

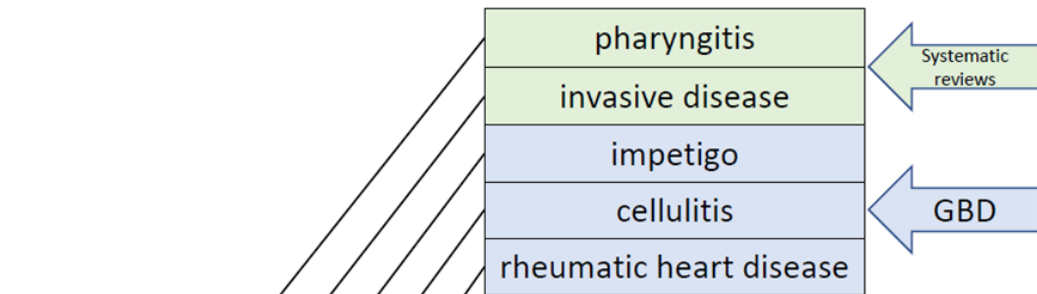
# Potential impact of prospective Strep A vaccines on the global burden of disease: model-based analysis

Fiona Giannini, Jeffrey Cannon, Kaja Abbas



# Aim

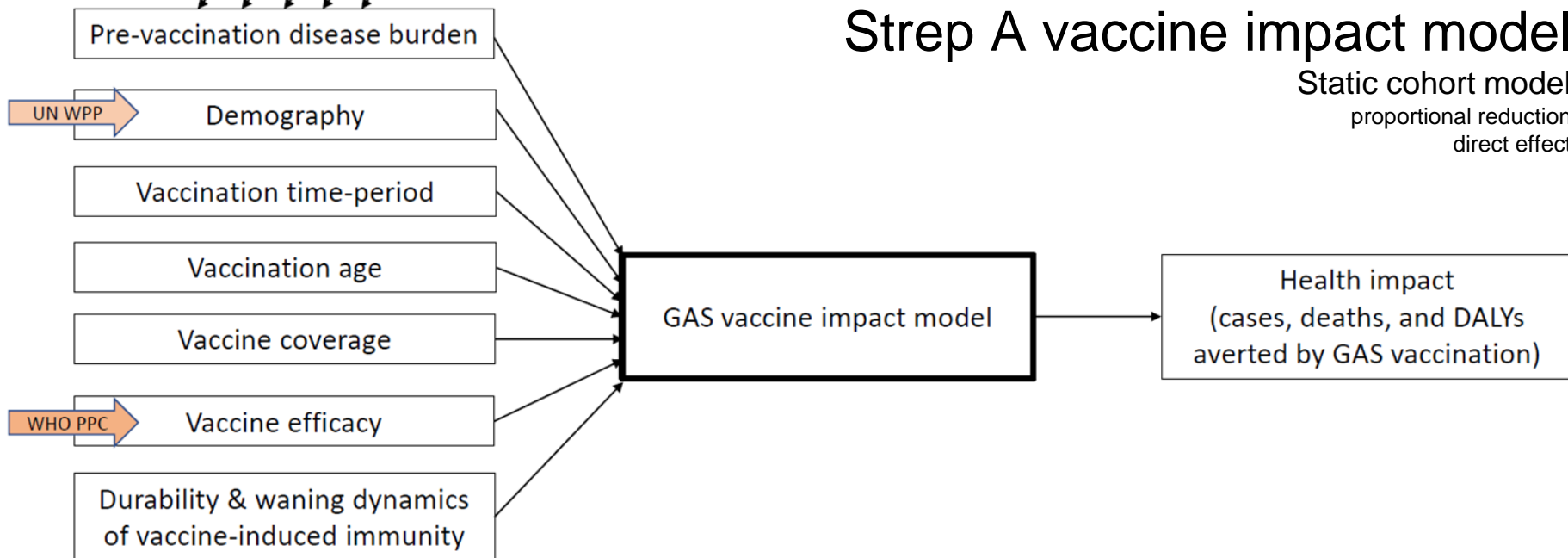
- Estimate the projected health impact of Strep A vaccination at the global, regional, national (183 countries), and income levels
  - Strep A disease states and sequelae
    - pharyngitis
    - impetigo
    - invasive disease
    - cellulitis
    - rheumatic heart disease
  - Vaccination impact
    - cases, deaths, DALYs averted
    - lifetime impact of vaccination
    - 30 birth cohorts (2022 - 2051)



