact of vaccination be estimated?

Susy Echeverria-Londono[1†], Xiang Li[1†], Jaspreet Toor[1†], Margaret J. de Villiers[1], Shevanthi Nayagam[1], Timothy B. Hallett[1], Kaja Abbas[2], Mark Jit[2], Petra Klepac[2], Kévin Jean[1,3,4], Tini Garske[1], Neil M. Ferguson[1] and Katy A. M. Gaythorpe[1*]

**Table 2** Stratifications of the impact ratios ($\rho$)

**No stratification:** Vaccine impact does not vary between vaccination activities or birth cohorts in a population.

$$\rho = \frac{D_R + D_C}{FVP_R + FVP_C}$$

**Stratification by activity type:** Vaccine impact varies between RV and CV but does not vary across birth cohorts.

**RV**: $\rho_R = \frac{D_R}{FVP_R}$ and **CV**: $\rho_C = \frac{D_C}{FVP_C}$

**Stratification by birth cohort:** Vaccine impact varies across birth cohorts in a population but does not vary between vaccination activities.

$$\rho(k) = \frac{D(k)}{FVP(k)}$$

**Stratification by activity type and birth cohort:** Vaccine impact varies between vaccination activities and birth cohorts.

**RV**: $\rho_R(k) = \frac{D_R(k)}{FVP_R(k)}$ and **CV**: $\rho_C(k) = \frac{D_C(k)}{FVP_C(k)}$

Here, $FVP_R$ and $FVP_C$ denote fully vaccinated persons (FVPs) due to routine (RV) or campaign vaccination activities (CV) only; $D_R$ and $D_C$ denote impact due to RV or CV only, $D$ denotes impact from both routine and campaign vaccinations, and $k$ denotes a particular birth cohort

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(Echeverria-Londono et al, 2021)

# VIMC-wide publications

https://www.vaccineimpact.org/publications

## Estimating the health impact of vaccination against ten pathogens in 98 low-income and middle-income countries from 2000 to 2030: a modelling study

*Xiang Li*, Christinah Mukandavire*, Zulma M Cucunubá, Susy Echeverria Londono, Kaja Abbas†, Hannah E Clapham†, Mark Jit†, Hope L Johnson†, Timos Papadopoulos†, Emilia Vynnycky†, Marc Brisson, Emily D Carter, Andrew Clark, Margaret J de Villiers, Kirsten Eilertson, Matthew J Ferrari, Ivane Gamkrelidze, Katy A M Gaythorpe, Nicholas C Grassly, Timothy B Hallett, Wes Hinsley, Michael L Jackson, Kévin Jean, Andromachi Karachaliou, Petra Klepac, Justin Lessler, Xi Li, Sean M Moore, Shevanthi Nayagam, Duy Manh Nguyen, Homie Razavi, Devin Razavi-Shearer, Stephen Resch, Colin Sanderson, Steven Sweet, Stephen Sy, Yvonne Tam, Hira Tanvir, Quan Minh Tran, Caroline L Trotter, Shaun Truelove, Kevin van Zandvoort, Stéphane Verguet, Neff Walker, Amy Winter, Kim Woodruff, Neil M Ferguson, Tini Garske, for the Vaccine Impact Modelling Consortium*

## Lives saved with vaccination for 10 pathogens across 112 countries in a pre-COVID-19 world

**Jaspreet Toor[1†], Susy Echeverria-Londono[1†], Xiang Li[1†], Kaja Abbas[2], Emily D Carter[3], Hannah E Clapham[4], Andrew Clark[2], Margaret J de Villiers[1], Kirsten Eilertson[5], Matthew Ferrari[6], Ivane Gamkrelidze[7], Timothy B Hallett[1], Wes R Hinsley[1], Daniel Hogan[8], John H Huber[9], Michael L Jackson[10], Kevin Jean[1,11], Mark Jit[2,12], Andromachi Karachaliou[13], Petra Klepac[2], Alicia Kraay[14], Justin Lessler[3], Xi Li[15], Benjamin A Lopman[14], Tewodaj Mengistu[8], C Jessica E Metcalf[16], Sean M Moore[9], Shevanthi Nayagam[1,17], Timos Papadopoulos[18,19], T Alex Perkins[9], Allison Portnoy[20], Homie Razavi[7], Devin Razavi-Shearer[7], Stephen Resch[20], Colin Sanderson[2], Steven Sweet[20], Yvonne Tam[3], Hira Tanvir[2], Quan Tran Minh[9], Caroline L Trotter[13], Shaun A Truelove[3], Emilia Vynnycky[18], Neff Walker[3], Amy Winter[3], Kim Woodruff[1], Neil M Ferguson[1], Katy AM Gaythorpe[1]***

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(Li et al, 2021)
(Toor et al, 2021)
(Hartner et al, 2023)


## COVID-19 related immunisation disruptions from 2020-2030: Projecting health impact and mitigation strategies for 14 pathogens across 112 low- and middle-income countries

Anna-Maria Hartner, Xiang Li, Susy Echeverria-Londono, Jeremy Roth, Kaja Abbas, Megan Auzenbergs, Margaret J de Villiers, Matthew J Ferrari, Keith Fraser, Han Fu, Timothy Hallett, Wes Hinsley, Mark Jit, Andromachi Karachaliou, Sean M Moore, Shevanthi Nayagam, Timos Papadopoulos, T Alex Perkins, Allison Portnoy, Quan Tran Minh, Emilia Vynnycky, Amy K Winter, Holly Burrows, Cynthia Chen, Hannah E Clapham, Aniruddha Deshpande, Sarah Hauryski, John Huber, Kevin Jean, Chaelin Kim, Jong-Hoon Kim, Jemima Koh, Benjamin A Lopman, Virginia E Pitzer, Yvonne Tam, Philipp Lambach, So Yoon Sim, Kim Woodruff, Neil M Ferguson, Caroline L Trotter, Katy A M Gaythorpe

# VIMC - contact info

- Vaccine Impact Modelling Consortium
  - https://www.vaccineimpact.org

- VIMC Secretariat
  - https://www.vaccineimpact.org/secretariat

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