

# DTP Boost: An Interactive Tool for Modelling the Health and Economic Impact of Introducing Diphtheria-Tetanus-Pertussis-Containing Vaccine Booster Doses

IHEA Congress 2023

11 July 2023

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# Acknowledgements

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## CORE Team

The **MASHA** team

- Prof Sheetal Silal
- Ms Rachel Hounsell
- Mr Jared Norman
- Prof Rudzani Muloiwa
- Mr Retselisitsoe Monyake

The U.S. Centers for Disease Control and Prevention (**CDC**) team includes

- Ms Kirsten Ward
- Dr Sarah Pallas
- Dr Nishant Kishore
- Dr Aaron Wallace

The **AFENET** team

- Mr Joseph Magoola
- Mr Michael Nkanika

## Expert reference group

- Dr Ampeire Immaculate (UNEPI)
- Dr Anna Acosta (US CDC)
- Dr Annet Kisakye (WHO Uganda)
- Prof Paula Mendes Luz (INI, Brazil)
- Dr Todi Mengistu (Gavi)
- Dr Helen Quinn (NCIRS, Australia)
- So Yoon Sim (WHO HQ)
- Dr Rania Tohme (US CDC)

## **Ugandan National Expanded Program on Immunization**

- Mr Albert Besigye (M&E unit, UNEPI)
- Mr Godfrey Biroma (M&E unit, UNEPI)
- Dr Ampeire Immaculate (UNEPI)

# DTP Boost - Work in Progress

This is an ongoing collaborative project with the application yet to be concluded in country. Manuscripts describing the models and application are under development.

The demo model and application code is available on Github (uct-masha/DTPBoost-Demo)

Citation: Hounsell, RA., Norman, JM., Monyake, R., Silal, SP (2023) *DTPBoost-Demo*. (Version 1.0.0). Available at: <https://github.com/uct-masha/DTPBoost-Demo/releases/tag/1.0.0>

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Please note: The app demonstration in this slidedeck shows example settings and outputs for a hypothetical Country X

# DTP Background

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- Diphtheria, tetanus and pertussis (DTP)
  - **Vaccine preventable** -> high coverage and considerable progress in reducing cases and deaths
  - True burden difficult to assess -> **underreporting** and surveillance challenges
  - Waning immunity and **resurgence** dynamics
- WHO recommends three booster doses of DTaP/DTaP-IPV to enhance duration of protection
  - Early childhood booster (12–23 months)
  - Child booster (4–7 years)
  - Adolescent booster (9–15 years)
- Require additional vaccination encounters and potentially different delivery platforms (e.g., school-based) -> **logistics & costs**

# DTP Boost

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## Purpose

- Support country-level decision-making on the introduction of DTaP2 booster doses

## Approach

- Interactive web-based decision-making tool - make modelling accessible!
- Integrated live running mathematical model (disease and economic)
- Collaborative and multidisciplinary
- Explore: Health and economic impact (focusing on budget impact)

# What kind of questions can we answer?

Would a booster targeted at children or adolescents be more impactful and cost-effective?

Should we introduce multiple boosters simultaneously or in a phased approach?

What are the costs and benefits of Td vs Tdap?

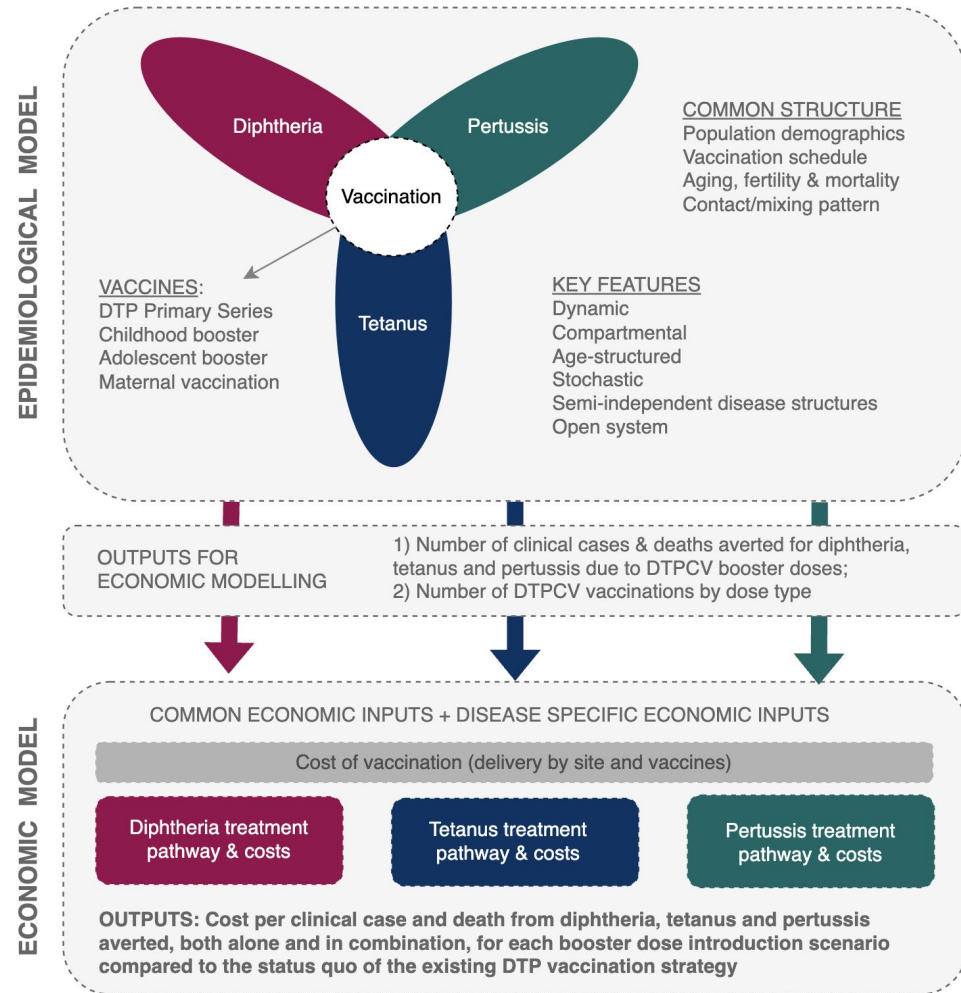
How much would the burden of disease cost the healthcare system over the next ten years?