# Strep A vaccine impact model

Static cohort model

proportional reduction  
direct effect



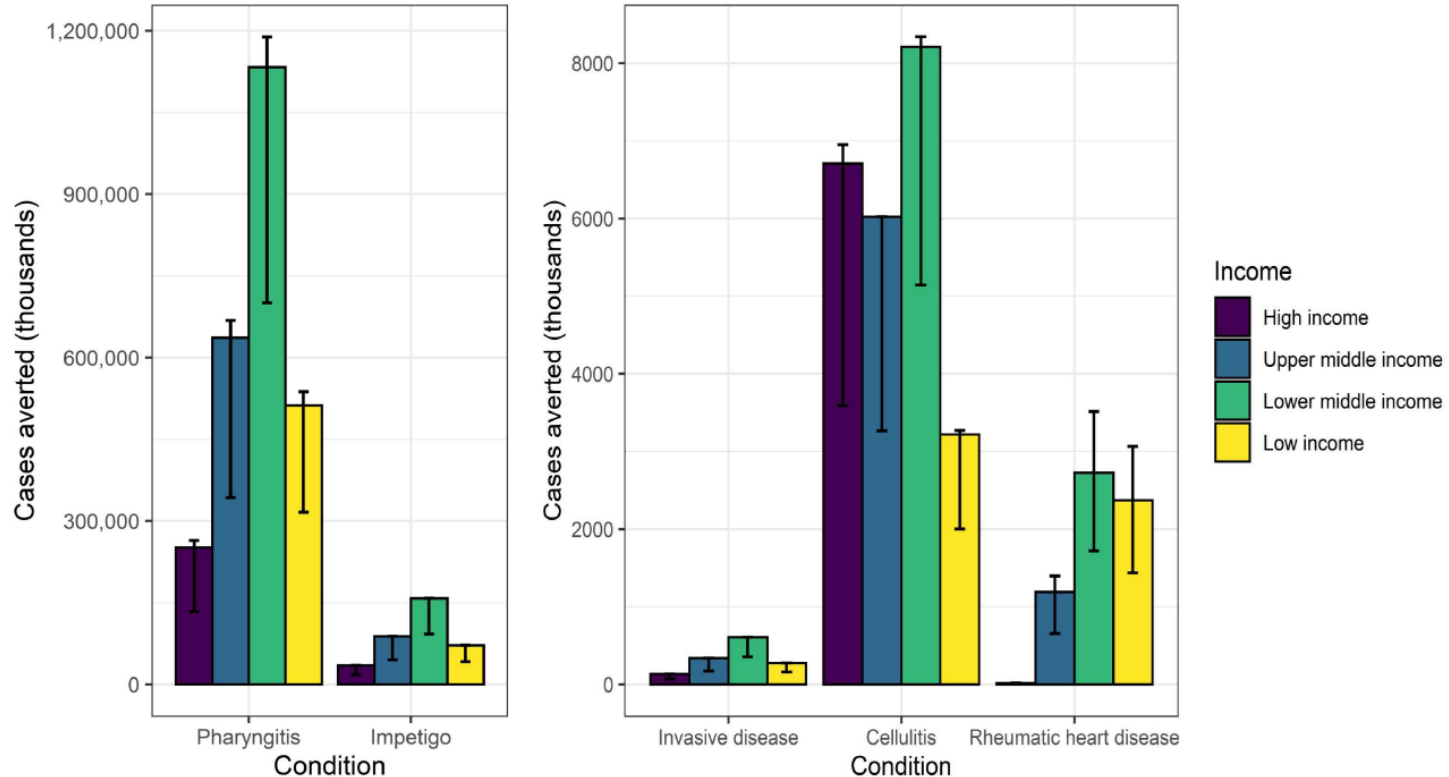
# Vaccine efficacy

<b>Group A streptococcus disease state/sequelae</b>	<b>Vaccine efficacy (%)</b>
Pharyngitis	80
Impetigo	80
Invasive disease	70
Cellulitis	70
Rheumatic heart disease	50

