Package 'LTASR'

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Title Functions to Replicate the Center for Disease Control and Prevention's 'LTAS' Software in R

Version 0.1.4

Description A suite of functions for reading in a rate file in XML format, stratify a cohort, and calculate 'SMRs' from the stratified cohort and rate file.

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Contents

`checkStrata` *Checks all strata in py_table are contained in rate file*

Description

Checks all strata in py_table are contained in rate file

Usage

```
checkStrata(py_table, rateobj)
```

Arguments

`py_table`	A stratified cohort created by `get_table`
`rateobj`	A rate object created by `parseRate`

Value

A list containing:

1. The py_table with strata removed not found in rateobj
2. The observations from py_table that were removed

Examples

```
library(LTASR)
library(dplyr)
library(purrr)

#Import example person file
person <- person_example %>%
  mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021
```

```
#Stratify person table
py_table <- get_table(person, rateobj)

#Check Strata are in rate file
checkStrata(py_table, rateobj)
```

---

expand_dates *Expand data through range of date values*

Description

Expand a data.frame to include all dates between a start and end value defined by parameters x and y

Usage

```
expand_dates(
  df,
  start,
  end,
  md_tmplt = seq(as.Date("1/1/2015", "%m/%d/%Y"), as.Date("12/31/2015",
    "%m/%d/%Y"), by = "day")
)
```

Arguments

df	Input data.frame
start	start date
end	end date
md_tmplt	Date vector that defines which dates within a year to output.

Value

A data.frame/tibble containing all variables of the input data.frame as well as a new variable, date, with repeated rows for each date between start and end spaced as defined by md_tmplt.

Examples

```
library(LTASR)
data <- data.frame(id = 1,
                   start = as.Date('3/1/2015', format='%m/%d/%Y'),
                   end = as.Date('3/15/2015', format='%m/%d/%Y'))
expand_dates(data, start, end)
```

exp_strata *Create exp_strata object*

Description

`exp_strata()` creates an exp_strata that defines which variable to consider, any lag to be applied, and cutpoints for the strata.

Usage

```
exp_strata(var = character(), cutpt = numeric(), lag = 0)
```

Arguments

`var`	character naming the variable within the history data.frame to consider.
`cutpt`	numeric vector defining the cutpoints to use to stratify the calculated cumulative exposure for variable `var`. Should include min and max values (typically -Inf and Inf).
`lag`	numeric defining the lag, in years, to be applied to exposure variables. Default is 0 yrs (i.e. unlagged). Must be a whole number.

Value

an object of class `exp_strata` to be used in the `get_table_history()`.

Examples

```
library(LTASR)
exp1 <- exp_strata(var = 'employed',
                   cutpt = c(-Inf, 365, Inf),
                   lag = 10)
```

get_table *Stratify Person Table*

Description

`get_table` reads in a data.frame/tibble containing basic demographic information for each person of the cohort and stratifies the person-time and deaths into 5-year age, 5-year calendar period, race, and sex strata. See `Details` for information on how the person file must be formatted.

Usage

```
get_table(persondf, rateobj, strata = dplyr::vars(), batch_size = 500)
```

Arguments

persondf	data.frame like object containing one row per person with the required demographic information
rateobj	a rate object created by the parseRate function, or the included rate object us_119ucod_19602021
strata	any additional variables contained in persondf on which to stratify. Must be wrapped in a vars() call from dplyr.
batch_size	a number specifying how many persons to stratify at a time. Default is 500

Details

The persondf tibble must contain the variables:

- id,
- gender (character: 'M'/'F'),
- race (character: 'W'/'N'),
- dob (date),
- pybegin (date),
- dlo (date),
- vs (character: indicator identifying deaths as 'D')
- rev (numeric: values 5-10),
- code (character: ICD code)

Value

A data.frame with a row for each strata containing the number of observed deaths within each of the defined minors/outcomes (_o1-_oxxx) and the number of person days.