How would our predicted burden of disease change if we changed other healthcare metrics such as vaccination coverage?



# DTP Boost // Model

- Integrated epidemiological and health economic model
- Three semi-independent dynamic compartmental models for the same population
- Linked through vaccination and population dynamics
- Age structured (56 age categories to capture detailed age bands around vaccination schedules)



# Economic analysis

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- **Costs:** Cost of vaccination (vaccines & delivery) and cost of illness
- **Currency:** Users choose whether to add/view costs in USD or local currency
- **Provider (government) perspective**, no societal costs included
- **Discount rate:** applied to costs and benefits. Default is 3.5% but can be adjusted by the user. Users can view economic results as either discounted or undiscounted.
- User can specify whether the vaccination costs (delivery and/or vaccines) include any contributions from donors (e.g. vaccine supply donated, cost sharing agreements). All results can be viewed as the proportion paid directly by government, or the “full” costs (including any donor support).
- **Results:** Budget impact and cost effectiveness

# DTP Boost // Process

---

STEP 1. SET BASELINE COUNTRY PROFILE



STEP 2. CALIBRATE MODEL

REALISTIC  
PAST



STEP 3. DESIGN STRATEGIES



STEP 4. EXPLORE RESULTS

POTENTIAL  
FUTURE

# Step 1. Country Profile

Setting up the baseline

## Country selection

Select country: ⓘ

Country X ▼

## Currency selection

Select currency: ⓘ

USD

LOCAL

VERIFY SELECTIONS

ⓘ Once verified, the country and currency selections cannot be changed. To change the selection, please restart the application. You can restart the application by refreshing this web page.

## Instructions for Step 1

## Setting up a country profile

**Process:** Proceed through each tab to create a baseline profile that is representative of your selected country's current vaccine schedule; clinical burden of diphtheria, tetanus and pertussis; health system features; and costs.

Each tab is pre-populated with default data and settings for the selected country, which you can replace.

**Default data:** Each tab is pre-populated with default data and settings for the selected country. Click ⓘ for more information on the default data source.

You may proceed with the defaults or replace the defaults with your own data and/or settings.

**Replace defaults:** If you would like to replace the default data or settings, click the **Replace** button under each dataset or adjust the parameters using the sliders.

**Save your country profile:** Once you have completed setting up the country profile, you may save a copy for future use. This will allow you to skip Step 1 when revisiting the tool.

You may also proceed to the next steps and save your entire session (including your modelled booster strategies) at any stage using the **SAVE CURRENT SESSION** button at the top right of the screen.

Example settings  
for "Country X"

## Instructions

Please use the options below to indicate the selected country's currently implemented vaccination schedule (target age, vaccine, delivery platform and coverage for primary series and any boosters currently in use) for diphtheria, tetanus and pertussis. Where there is not a perfect match to select, please choose the closest option.

The defaults used are sourced from the World Health Organization's Immunization Data, which show reported coverage and the vaccines in use for each country.

You may proceed with the default selections or adjust the existing schedule using the dropdown menus and upload your own coverage data using the **Edit Coverage Data** button at the bottom.

## Currently implemented vaccination schedules

### Primary series

Use the options below to select the target age, vaccine type, and delivery location of the existing primary series.

#### Dose 1 target age

6 wk



#### Primary series vaccine

DTwP-Hib-HepB



#### Dose 2 target age

10 wk



#### Delivery: Health facility (%)

0%

75%

100%



#### Dose 3 target age

14 wk



#### Delivery: Outreach site (including schools)

25%

Example settings  
for “Country X”

Example settings for “Country X”

## Example settings for “Country X”

### Booster vaccination

Use the options below to select the target age, vaccine type, and delivery location of any existing booster doses.

#### Early childhood booster target age

None

#### Early childhood booster vaccine

DTwP+Hib-HepB

Delivery: Health facility (%)



Delivery: Outreach site (including schools)  
25%

#### Child booster target age

None

#### Child booster vaccine

Td

Delivery: Health facility (%)



Delivery: Outreach site (including schools)  
85%

#### Adolescent booster target age

None

#### Adolescent booster vaccine

Td

Delivery: Health facility (%)



Delivery: Outreach site (including schools)  
85%

#### Maternal vaccination (via ANC)

Td

Delivery: Health facility (%)



Delivery: Outreach site (including schools)  
25%

### Coverage

Please review coverage data in the table below. Either proceed with the default values  or use the EDIT COVERAGE DATA button to replace the values in the table.