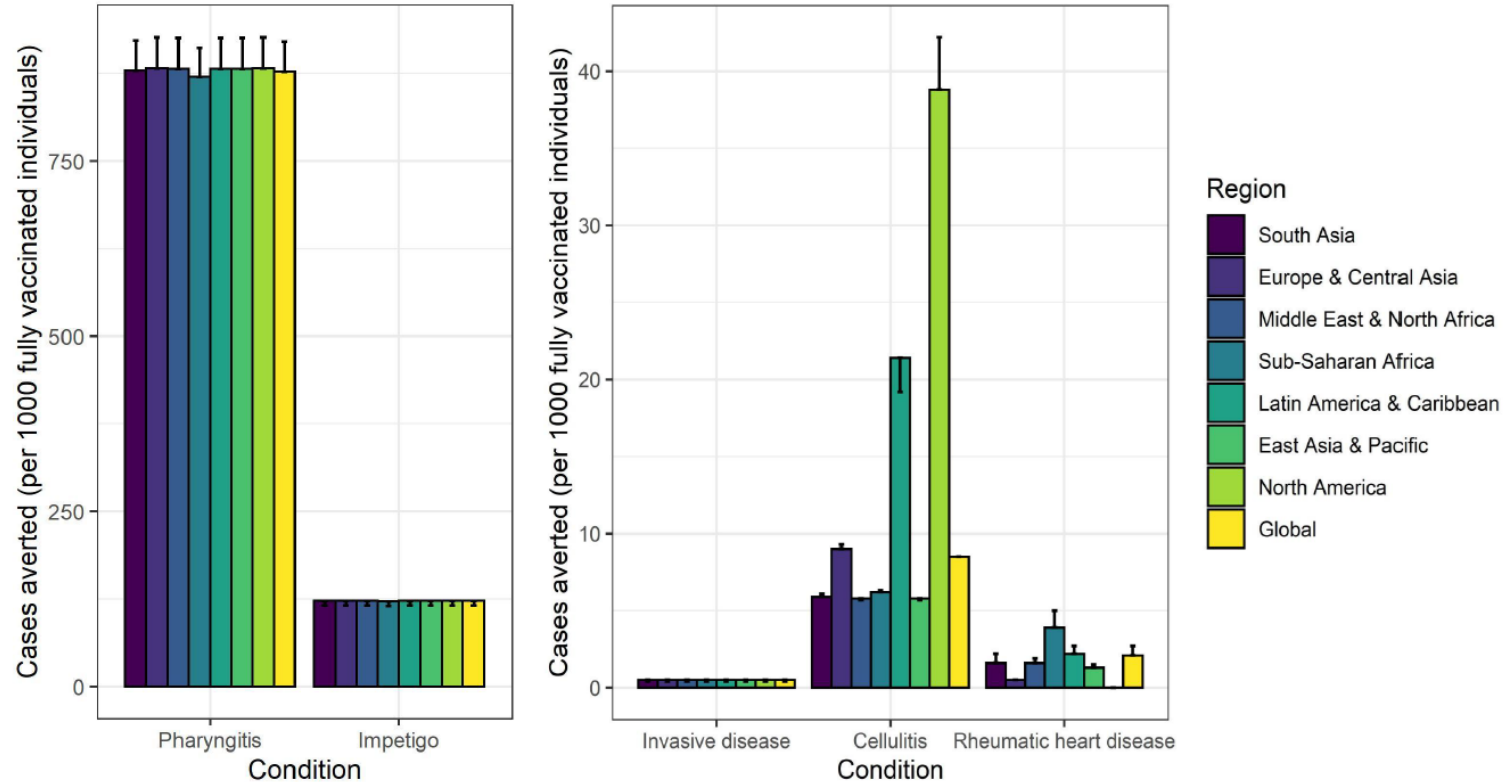
# Vaccination scenarios

<b>Scenario</b>	<b>Year of vaccine introduction</b>	<b>Maximum coverage</b>	<b>Durability of vaccine-derived immunity</b>
1	Country-specific (2022 - 2034)	Country-specific (9 - 99%)	Full efficacy for 10 years
2	Country-specific (2022 - 2034)	Country-specific (9 - 99%)	Linear waning over 20 years
3	2022	50%	Full efficacy for 10 years
4	2022	50%	Linear waning over 20 years
5	Country-specific (2022 - 2034)	50%	Full efficacy for 10 years
6	Country-specific (2022 - 2034)	50%	Linear waning over 20 years