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
  mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021

#Stratify person table
py_table <- get_table(person, rateobj)
```

`get_table_history` *Stratify Person Table with Time Varying Co-variate*

Description

`get_table_history` reads in a data.frame/tibble (`persondf`) containing basic demographic information for each person of the cohort as well as a data.frame/tibble (`historydf`) containing time varying exposure information and stratifies the person-time and deaths into 5-year age, 5-year calendar period, race, sex and exposure categories. See `Details` for information on how the person file and history file must be formatted.

Usage

```
get_table_history(
  persondf,
  rateobj,
  historydf,
  exps = list(),
  strata = dplyr::vars(),
  batch_size = 500
)
```

Arguments

`persondf`	data.frame like object containing one row per person with the required demographic information.
`rateobj`	a rate object created by the `parseRate` function, or the included rate object `us_119ucod_19602021`.
`historydf`	data.frame like object containing one row per person and exposure period. An exposure period is a period of time where exposure levels remain constant. See `Details` for required variables.
`exps`	a list containing exp_strata objects created by `exp_strata()`.
`strata`	any additional variables contained in persondf on which to stratify. Must be wrapped in a `vars()` call from `dplyr`.
`batch_size`	a number specifying how many persons to stratify at a time. Default is 500.

Details

The persondf tibble must contain the variables:

- id,
- gender (character: 'M'/'F'),
- race (character: 'W'/'N'),
- dob (date),
- pybegin (date),

- dlo (date),
- rev (numeric: values 5-10),
- code (character: ICD code)

The historydf tibble must contain the variables:

- id,
- begin_dt (date),
- end_dt (date),
- <*daily exposure levels*>

Value

A data.frame with a row for each strata containing the number of observed deaths within each of the defined minors/outcomes (_o1-_oxxx) and the number of person days.

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import example history file
history <- history_example %>%
  mutate(begin_dt = as.Date(begin_dt, format='%m/%d/%Y'),
         end_dt = as.Date(end_dt, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021

#Define exposure of interest. Create exp_strata object.The `employed` variable
#indicates (0/1) periods of employment and will be summed each day of each exposure
#period. Therefore, this calculates duration of employment in days. The cut-points
#used below will stratify by person-time with less than and greater than a
#year of employment (365 days of employment).
exp1 <- exp_strata(var = 'employed',
                   cutpt = c(-Inf, 365, Inf),
                   lag = 0)

#Stratify cohort by employed variable.
py_table <- get_table_history(persondf = person,
                              rateobj = rateobj,
                              historydf = history,
                              exps = list(exp1))

#Multiple exposures can be considered.
```

```
exp1 <- exp_strata(var = 'employed',
                   cutpt = c(-Inf, 365, Inf),
                   lag = 0)
exp2 <- exp_strata(var = 'exposure_level',
                   cutpt = c(-Inf, 0, 10000, 20000, Inf),
                   lag = 10)

#Stratify cohort by employed variable.
py_table <- get_table_history(persondf = person,
                              rateobj = rateobj,
                              historydf = history,
                              exps = list(exp1, exp2))
```

`get_table_history_est` *Stratify Person Table with Time Varying Co-variate*

Description

`get_table_history_est` reads in a data.frame/tibble (`persondf`) containing basic demographic information for each person of the cohort as well as a data.frame/tibble (`historydf`) containing time varying exposure information and stratifies the person-time and deaths into 5-year age, 5-year calendar period, race, sex and exposure categories. Additionally, average cumulative exposure values for each strata and each exposure variable are included. These strata are more crudely calculated by taking regular steps (such as every 7 days) as opposed to evaluating every individual day. See `Details` for information on how the person file and history file must be formatted.

Usage

```
get_table_history_est(
  persondf,
  rateobj,
  historydf,
  exps,
  strata = dplyr::vars(),
  step = 7,
  batch_size = 25 * step
)
```

Arguments

`persondf`	data.frame like object containing one row per person with the required demographic information.
`rateobj`	a rate object created by the `parseRate` function, or the included rate object `us_119ucod_19602021`.
`historydf`	data.frame like object containing one row per person and exposure period. An exposure period is a period of time where exposure levels remain constant. See `Details` for required variables.

exps	a list containing exp_strata objects created by exp_strata().
strata	any additional variables contained in persondf on which to stratify. Must be wrapped in a vars() call from dplyr.
step	numeric defining number of days to jump when calculating cumulative exposure values. Exact stratification specifies a step of 1 day.
batch_size	a number specifying how many persons to stratify at a time.