Year	Dose 1	Dose 2	Dose 3	Early childhood booster	Child booster	Adolescent booster	ANC*	TTCV2
2022	96.0%	93.5%	91.0%	0.0%	0.0%	0.0%	80.0%	50.0%
2021	96.0%	93.5%	91.0%	0.0%	0.0%	0.0%	80.0%	50.0%
2020	96.0%	93.5%	91.0%	0.0%	0.0%	0.0%	80.0%	50.0%
2019	96.0%	95.0%	94.0%	0.0%	0.0%	0.0%	80.0%	50.0%
2018	97.0%	95.5%	94.0%	0.0%	0.0%	0.0%	80.0%	50.0%

Example settings  
for “Country X”

## DTP Treatment

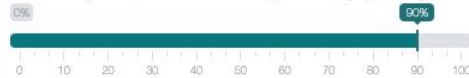
Use the options below to select how likely it is that if cases are present, a mild/severe case will be treated.

Diphtheria

Probability of a mild case being treated (outpatient)



Probability of a severe case being treated (inpatient)

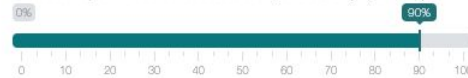


Pertussis

Probability of a mild case being treated (outpatient)

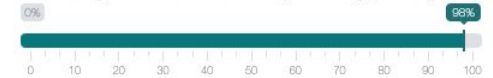


Probability of a severe case being treated (inpatient)



Tetanus

Probability of a severe case being treated (inpatient)



## DTP Reporting

Use the options below to select (1) how likely it is that if symptomatic cases are present, they will be diagnosed, and (2) how likely it is that if deaths occur, they will be reported and classified as caused by the disease.

Diphtheria

Probability of symptomatic cases being diagnosed

10.00%

Pertussis

Probability of symptomatic cases being diagnosed

0.50%

Tetanus

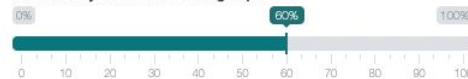
Probability of symptomatic cases being diagnosed

90.00%

Probability of deaths being reported



Probability of deaths being reported



Probability of deaths being reported



Example settings for “Country X”

🏠 Welcome

1 Step 1. Set-up Country Profile

2 Step 2. Calibrate Model

3 Step 3. Design Booster Strategy

4 Step 4. Explore Results

1.1 Country

1.2 Current Vaccine Schedule

1.3. Health System

1.4 Costs

NEXT

## Instructions

Please use the options below to indicate relevant cost data for DTP immunisation and cost of illness estimates. You can use the defaults or replace with your own cost estimates using the slider and input boxes below.

For more details, please click the information button. ⓘ

Discount rate (%)

3.50

## Cost of vaccination (delivery + vaccine)

### Cost of routine delivery (per dose)

Average cost per dose of routine vaccine delivery (delivery only, excluding vaccine cost)

Primary series

Health facility (USD)

2.000

Outreach (USD)

1.500

Delivery costs paid directly by government (%)

0%

50%

100%

Maternal vaccination (via ANC)

Health facility (USD)

2.000

Outreach (USD)

1.500

Delivery costs paid directly by government (%)

0%

50%

100%

Example settings  
for “Country X”

## Cost of vaccines (per dose)

Cost of vaccine per dose (unit cost of vaccine only, no delivery cost)

Primary series

DTwP-Hib-HepB (USD)

0.800

Cost of vaccines paid directly by government (%)



Maternal vaccination

Td (USD)

0.110

Cost of vaccines paid directly by government (%)



## Cost of illness

### Diphtheria

Cost per outpatient case (USD)

55.000

Cost per inpatient case (USD)

150.000

### Pertussis

Cost per outpatient case (USD)

55.000

Cost per inpatient case (USD)

150.000

### Tetanus

Cost per outpatient case (USD)

55.000

Cost per inpatient case (USD)

200.000

## Notes

Please add any notes or comments here (e.g. details of the source of data used)

Example settings  
for “Country X”

# Step 2. Calibration

Calibrate model to different data sources

🏠 Welcome

1 Step 1. Set-up Country Profile

2 Step 2. Calibrate Model

3 Step 3. Design Booster Strategy

4 Step 4. Explore Results

## 2.1 Select data 2.2 Calibration 2.3 Assessing uncertainty

## Instructions

Please use the options below to select the incidence dataset to be used for model fitting. Model fitting is conducted to validate that the transmission model produces estimates that are similar to observed data. A fitted model adds validity to predictions of the impact of vaccination. The reporting rate specified in the Health System section will be used to correct for under-reporting of diagnosed cases.

Two data options are available: 1) WHO observed incidence data and 2) Global Burden of Disease incidence estimates. ⓘ If you prefer to upload your own incidence data, you may do so in the 'Upload your data' box below.

Given that unpredictable external drivers often seed diphtheria outbreaks, calibration is applied to pertussis and tetanus only. It is important to interrogate the datasets to determine if data are valid given local experience for *both pertussis and tetanus* to fit the model.