# Vaccine impact @ country income levels

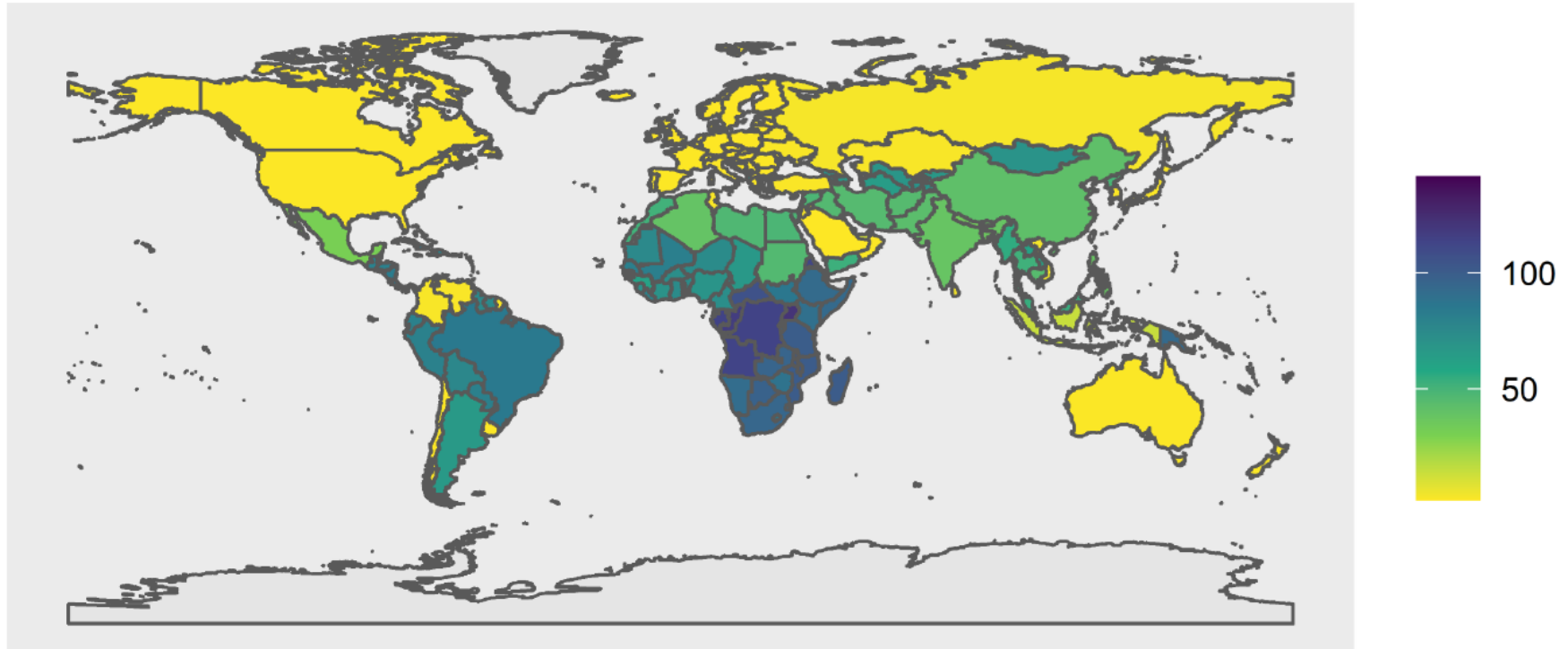


# Vaccine impact @ regional and global levels



# Vaccine impact @ national and global levels

Disability-adjusted life years (DALYs) averted per 1000 fully vaccinated individuals





