

Package: mpoxseir (via r-universe)

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Title Stochastic compartmental model of mpox transmission

Version 0.2.28

Description Stochastic compartmental model of mpox transmission in
odin.dust.

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div_pop	<i>Divide matrix by population</i>
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Description

Divide matrix by population

Usage

div_pop(contact, population)

Arguments

contact	Matrix
population	Population vector

Value

Matrix

get_age_bins	<i>Get age bins for use in the model</i>
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Description

A function that gets the age bins used in the model.

Usage

get_age_bins()

Value

A data frame containing the labels for the age bins, and their start and end values

`get_compartment_indices`*Get compartment indices used throughout the model*

Description

A function that gets the compartment indices used in the model

Usage

```
get_compartment_indices()
```

Value

A list containing entries: `dim` giving the dimensions of each compartment, currently: `group = 18`, `vax = 4`; `group`, a named list of the array indices corresponding to the first dimension of model compartments: 16 5-year age bands + SW + PBS; and `vax`, a named list of the vaccine strata used in the second dimension of model compartments:

1. historic smallpox; 2. unvaccinated; 3. one-dose; 4. two-dose.

Use this function wherever you need to refer to these standards in your code to avoid duplication, and make modifying universally easier.

`matrix_set`*Process set of contact matrices -> mixing matrices*

Description

Process set of contact matrices -> mixing matrices

Usage

```
matrix_set(contact_matrix_set, population)
```

Arguments

`contact_matrix_set`

Set of contact matrices

`population`

Vector of populaion by age

Value

Processed set of mixing matrices

model_targeted_vax	<i>Stochastic compartmental transmission model of Mpox virus</i>
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Description

The basic model; we may add more or adapt this one over time.

mpoxseir_date	<i>Date handling for mpoxseir</i>
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Description

We need to map "dates" onto `dust::dust`'s concept of model "step" and we do this by mapping a date such as 2024-03-02 into the number of days since the start of 2023 (426 here, with the 1st of January being day 0). We call this integer number an "mpoxseir date".

Usage

```
mpoxseir_date(date)

mpoxseir_date_as_date(date)

as_mpxseir_date(date)

as_date(date)
```

Arguments

date	A Date object, or something that can be converted to one, or an "mpoxseir date"; see Details
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Details

There are several related functions here

- `mpoxseir_date` converts its argument into an R Date object, then applies this transformation. If the argument is not a Date object or a string representing one, an error will be thrown.
- `mpoxseir_date_to_date` does the reverse conversion to `mpoxseir_date`, converting an integer mpoxseir date into an R Date
- `as_mpxseir_date` does the same conversion as `mpoxseir_date` but will assume that an integer *already* represents an mpoxseir date and will return it unmodified rather than erroring.
- `as_date` does a string to date conversion, using `as.Date()` but requiring the dates are in ISO 8601 (YYYY-MM-DD) format (it is a helper that avoids conversion to NA, instead throwing an error)

Value

An integer, being the number of days into 2023

Examples

```
# Convert dates into mpoxseir dates:
mpoxseir::mpoxseir_date("2023-01-01")
mpoxseir::mpoxseir_date(c("2024-03-01", "2024-10-01"))

# Reverse the conversion:
mpoxseir::mpoxseir_date_as_date(0)
mpoxseir::mpoxseir_date_as_date(c(425, 639))

# Double conversion not possible with mpoxseir_date...
try(mpxseir::mpoxseir_date(61))
# ...but allowed with as_mpxseir_date
mpoxseir::as_mpxseir_date(61)

# Strict date conversion with as_date
mpoxseir::as_date("2024-03-01")
try(mpxseir::as_date("03-01-2024"))
```

parameters_demographic

Get demographic parameters

Description

A function that returns the demographic parameters for use in the model

Usage

```
parameters_demographic(
  region,
  mixing_matrix = "Zimbabwe",
  p_SW = NULL,
  p_HCW = NULL
)
```