### Choose a dataset for calibration

Use the buttons to select a dataset for calibration that best fits your country's profile.

 WHO

GO TO CALIBRATION

 GBD OWN DATA

The plots below display the **WHO data** and **GBD estimates** to help you select the best approach. The option to upload your own data is shown under the heading **Upload your data**.

WHO data: Global Health Observatory annual reported incidence

1

Diphtheria

3000

Tetanus

1

Pertussis

Example settings  
for "Country X"

## Instructions

The aim of the manual calibration is to adjust the slider values for both pertussis and tetanus until the model output resembles the data. You will need to press the **RUN THE MODEL** button after each adjustment of the sliders.

This manual calibration is a simple form of face validation, which qualitatively assesses if the model is an adequate representation of the data.

If you are happy with your calibration, press the **ACCEPT THIS CALIBRATION AND MOVE ON** button to move to Step 3: Booster Strategy Design.

### Tetanus transmission tuning parameter

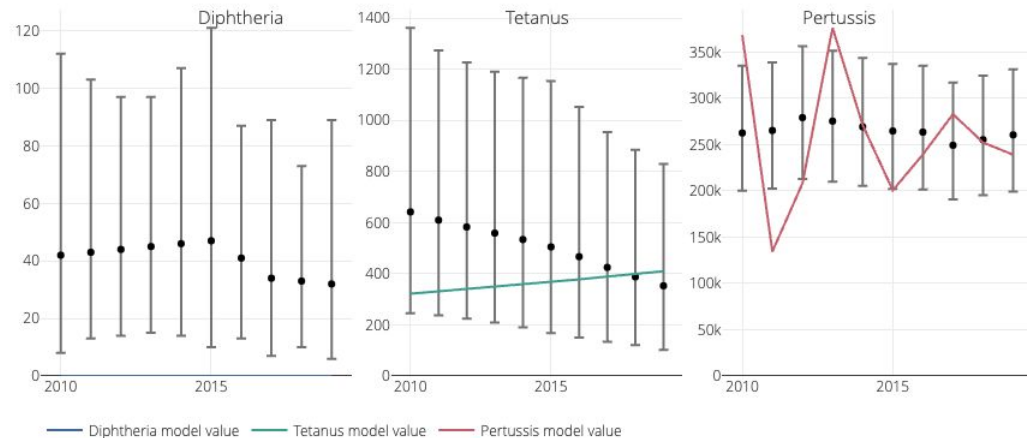


### Pertussis transmission tuning parameter



RUN THE MODEL

## DTP Estimated Incidence



Example settings  
for “Country X”

# Step 3. Strategy design

Develop different scenarios to run

🏠 Welcome

1 Step 1. Set-up Country Profile

2 Step 2. Calibrate Model

3 Step 3. Design Booster Strategy

4 Step 4. Explore Results

3.1 Instructions

3.2 Build a vaccination strategy

To design a vaccination strategy, toggle on the options you would like to include. Once in the 'on' position, a settings button will become visible. This allows you to adjust the details of each option (see below). Defaults are provided but should be updated to reflect your selected strategy and context.

## DTP Booster doses ⓘ

Early childhood booster

Child booster

Adolescent booster

Maternal vaccination

Target	Timeline	Delivery	Cost of routine delivery (per dose)	Cost of vaccines (Per dose)
<b>Age group:</b> 18 mth	<b>Start year:</b> 2024 — 2034	<b>Health facility (%)</b> 0% — 77%	<b>Health facility (USD)</b> 2.000	<b>Unit cost of vaccine (average per dose, excl delivery) (USD)</b> 0.800
<b>Vaccine:</b> DTwP-Hib-HepB	<b>Operational coverage:</b> 0% — 75%	<b>Outreach site (%)</b> 0% — 24% — 100%	<b>Outreach (USD)</b> 1.500	<b>Proportion of unit costs paid directly by government</b> 0% — 50% — 100%
	<b>Years to reach coverage:</b> 1 years — 7 years		<b>Proportion of routine delivery costs paid directly by government</b> 0% — 50% — 100%	

Once you have built your vaccination strategy, you can view the average total cost of introducing new vaccine dose(s) in a given year. This is a fixed cost regardless of the number of doses introduced in the introduction year. The cost will only be incurred once, even if additional booster doses are introduced in future years.

## Cost of introduction (total) ⓘ

Average total once-off cost of introducing new vaccine dose(s) in a given year (fixed cost regardless of number of doses introduced in the introduction year).

Strategy name:

Early Childhood+ Child+ Adolescent

Early Childhood+ Child+ Adolescent

RUN

Example settings  
for "Country X"

Child booster

SETTINGS

Adolescent booster

SETTINGS

### Other DTP Vaccinations ⓘ

Maternal vaccination

Once you have built your vaccination package, please indicate the anticipated cost of introducing new dose(s). You only need to complete this information once. The introduction cost is the average total cost of introducing new vaccine dose(s) in a given year. This is a fixed cost regardless of the number of doses introduced in the introduction year. Please indicate whether this cost will only be incurred once, even if additional booster doses are introduced in future years.

### Cost of introduction (total) ⓘ

Average total once-off cost of introducing new vaccine dose(s) in a given year (fixed cost regardless of number of doses introduced in the introduction year).