# Vaccine impact @ regional and global levels

UN regions	Scenarios	Fully vaccinated individuals (millions)	Cases averted through vaccination (thousands) (range for scenarios 1-2 and 3-6)				
			Pharyngitis	Impetigo	Invasive disease	Cellulitis	Rheumatic heart disease
South Asia	1-2*	657	(578,344, 606,913)	(76,156, 80,716)	(291, 310)	(3,880, 3,992)	(1,041, 1,466)
	3-6	(381, 388)	(334,999, 357,905)	(44,117, 47,620)	(169, 183)	(2,246, 2,352)	(608, 870)
Europe & Central Asia	1-2*	226	(199,636, 209,585)	(26,231, 27,796)	(100, 106)	(2,027, 2,104)	(102, 120)
	3-6	(122, 124)	(107,661, 114,573)	(14,146, 15,197)	(54, 58)	(1,115, 1,171)	(53, 62)
Middle East & North Africa	1-2*	218	(192,160, 201,701)	(25,266, 26,776)	(96, 102)	(1,253, 1,258)	(348, 407)
	3-6	(121, 122)	(106,638, 112,917)	(14,025, 14,991)	(53, 57)	(693, 701)	(196, 232)
Sub-Saharan Africa	1-2*	918	(799,501, 838,027)	(105,671, 112,075)	(407, 433)	(5,548, 5,635)	(3,635, 4,633)
	3-6	(583, 607)	(505,846, 553,384)	(62,933, 74,061)	(258, 286)	(3,562, 3,777)	(2,285, 3,030)
Latin America & Caribbean	1-2*	184	(162,482, 170,555)	(21,361, 22,637)	(81, 87)	(3,544, 3,949)	(413, 501)
	3-6	(109, 113)	(95,898, 104,796)	(12,608, 13,913)	(48, 53)	(2,091, 2,435)	(244, 306)
East Asia & Pacific	1-2*	575	(507,378, 532,590)	(66,695, 70,679)	(254, 270)	(3,261, 3,354)	(763, 860)
	3-6	(317, 329)	(279,857, 304,513)	(36,790, 40,426)	(140, 155)	(1,837, 1,954)	(414, 483)
North America	1-2*	107	(94,334, 99,039)	(12,395, 13,134)	(47, 50)	(4,145, 4,506)	(4, 4)
	3-6	(58, 58)	(51,094, 53,879)	(6,714, 7,145)	(26, 27)	(2,245, 2,451)	(2, 2)
Global	1-2*	2,886	(2,533,834, 2,658,410)	(333,775, 353,814)	(1,277, 1,359)	(23,657, 24,797)	(6,306, 7,991)
	3-6	(1,690, 1,741)	(1,481,995, 1,601,967)	(195,332, 213,353)	(748, 820)	(13,789, 14,843)	(3,802, 4,985)

\* Same number of fully vaccinated individuals for scenarios 1 and 2.

# Pre-vaccination disease burden

Region settings

World region:  
East Asia & Pacific

Country:  
Australia

Condition settings

Condition:  
Rheumatic Heart Disease

Vaccine settings

Year of vaccine introduction  
2020 - 2020

Age of vaccination  
0 - 80

Durability  
1 - 80

Waning immunity

Coverage %  
1 - 100

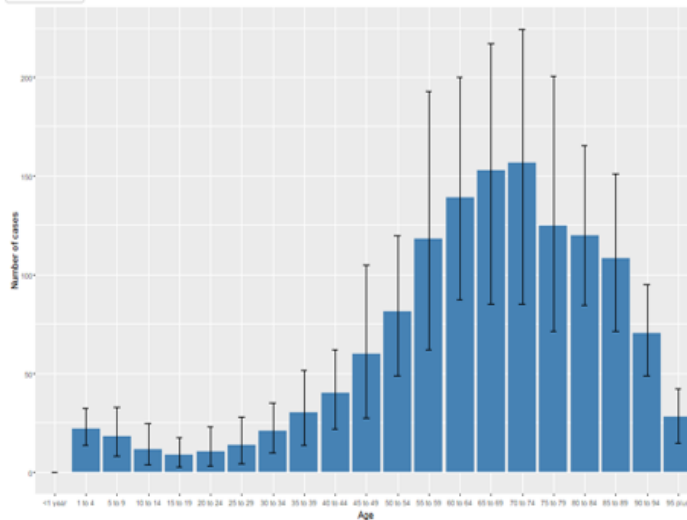
Ramp to maximum

Efficacy %  
1 - 100

Impact analysis Incidence data About

Assumed constant age-specific incidence for selected country and condition is based on below number of cases. Cellulitis (adjusted by proportion attributable) and rheumatic heart disease data is from Global Health Data Exchange (2019) with error bars showing 95% confidence intervals. For further description of source data and methods see About

Save plot



## R package documentation

### GASImpactModel

August 5, 2021

Title: Model the current and future health and economic impact of Strep A diseases

Version: 0.0.0-9000

Author: Fiona Giannini

Maintainer: Fiona Giannini <fiona.giannini@telethonkids.org.au>

Description: An app to estimate the current impact of Strep A diseases using health and economic metrics, and to investigate the effect of a vaccine on predicted future burden of Strep A diseases for a given cohort.