Arguments

region	The region for the parameters, must be either "equateur", "sudkivu", "burundi" or "bujumbura"
mixing_matrix	The mixing matrix must be either "Zimbabwe", "synthetic_home", or "synthetic_all"
p_SW	The proportion of SW-age groups that are sex workers. Note that e.g. a value of 0.01 means 1% of all SW-age groups are sex workers and not just 1% of women in those groups. Default is NULL, in which case we use the default value for the region given in the package

p_HCW The proportion of HCW-age groups that are healthcare workers. Default is NULL, in which the default values for DRC and Burundi are used.

Value

A list containing all the demographic parameters

parameters_fixed	<i>Get fixed parameters for use in the model</i>
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Description

A function that gets the fixed parameters for use in the model

Usage

```
parameters_fixed(
  region,
  initial_infections,
  use_ve_D = FALSE,
  mixing_matrix = "Zimbabwe",
  p_SW = NULL,
  p_HCW = NULL,
  overrides = list()
)
```

Arguments

region	The region for the parameters, must be either "equateur", "sudkivu", "burundi" or "bujumbura"
initial_infections	The initial number of infections
use_ve_D	logical, indicating whether model should allow for vaccine efficacy against death (above and beyond protection against infection)
mixing_matrix	The mixing matrix must be either "Zimbabwe", "synthetic_home", or "synthetic_all"
p_SW	The proportion of SW-age groups that are sex workers. Note that e.g. a value of 0.01 means 1% of all SW-age groups are sex workers and not just 1% of women in those groups. Default is NULL, in which case we use the default value for the region given in the package
p_HCW	The proportion of HCW-age groups that are healthcare workers. Default is NULL, in which the default values for DRC and Burundi are used.
overrides	A list, containing any parameters for which you want to override the default values

Value

A list of the fixed parameters

`process_contact_matrix`*Process a contact matrix*

Description

Process a contact matrix

Usage

```
process_contact_matrix(contact_matrix, population)
```

Arguments

`contact_matrix` A contact matrix

`population` Vector of population by age

Value

Processed matrix

`process_contact_matrix_scaled_age`*Process a contact matrix with an extra*

Description

Process a contact matrix with an extra

Usage

```
process_contact_matrix_scaled_age(contact_matrix, population)
```

Arguments

`contact_matrix` A contact matrix

`population` Vector of population by age

Value

Processed matrix

proportion_in_age_bins

calculate the proportion of each age group that lies between min_age and max_age (inclusive) based on uniform distribution within each age band

Description

A function that calculates the proportion of each age group than lies inside a given interval

Usage

```
proportion_in_age_bins(min_age, max_age)
```

Arguments

min_age	a scalar giving the bottom of the age range
max_age	a scalar giving the top of the age range

Value

a vector of length $n_age = 16$ giving the proportion for each age band

run_mpoxSEIR_targetedVax_multiple

Run multiple iterations of the model with different parameter values

Description

Run multiple iterations of the model with different parameter values

Usage

```
run_mpoxSEIR_targetedVax_multiple(
  region,
  initial_infections,
  n_weeks,
  beta_z_max,
  R0_hh,
  R0_sw_st,
  n_vax = 0,
  daily_doses = 0,
  N_prioritisation_steps = 0,
  prioritisation_strategy = 0,
  vaccination_coverage_target = 0,
```

```

    vaccine_uptake = 0,
    ve_T = 0,
    ve_I = 0,
    ve_D = 0,
    vaccination_campaign_length = 0,
    overrides = list(),
    n_particles = 1,
    n_threads = 1,
    seed = 42,
    deterministic = TRUE,
    outputs_retained = NULL
)