Fixed cost (USD)

2,000,000.000

Proportion of fixed introduction costs paid directly by government



Select if the introduction cost will only be incurred once

Save and simulate strategy

Strategy name:

Early Childhood+ Child+ Adolescent

Simultaneous (Tdap)

RUN

Example settings  
for “Country X”

# Step 4. Results

Explore epidemiological and economic model outputs

Welcome

1 Step 1. Set-up Country Profile

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4 Step 4. Explore Results

4.1 Epidemiological Output

4.2 Budget Impact

4.3 Cost Effectiveness

4.4 Downloads

## Baseline &amp; Strategies (Display/Hide)

👁️ Drag here to display

Baseline

Simultaneous (Td) ?

Phased (Td) ?

👁️ Drag here to hide

Simultaneous (TdaP) ?

Phased (TdaP) ?

🗑️ Delete packages that are hidden.

## Output options

Select model output

Population protected ▼

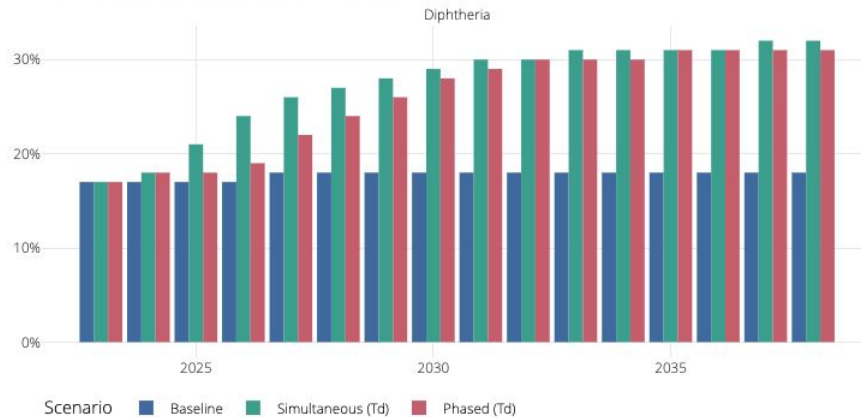
 Fix vertical axis range

All Diphtheria Pertussis Tetanus

This section allows the user to explore key model outputs such as clinical cases, deaths, reported cases and deaths, treatment and population protected. Please use the menu on the left to select the model output you would like to view and to change how the results are displayed in the plot below.

**NOTE: As diphtheria is a disease prone to outbreaks, it often has very low (often zero) cases in periods outside of outbreaks. The model is not designed to predict the future occurrence of diphtheria outbreaks. Rather it is intended to model the level of vaccine-derived protection in the population. Therefore, model output should be interpreted in this context.**

## Population protected plot for age=All



Example output  
for “Country X”

1 Step 1. Set-up Country Profile

2 Step 2. Calibrate Model

3 Step 3. Design Booster Strategy

4 Step 4. Explore Results

Example output for "Country X"

## Baseline & Strategies (Display/Hide)

👁️ Drag here to display

Baseline

Simultaneous (Td) ?

Simultaneous (TdaP) ?

Phased (TdaP) ?

👁️ Drag here to hide

Phased (Td) ?

🗑️ Delete packages that are hidden.

## Output options

### Output options

#### Select model output

Clinical cases

Fix vertical axis range

#### View output as

COUNT

PER 100,000

#### Age groups

All

#### Plot time window



## Output options

### Select model output

Clinical cases

Fix vertical axis range

#### View output as

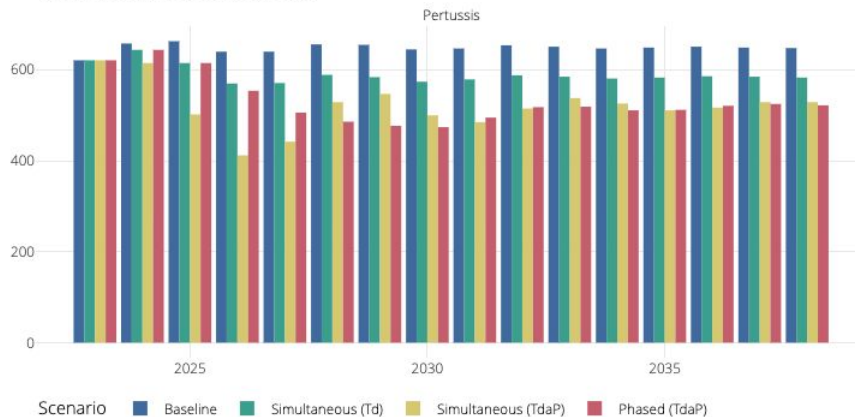
COUNT

PER 100,000

All Diphtheria Pertussis Tetanus

This section allows the user to explore key model outputs such as clinical cases, deaths, reported cases and deaths, treatment and population protected. Please use the menu on the left to select the model output you would like to view and to change how the results are displayed in the plot below.

## Clinical cases plot for age=All



The table below shows the total number of clinical cases and total number of deaths for pertussis only, combined for the full model time frame (15 years). The baseline (existing schedule with no new doses added) and user-defined strategies are presented. Cases and deaths averted compare each strategy to the baseline.