Details

The persondf tibble must contain the variables:

- id,
- gender (character: 'M'/'F'),
- race (character: 'W'/'N'),
- dob (date),
- pybegin (date),
- dlo (date),
- rev (numeric: values 5-10),
- code (character: ICD code)

The historydf tibble must contain the variables:

- id,
- begin_dt (date),
- end_dt (date),
- *<daily exposure levels>*

Value

A data.frame with a row for each strata containing the number of observed deaths within each of the defined minors/outcomes (_o1-_oxxx) and the number of person days.

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import example history file
history <- history_example %>%
  mutate(begin_dt = as.Date(begin_dt, format='%m/%d/%Y'),
         end_dt = as.Date(end_dt, format='%m/%d/%Y'))
```

```
#Import default rate object
rateobj <- us_119ucod_19602021
#Define exposure of interest. Create exp_strata object.The `employed` variable
#indicates (0/1) periods of employment and will be summed each day of each exposure
#period. Therefore, this calculates duration of employment in days. The cut-points
#used below will stratify by person-time with less than and greater than a
#year of employment (365 days of employment).
exp1 <- exp_strata(var = 'employed',
                   cutpt = c(-Inf, 365, Inf),
                   lag = 0)

#Stratify cohort by employed variable.
py_table <- get_table_history_est(persondf = person,
                                  rateobj = rateobj,
                                  historydf = history,
                                  exps = list(exp1))

#Multiple exposures can be considered.
exp1 <- exp_strata(var = 'employed',
                   cutpt = c(-Inf, 365, Inf),
                   lag = 0)
exp2 <- exp_strata(var = 'exposure_level',
                   cutpt = c(-Inf, 0, 10000, 20000, Inf),
                   lag = 10)

#Stratify cohort by employed variable.
py_table <- get_table_history_est(persondf = person,
                                  rateobj = rateobj,
                                  historydf = history,
                                  exps = list(exp1, exp2))
```

`history_example` *Example History File for Testing*

Description

A tibble containing example history file data to be used for testing and demonstration of the package

Usage

```
history_example
```

Format

A data frame with 4 rows and 5 variables:

id unique identifier; numeric

begin_dt beginning date of an exposure period; character

end_dt beginning date of an exposure period; character

employed a hypothetical variable indicating employment during the given exposure period; numeric (0/1)

exposure_level a hypothetical variable identifying daily exposure levels to be summed to calculate a cumulative exposure; numeric

...

Source

Internally Generated

`mapDeaths` *Map ICD codes to grouped minors*

Description

Map ICD codes to grouped minors

Usage

```
mapDeaths(persondf, rateobj)
```

Arguments

`persondf`	Person data.frame
`rateobj`	A rate object created from `parseRate`, or the included rate object `us_119ucod_19602021`.

Value

A data.frame for each death observed in the person file with the following variables: id, code, rev: from the `persondf` minor: the minor/outcome from the rate file that the death was mapped to

Examples

```
library(LTASR)

#Import example person file
person <- person_example

#Import default rate object
rateobj <- us_119ucod_19602021

#Check mapping of deaths to minors/outcomes
mapDeaths(person, rateobj)
```

parseRate *Parses LTAS rate file in .xml format*

Description

Parses LTAS rate file in .xml format

Usage

```
parseRate(xmlpath)
```

Arguments

xmlpath	path of LTAS rate file

Value

returns a list containing:

1. $residual: the minor number where all unknown deaths will be assigned
2. $MinorDesc: a data.frame/tibble giving descriptions of minor numbers as well as how minors are mapped to majors
3. $mapping: a data.frame/tibble listing how each icd-code and revision will be mapped to each minor number
4. $age_cut: a numeric specifying cut-points for age strata
5. $cp_cut: a numeric specifying cut-points for calendar period strata

person_example *Example Person File for Testing*

Description

A tibble containing example person file data to be used for testing and demonstration of the package

Usage

```
person_example
```

Format

A tibble with 3 observations and 9 variables:

id unique identifier; character

gender Gender/Sex; character 'M' or 'F'

race Race; character 'W' or 'N'

dob Date of Birth; character to be converted to date

pybegin date to begin follow-up/at-risk accumulation, character to be converted to date

dlo Date last observed; character to be converted to date

vs indicator identifying the vital status of the cohort. A value of 'D' indicates an observed death; character

rev ICD revision of the ICD code; numeric

code ICD-code for the cause of death; character ...

Source

Internally Generated

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smr_custom *Calculate SMRs for Custom minor groupings*

Description

`smr_major` will collapse minor outcomes into "major" groupings as defined in the rate object, `rateobj`.

Usage

