

Package: msdes (via r-universe)

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Title CE Model

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Description This is the Multiple Sclerosis MS Multiple Technology
Appraisal MTA ID6369 Descrete Event Simulation DES Model.

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Imports hesim, purrr, rlang, progressr, data.table, MASS, utils,
flexsurv, BCEA, voi, VGAM, WARDEN, utils

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Repository <https://daysnmake.r-universe.dev>

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df_c_tx	<i>DMT costs by year</i>
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Description

A matrix of annual Disease Modifying Therapy DMT costs by year

Usage

df_c_tx

Format

A matrix with 3 rows and 17 columns. Each column contains the costs by treatment:

cost_annual_yr1 Annual DMT costs during 1st year of treatment

cost_annual_yr2 Annual DMT costs during 2nd year of treatment

Source

British National Formulary

df_c_tx_admin	<i>Treatment administration costs by year</i>
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Description

A matrix of annual treatment administration costs by year

Usage

df_c_tx_admin

Format

A matrix with 3 rows and 17 columns. Each column contains the costs by treatment:

cost_annual_yr1 Annual treatment administration costs during 1st year of treatment

cost_annual_yr2 Annual treatment administration costs during 2nd year of treatment

Source

UoB_TAG analysis (refer to report)

df_c_tx_load	<i>Annual treatment scheduled load factors years 1-5</i>
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Description

A matrix of annual treatment scheduled load factors years 1-5

Usage

df_c_tx_load

Format

A matrix with 5 rows and 8 columns. Each column contains the percentage of patients treated/re-treated by by DMT, with the 5 rows representing the load factors during the first years.

Source

UoB_TAG analysis (refer to report)

df_c_tx_monitor

Treatment monitoring costs by year

Description

A matrix of annual treatment monitoring costs by year

Usage

```
df_c_tx_monitor
```

Format

A matrix with 3 rows and 17 columns. Each column contains the costs by treatment:

cost_annual_yr1 Annual treatment monitoring costs during 1st year of treatment

cost_annual_yr2 Annual treatment monitoring costs during 2nd year of treatment

Source

UoB_TAG analysis (refer to report)

draw_tte_new_warden

Draw time to Event custom function

Description

draw_tte_new_warden() adds additional capability for the modelling of the UK life tables

Usage

```
draw_tte_new_warden(
  n_chosen,
  dist,
  coef1 = NULL,
  coef2 = NULL,
  coef3 = NULL,
  hr = 1,
  time = NULL,
  ...,
  beta_tx = 1,
  seed = NULL
)
```

Arguments

time	should be the start times of the intervals (last is assumed to go to infinity)
dcoef1	should be a vector of log-rates over time intervals

Details

Adaptation of `WARDEN::draw_tte()` to include piece wise exponential distributions Utilizing `hesim::rpwexp()`

gen_common_all_inputs *Generate Global inputs*

Description

gen_common_all_inputs() Global input parameters for the model are common to all patients and treatments.

Usage

```
gen_common_all_inputs()
```

Arguments

drc	discount rate for costs
drq	discount rate for qalys
reference	The treatment arm specified as the reference for the comparison

Details

Input parameters here that do not change as we loop through treatments for a patient. The input parameters are called from 'gen_inputs()' function or the main analysis script. They are called in with 'WARDEN::add_item()' functions, these are piped with `%>%` operator. Probabilistic input parameters are specified with 'WARDEN::pick_val_v()' function creating a list of deterministic and probabilistic values

gen_init_events *Generate initial events*

Description

gen_init_events() WARDEN implementation of initial events

Usage

```
gen_init_events(RRMS_events)
```

Details

reaction events run on treatment codes

gen_inputs	<i>generate inputs</i>
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Description

gen_inputs() generates model inputs from saved data and returns a list with the data required for the model to run.

Usage

```
gen_inputs(
  drc = drc,
  drq = drq,
  time_horizon = time_horizon,
  p_eid = p_eid,
  jcvtest_cost = jcvtest_cost
)
```

Arguments

drc	discount rate for costs
drq	discount rate for qalys
time_horizon	the duration of the patients' life in the model
p_eid	proportion pf patients treated with Natalizumab Extended Interval Dosing
jcvtest_cost	JCV test cost assumption

Details

Stored within the function are all the default values of the inputs, some parameters are modifiable by user here as described below. The generated inputs will be called and processed by [gen_common_all_inputs\(\)](#) to specify common and [gen_common_all_inputs\(\)](#) unique patient inputs, by [gen_init_events\(\)](#) to set initial and [gen_react_events\(\)](#) reaction events. Parameters called by the model are specified here, they can be modified or new ones can be added.

Value

a list of inputs

gen_react_events	<i>Generate reaction events</i>
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Description

gen_react_events() WARDEN implementation of reaction events

Usage

```
gen_react_events(RRMS_events)
```

Details

reaction events run on treatment codes

gen_unique_pt_inputs	<i>Generate Individual inputs</i>
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Description

gen_unique_pt_inputs() Individual patient parameters of the model as they are unique patients and history including treatments

Usage

```
gen_unique_pt_inputs()
```

Arguments

sex	individual patient sex
n_relapse	number of relapses counter
n_edssinc_evts	number of edss increases counter

Details

These are called for each new patient so sampled from distribution specified for heterogeneous characteristics and may depend on treatment Note that the current treatment is later initialised to trt

m_n_patients_edss	<i>Patient counts by EDSS score</i>
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Description

A matrix of patient counts stratified by EDSS score.