## Model outputs (pertussis)\*

Scenario	Clinical cases (Total)	Deaths (Total)	Averted clinical cases**	Averted deaths**
Baseline	5 004 067	7 380	-	-

Welcome

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4.1 Epidemiological Output

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## Baseline &amp; Strategies (Display/Hide)

☑ Drag here to display

Baseline

Simultaneous (Td) ?

Simultaneous (TdaP) ?

Phased (Td) ?

Phased (TdaP) ?

🗑 Drag here to hide

## Output options

Model horizon

15 years ▼

Costing approach

Proportion paid by government ▼

Discounting

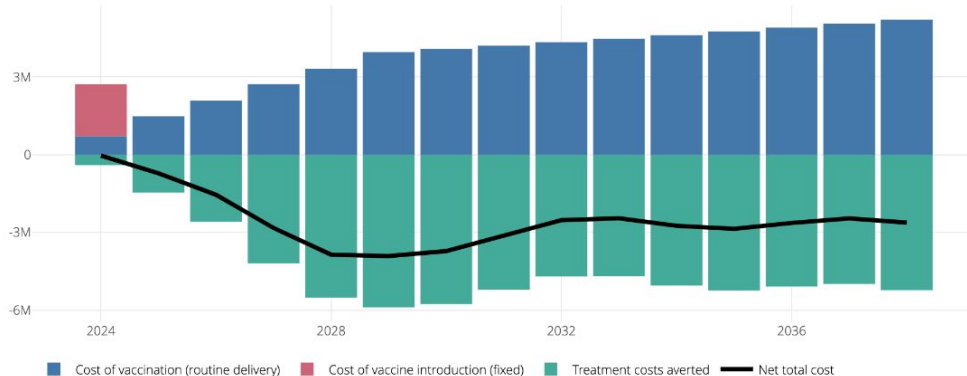
Undiscounted costs and benefits ▼

All

The annual net total cost shows the yearly cost of each user-defined scenario compared to the baseline (existing schedule with no new doses added). These costs include both the cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant) and the cost of illness (treating inpatient and outpatient cases of diphtheria, tetanus and pertussis). As introducing booster doses is anticipated to reduce cases, this leads to a lower cost of illness due to averted treatment costs. This is shown as the green bar extending below zero. The black line shows the annual net total (the difference between higher vaccination cost and lower treatment cost, compared to the baseline).

This plot shows the net total cost for one scenario at a time. Please use the dropdown menu on the left to select the scenario you would like to view.

## Annual costs (vaccination and treatment) compared to baseline (USD)



The net total costs plot below shows the yearly cost of each user-defined strategy compared to the baseline. Total costs include both treatment costs averted and the cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant). The black 'Net total cost' line in the plot above,

Example output  
for "Country X"

Example settings for "Country X"

- Welcome
- 1 Step 1: Set up Country Profile
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- 3 Step 3: Design Booster Strategy
- 4 Step 4: Explore Results

Baseline & Strategies (Display/Hide)

Drag here to display Drag here to hide

Baseline

Simultaneous (Td)

Simultaneous (TdaP)

Phased (Td)

Phased (TdaP)

Output options

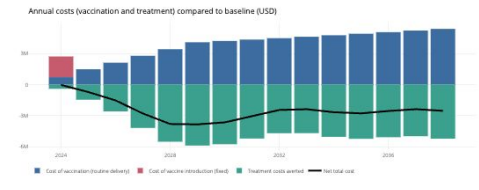
Model horizon  
15 years

Costing approach  
Proportion paid by government

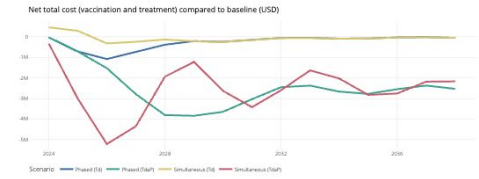
Discounting  
Undiscounted costs and benefits

Scenario for net cost comparison  
Phased (TdaP)

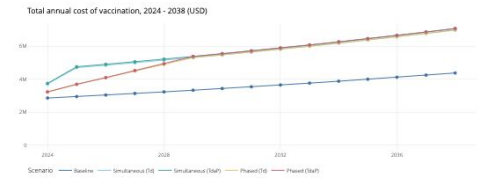
The annual net total cost shows the yearly cost of each user-defined scenario compared to the baseline (existing schedule with no new doses added). These costs include both the cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant) and the cost of illness (treating equipment and equipment costs of epidemics, malaria and pneumonia). As introducing booster doses is assumed to reduce cases, this leads to a lower cost of illness due to averted treatment costs. This is shown as the green bar extending below zero. The black line shows the annual net total (the difference between higher vaccination cost and lower treatment cost, compared to the baseline).  
This plot shows the net total cost for one scenario at a time. Please use the dropdown menu on the left to select the scenario you would like to view.



The net total costs plot below shows the yearly cost of each user-defined strategy compared to the baseline. Total costs include both treatment costs averted and the cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant). The black 'Net total cost' line in the plot above, for each scenario, are shown here for easy comparison.