License: AGPL (>= 3)

Encoding: UTF-8

LazyData: true

Roslyn: list(markdown = TRUE)

RoslynNote: 7.1.1

Imports: FinCal,

ggplot2,

lme4,

reshape2,

stats,

string,

triangle

R topics documented:

data	2
data.cellulitis2019	3
data.life.australia2019	3
data.life.nz2019	3
data.life.new-zealand2019	5
data.popbyage2020	6
data.region	6
data.rhd2019	6
findCER	7
findVaxValue	7
getCountries	8
getMedData	8
getPopData	9
getRateData	9

R package and Shiny web app

- <https://github.com/fionagi/GASImpactModel>
- [https://github.com/fionagi/GASImpactModel\\_app](https://github.com/fionagi/GASImpactModel_app)



# Vaccination impact

(cases, deaths, DALYs averted)

Region settings

World region:  
East Asia & Pacific

Country:  
Australia

Condition settings

Condition:  
Rheumatic Heart Disease

Vaccine settings

Year of vaccine introduction  
2000 - 2020

Age of vaccination  
0 - 80

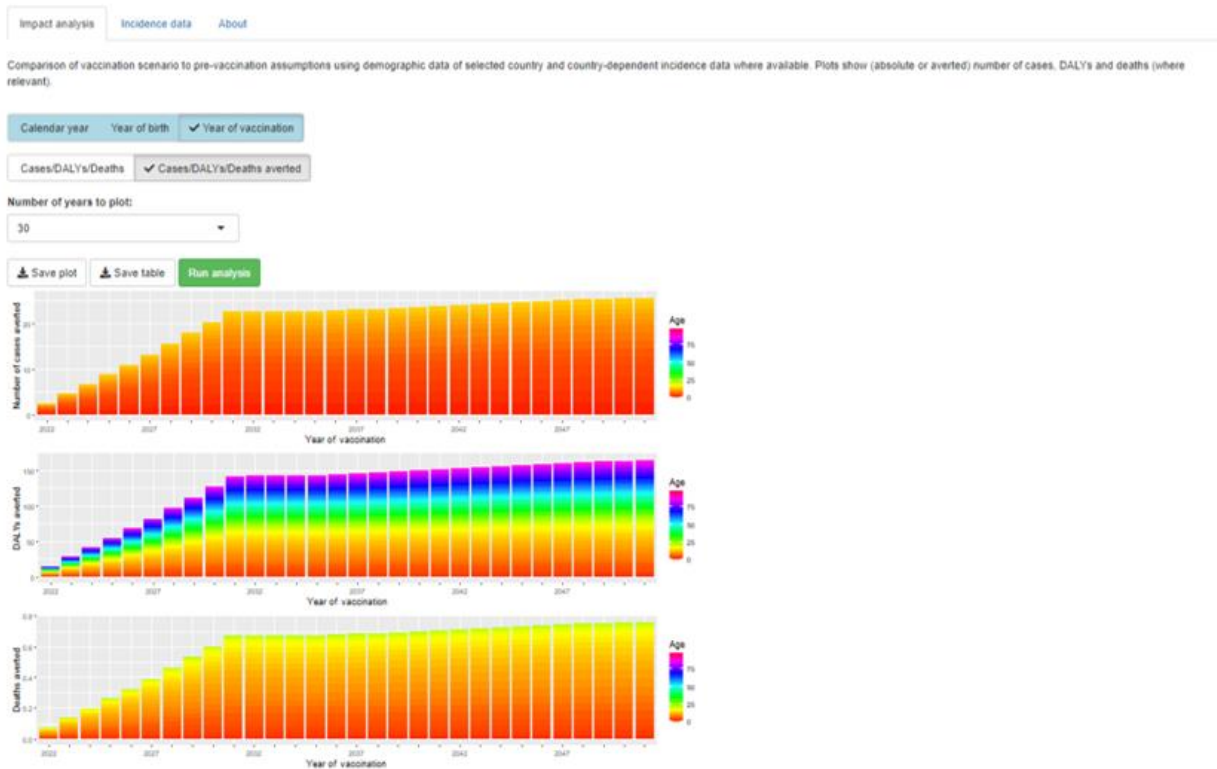
Durability  
0 - 80 (set to 15)

Waning immunity

Coverage %  
0 - 100 (set to 60)

Ramp to maximum

Efficacy %  
0 - 100 (set to 60)



R package and Shiny web app

- <https://github.com/fionagi/GASImpactModel>
- [https://github.com/fionagi/GASImpactModel\\_app](https://github.com/fionagi/GASImpactModel_app)

# Thank you

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**Strep A Vaccine Global Consortium**  
<https://savac.ivi.int/>