Usage

m_n_patients_edss

Format

A matrix with 2 rows and 10 columns. Each column contains the number of patients at that EDSS score:

- harrms** distribution of patients
- rrms** distribution of patients

Source

AFFIRM baseline

m_proportion_ontrtline	<i>A matrix of patient counts stratified by treatment</i>
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Description

A matrix of patient counts stratified by treatment

Usage

m_proportion_ontrtline

Format

A matrix with 4 rows and 8 columns. Each column contains the number of patients on treatment at line of treatment :

- alpha_2ndline** distribution of patients on 2nd line treatment
- beta_2ndline** distribution of patients on 2nd line treatment
- alpha_3rdline** distribution of patients on 3rd line treatment
- beta_3rdline** distribution of patients on 3rd line treatment

Source

MS Registry analysis

m_tto_edss_increase_harrms_sigma

Natural history treatment dependent variance covariance.

Description

Natural history treatment dependent variance covariance.

Format

A matrix with 3 rows and 3 columns #'

rate intercept VCV

BaselineWebEDSS EDSS VCV

DMTNatalizumab on treatment with Natalizumab VCV

Source

MS Registry analysis

m_tto_edss_increase_spms_sigma

Natural history variance covariance.

Description

Natural history variance covariance.

Format

A matrix with 2 rows and 2 columns #'

rate intercept VCV

BaselineWebEDSS EDSS VCV

Source

MS Registry analysis

`pluck_vector_from_env` *Pluck vector from enviroment*

Description

`pluck_vector_from_env()` function to extract vectors or condition on them when using environment in WARDEN `pick_val()` or `input_block()`.

Usage

```
pluck_vector_from_env(anylist, anyindex, ...)
```

Arguments

<code>anylist</code>	The input parameters saved an environment object
<code>anyindex</code>	conditioning on treatment or severity

Details

Vector of objects pulled from WARDEN environment (ex. lists saved in common inputs) and indexing on a vector (ex. treatments, severity)

`rrmsdessetup` *Model as a function*

Description

`rrmsdessetup()` RRMS DES model inputs written as a function to be called from Shiny APP
`rrmsdesmodel()` RRMS DES model run written as a function to be called from Shiny APP

Usage

```
rrmsdessetup(
  drc = drc,
  drq = drq,
  time_horizon = time_horizon,
  p_eid = p_eid,
  jcvtest_cost = jcvtest_cost
)
```

Details

For exclusive use of SHINY APP.

run_sim_new

*Run Sim new***Description**

run_sim_new() modified run_sim() function

Usage

```
run_sim_new(
  arm_list = c("int", "noint"),
  sensitivity_inputs = NULL,
  common_all_inputs = NULL,
  common_pt_inputs = NULL,
  unique_pt_inputs = NULL,
  init_event_list = NULL,
  evt_react_list = evt_react_list,
  util_ongoing_list = NULL,
  util_instant_list = NULL,
  util_cycle_list = NULL,
  cost_ongoing_list = NULL,
  cost_instant_list = NULL,
  cost_cycle_list = NULL,
  other_ongoing_list = NULL,
  other_instant_list = NULL,
  npats = 500,
  n_sim = 1,
  psa_bool = NULL,
  sensitivity_bool = FALSE,
  sensitivity_names = NULL,
  n_sensitivity = 1,
  input_out = character(),
  ipd = 1,
  constrained = FALSE,
  timed_freq = NULL,
  debug = FALSE,
  accum_backwards = FALSE,
  continue_on_error = FALSE,
  seed = NULL,
  save_input_matrix = FALSE
)
```

Details

This runs the model to allow for extra functionality for VOI analysis Appends input_matrix to results, this contains the paramters sampled per simulation

summarise_ce_results *Summarise Cost-effectiveness results*

Description

summarise_ce_results() Function to tabulate the PSA results at willingness to pay (WTP) thresholds

Usage

```
summarise_ce_results(
  wtp1 = wtp1,
  wtp2 = wtp2,
  total_qalys,
  total_costs,
  reference = "Natalizumab-IV"
)
```

Arguments

wtp1	set the willingness to pay threshold, NICE default is £25,000
wtp2	set the willingness to pay threshold, NICE default is £35,000
total_qalys	input from the model results: the average total quality adjusted life years per treatment arm
total_costs	input from the model results: the average total costs per treatment arm
reference	The treatment arm specified as the reference for the comparison

Details

Returns the incremental cost and qalys calculates the expected incremental cost effectiveness ratio calculates the expected incremental net benefit ratio returns the probability of treatment arms being cost effective

summarise_samples *Summarise Samples*

Description

summarise_samples() Function to summarise PSA samples

Usage

```
summarise_samples(x, n_digits = 2)
```

Arguments

x data to be supplied

Details

returns the mean and 95% Credible Intervals

v_smr_severity_harding

A matrix of excess all cause mortality for MS patients by severity

Description

A matrix of excess all cause mortality for MS patients by severity

Usage

v_smr_severity_harding

Format

A matrix with 3 rows and 10 columns. Each column contains the data by EDSS severity state:

smr average standard mortality ratio by severity state

sd standard deviation by severity state

logsd log standard deviation by severity state

Source

edss<4 (Jick et al), edss>=4 (Harding et al)

v_tto_edss_increase_harms_mu

Natural history treatment dependent coefficients.

Description

Natural history treatment dependent coefficients.

Format

A named vector with 3 elements containing the formula coefficients: #'

rate intercept coefficient

BaselineWebEDSS EDSS coefficient

DMTNatalizumab on treatment with Natalizumab coefficient

Source

MS Registry analysis

v_tto_edss_increase_spms_mu
<i>Natural history coefficients.</i>

Description

Natural history coefficients.

Format

A named vector with 2 elements containing the formula coefficients: #'
rate intercept coefficient
BaselineWebEDSS EDSS coefficient

Source

MS Registry analysis

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