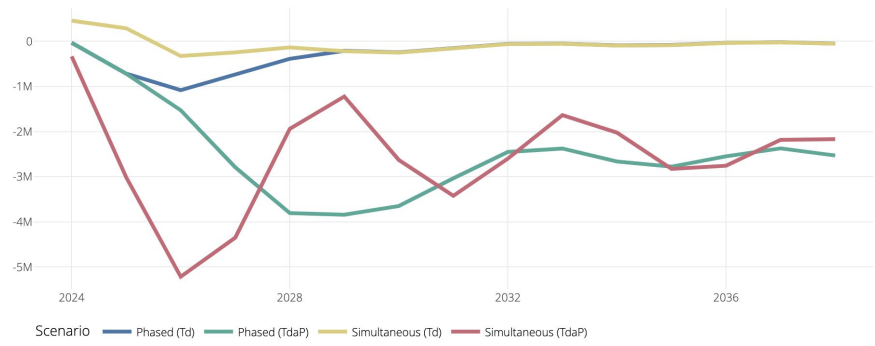
The total annual cost of vaccination shows the yearly cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant). The baseline (existing schedule with no new doses added) and user-defined scenarios are presented for comparison. Note that this plot shows the cost of vaccination only, not the cost of illness.  
Please use the dropdown menu on the left to select whether you would like to view the entire cost or only the proportion of the cost paid by government (based on the inputs given by the user in Step 1 and Step 3).



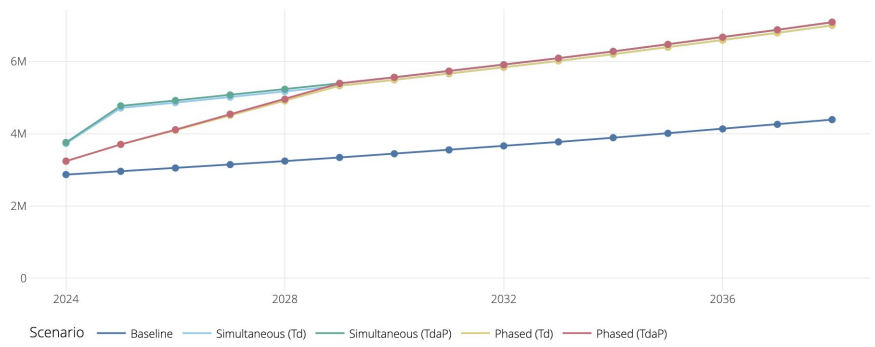
Projected costs by component (total cost for 2024 - 2038)

Scenario	Total cost	Cost of vaccination	Cost of illness	Cost of early childhood booster	Cost of child booster	Cost of adolescent booster	Cost of maternal vaccination
Baseline	425,609,000	53,684,000	371,925,000	0	0	0	0
Simultaneous (Td)	424,862,000	84,719,000	340,263,000	13,158,000	9,498,000	8,369,000	0
Simultaneous (TdaP)	387,661,000	85,758,000	301,964,000	13,158,000	10,092,000	8,656,000	0
Phased (Td)	421,959,000	81,696,000	340,263,000	13,158,000	8,454,000	6,420,000	0
Phased (TdaP)	386,796,000	82,559,000	306,237,000	13,158,000	8,914,000	6,790,000	0

Net total cost (vaccination and treatment) compared to baseline (USD)



Total annual cost of vaccination, 2024 - 2038 (USD)



Example output for "Country X"

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Example output for "Country X"

Baseline & Strategies (Display/Hide)

👁️ Drag here to display

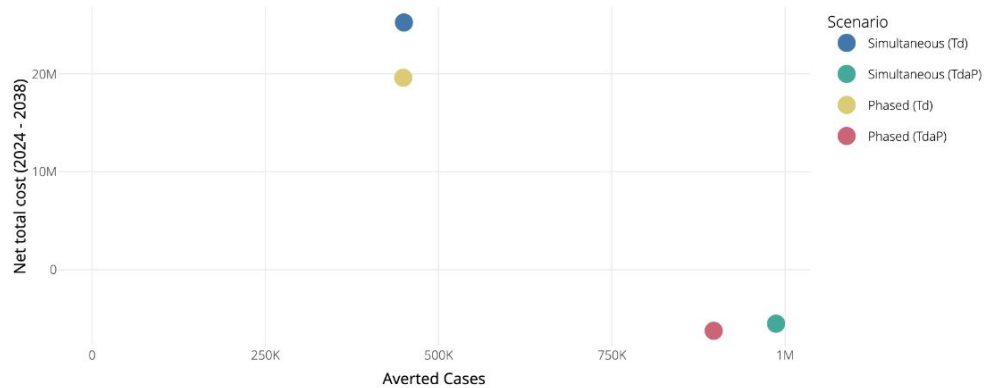
- Baseline
- Simultaneous (Td) ?
- Simultaneous (TdaP) ?
- Phased (Td) ?
- Phased (TdaP) ?

🙋 Drag here to hide

These results show the cost-effectiveness of the vaccination programme in terms of cost per clinical case averted and cost per death averted, for each user-defined strategy compared to baseline (existing schedule with no new doses added). The total cost includes both the cost of the vaccination programme (cost of vaccines, routine delivery costs and cost of introducing new doses if relevant) and the cost of illness (treating inpatient and outpatient cases of diphtheria, tetanus and pertussis). Clinical cases and deaths are counted for diphtheria, tetanus and pertussis combined.