```

Arguments

region	The region to run the model for, must be either "equateur" or "sudkivu"
initial_infections	The initial number of infections to seed with
n_weeks	number of weeks to run for
beta_z_max	beta for the age-group with highest zoonotic transmission (a number)
R0_hh	R0 for the household
R0_sw_st	R0 for sex workers to people who buy sex
n_vax	number of vaccination compartments (integer, basis for an additional dimension in odin states)
daily_doses	the daily number of doses administered (matrix of vaccination_campaign_length * number of vaccination compartments)
N_prioritisation_steps	the number of different vaccination prioritisation categories we're considering
prioritisation_strategy	what each step corresponds to in terms of strategy (matrix of n_group * N_prioritisation_steps, with 1s and 0s indicating whether a group is included in prioritisation step)
vaccination_coverage_target	vaccination coverage target for each group and prioritisation step (matrix of n_group * N_prioritisation_steps)
vaccine_uptake	max achievable coverage for each group (vector of length n_group)
ve_T	vaccine efficacy against onwards transmissibility for each vaccinated compartment (vector of length n_vax)
ve_I	vaccine efficacy against infection for each vaccinated compartment (vector of length n_vax)
ve_D	vaccine efficacy against death for each vaccinated compartment (vector of length n_vax)
vaccination_campaign_length	length of the vaccination campaign (in timesteps NOT days - CHECK WITH RUTH THIS IS RIGHT)

overrides	list of other model parameters which if specified will overwrite the defaults
n_particles	Number of particles
n_threads	Number of threads
seed	The random seed to use
deterministic	Logical, whether to run the model deterministically or not
outputs_retained	The outputs to retain

Value

The output from running the model

run_mpoxSEIR_targetedVax_single

Run the model with single set of parameter values

Description

Run the model with single set of parameter values

Usage

```
run_mpoxSEIR_targetedVax_single(
  region,
  initial_infections,
  n_weeks,
  R0_hh,
  R0_sw_st,
  beta_z_max,
  n_vax = 0,
  daily_doses = 0,
  N_prioritisation_steps = 0,
  prioritisation_strategy = 0,
  vaccination_coverage_target = 0,
  vaccine_uptake = 0,
  ve_T = 0,
  ve_I = 0,
  ve_D = 0,
  vaccination_campaign_length = 0,
  overrides = list(),
  n_particles = 1,
  n_threads = 1,
  seed = 42,
  deterministic = TRUE,
  outputs_retained = NULL
)
```

Arguments

region	The region to run the model for, must be either "equateur" or "sudkivu"
initial_infections	The initial number of infections to seed with
n_weeks	number of weeks to run for
R0_hh	R0 for the household
R0_sw_st	R0 for sex workers to people who buy sex
beta_z_max	beta for the age-group with highest zoonotic transmission (a number)
n_vax	number of vaccination compartments (integer, basis for an additional dimension in odin states)
daily_doses	the daily number of doses administered (matrix of vaccination_campaign_length * number of vaccination compartments)
N_prioritisation_steps	the number of different vaccination prioritisation categories we're considering
prioritisation_strategy	what each step corresponds to in terms of strategy (matrix of n_group * N_prioritisation_steps, with 1s and 0s indicating whether a group is included in prioritisation step)
vaccination_coverage_target	vaccination coverage target for each group and prioritisation step (matrix of n_group * N_prioritisation_steps)
vaccine_uptake	max achievable coverage for each group (vector of length n_group)
ve_T	vaccine efficacy against onwards transmissibility for each vaccinated compartment (vector of length n_vax)
ve_I	vaccine efficacy against infection for each vaccinated compartment (vector of length n_vax)
ve_D	vaccine efficacy against death for each vaccinated compartment (vector of length n_vax)
vaccination_campaign_length	length of the vaccination campaign (in timesteps NOT days - CHECK WITH RUTH THIS IS RIGHT)
overrides	list of other model parameters which if specified will overwrite the defaults
n_particles	Number of particles
n_threads	Number of threads
seed	The random seed to use
deterministic	Logical, whether to run the model deterministically or not
outputs_retained	The outputs to retain

Value

The output from running the model

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