```
smr_custom(smr_minor_table, minor_grouping)
```

Arguments

`smr_minor_table`	A data.frame/tibble as created by `smr_minor` containing observed and expected number of deaths for each minor outcome
`minor_grouping`	A numeric vector defining which minors to group together

Value

A data.frame/tibble containing the expected and observed number of deaths as well the SMR, lower CI and upper CI for the outcome by the user

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
  mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021

#Stratify person table
py_table <- get_table(person, rateobj)

#Calculate SMRs for all minors
smr_minor_table <- smr_minor(py_table, rateobj)

#Calculate custom minor grouping for all deaths
smr_custom(smr_minor_table, 1:119)

#' #Calculate custom minor grouping for all deaths
smr_custom(smr_minor_table, 4:40)
```

---

smr_major *Calculate SMRs for Major groupings*

Description

smr_major will collapse minor outcomes into "major" groupings as defined in the rate object, rateobj.

Usage

```
smr_major(smr_minor_table, rateobj)
```

Arguments

smr_minor_table	A data.frame/tibble as created by smr_minor containing observed and expected number of deaths for each minor outcome
rateobj	A rate object created by parseRate, or the included rate object us_119ucod_19602021.

Value

A data.frame/tibble containing the expected and observed number of deaths as well as SMRs, lower CI and upper CI for each major as defined in the rate object rateobj

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
  mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021

#Stratify person table
py_table <- get_table(person, rateobj)

#Calculate SMRs for all minors
smr_minor_table <- smr_minor(py_table, rateobj)

#Calculate SMRs major groupings found within rate file
smr_major(smr_minor_table, rateobj)
```

---

smr_minor *Calculate SMRs for Minors*

Description

smr_minor calculates SMRs for all minor groupings found within the rate object, rateobj, for the stratified cohort py_table

Usage

```
smr_minor(py_table, rateobj)
```

Arguments

py_table	A stratified cohort created by get_table, or the included rate object us_119ucod_19602021.
rateobj	A rate object created by parseRate

Value

A dataframe/tibble containing the expected and observed number of deaths as well as SMRs, lower CI and upper CI for each minor found in the rate object rateobj

Examples

```
library(LTASR)
library(dplyr)

#Import example person file
person <- person_example %>%
  mutate(dob = as.Date(dob, format='%m/%d/%Y'),
         pybegin = as.Date(pybegin, format='%m/%d/%Y'),
         dlo = as.Date(dlo, format='%m/%d/%Y'))

#Import default rate object
rateobj <- us_119ucod_19602021

#Stratify person table
py_table <- get_table(person, rateobj)

#Calculate SMRs for all minors
smr_minor(py_table, rateobj)
```

---

us_119ucod_19602021 *119 UCOD U.S. Death Rate, 1960-2021*

Description

A list containing referent underlying cause of death (UCOD) rate information for the US population from 1960-2021 for the 119 minor/outcome LTAS groupings

Usage

```
us_119ucod_19602021
```

Format

A list with 4 elements:

residual the minor/outcome number to which unknown/uncategorized outcomes will be mapped to

MinorDesc a data.frame containing descriptions for each minor and major grouping

mapping a tibble detailing which minor number each icd-code and revision combination will be mapped to

rates the population referent rate for each minor for each gender/race/calendar period/age strata ...

Source

Available upon request from sbertke@cdc.gov

us_119ucod_recent *119 UCOD U.S. Death Rate, 1960-2022*

Description

A list containing referent underlying cause of death (UCOD) rate information for the US population from 1960-2022 for the 119 minor/outcome LTAS groupings

Usage

```
us_119ucod_recent
```

Format

A list with 4 elements:

residual the minor/outcome number to which unknown/uncategorized outcomes will be mapped to

MinorDesc a data.frame containing descriptions for each minor and major grouping

mapping a tibble detailing which minor number each icd-code and revision combination will be mapped to

rates the population referent rate for each minor for each gender/race/calendar period/age strata ...

Source

Available upon request from sbertke@cdc.gov

Index