Please use the dropdown menu on the left to select whether you would like to view the cost-effectiveness based on the entire cost or only the proportion of the cost paid by government (based on the inputs given by the user in Step 1 and Step 3).

Incremental Cost Effectiveness, 2024 - 2038 (USD)



Note: If the net total cost (plot above) or the cost per clinical case averted/cost per death averted (table below) is negative, the strategy is cost-saving. This happens when the amount saved through averted treatment costs is greater than the amount spent implementing the new vaccination strategy.

Output options

Select model output (cost effectiveness)

Clinical cases ▼

Model horizon

15 years ▼

Costing approach

Full cost (donor and government) ▼

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Full cost (donor and government)

Discounting

Discounted costs and benefits

- Phased (Td) ?
- Phased (TdaP) ?

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### Output options

#### Select model output (cost effectiveness)

Clinical cases ▼

#### Model horizon

15 years ▼

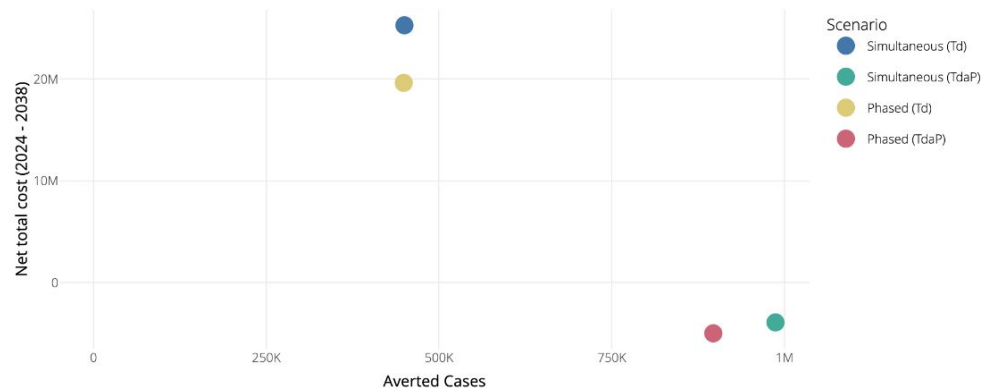
#### Costing approach

Full cost (donor and government) ▼

#### Discounting

Discounted costs and benefits ▼

### Incremental Cost Effectiveness, 2024 - 2038 (USD)



Note: If the net total cost (plot above) or the cost per clinical case averted/cost per death averted (table below) is negative, the strategy is cost-saving. This happens when the amount saved through averted treatment costs is greater than the amount spent implementing the new vaccination strategy.

### Effectiveness outputs (diphtheria, tetanus and pertussis)\*

Scenario	Total cost	Cost of vaccination	Cost of illness	Clinical cases (Total)	Deaths (Total)	Cost per clinical case averted**	Cost per death averted**
Baseline	374,932,000	83,681,000	291,251,000	4,680,000	6,500	-	-
Simultaneous (Td)	400,209,000	133,660,000	266,549,000	4,231,000	5,920	843	651,000
Simultaneous (TdaP)	371,028,000	135,266,000	235,761,000	3,693,000	5,390	-59	-52,900
Phased (Td)	394,558,000	127,950,000	266,609,000	4,231,000	5,950	655	535,000
Phased (TdaP)	369,967,000	129,224,000	240,743,000	3,783,000	5,500	-83	-74,600

\* Outputs are shown as the total for the full model timeframe

\*\* Compared to Baseline

Example output for “Country X”

🏠 Welcome

1 Step 1. Set-up Country Profile

2 Step 2. Calibrate Model

3 Step 3. Design Booster Strategy

4 Step 4. Explore Results

4.1 Epidemiological Output

4.2 Budget Impact

4.3 Cost Effectiveness

4.4 Downloads

### Download results

Results can be downloaded to view offline in two formats: 1) download a full set of results in csv format; or 2) generate a PDF report of your current session. The csv file contains the full set of epidemiological and economic model outputs (all years, by age group) for the baseline and all user-defined strategies. All available selections (e.g., output type, count vs per 100,000, costing approach, discounting) as well as details of the baseline and intervention strategy input selections are included. The PDF report includes a selection of results (plots and tables) with the relevant text to provide context.

If you would like to save additional figures using alternate selections (e.g., to view a specific age category, output type, costing approach), you can hover over any plot in the tool to download it as a png image.

Results for all strategies will be downloaded to a .csv file.

[↓ DOWNLOAD RESULTS](#)

Download a PDF report of your current session.

[↓ DOWNLOAD REPORT](#)

Example output  
for “Country X”

# First use case | Lessons Learned

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- Capacity building for use of tool & principles behind it (technical assistance is vital to make the most of the app)
- Data!
  - Gaps in input data - where are they? how to fill?
  - Multiple data sources - which to use? how to reach consensus?
- Collaboration - *it's important*
  - Feedback from worked examples and expert reference group helped identify key inputs and reach consensus on data sources
  - Mix of technical skills needed and practical knowledge of the setting; presence of multidisciplinary teams and different backgrounds
- Tailoring
  - Understand and adapt the approach to the audience, both the users of the app and the end-users of the results
  - Tailor scenarios and default input values to individual countries



# Thank you!

For more information on DTP Boost, please contact:

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