Package ‘SEERaBomb’

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Title SEER and Atomic Bomb Survivor Data Analysis Tools
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Author Tomas Radivoyevitch
Description Creates SEER (Surveillance, Epidemiology and End Results) and A-bomb data binaries from ASCII sources and provides tools for estimating SEER second cancer risks.
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Description

Creates SEER (Surveillance, Epidemiology and End Results) and Japanese A-bomb survivor data binaries from ASCII sources and provides tools for estimating SEER second cancer risks. Depicted below, mkSEER merges cancers and populations of all three of the SEER databases into single cancer and population data frames.
SEER data field positions and names change over the years and the original purpose of SEERaBomb was to buffer/protect R scripts from such changes. A second purpose was to speed up SEER data computations by reducing the data [via `pickFields()`] to only fields of interest. SEERaBomb now has an additional purpose: estimating relative risks of SEER second cancers after diagnoses of first cancers, using all three SEER databases.

### Details

- **Package:** SEERaBomb
- **Type:** Package
- **Depends:** LaF, RSQLite
- **Suggests:** bbmle
- **License:** GPL-2
- **LazyLoad:** yes
- **LazyData:** yes
- **URL:** http://epbi-radivot.cwru.edu/SEERaBomb/SEERaBomb.html

### Note

The old version of `mkSEER()` merged cancer files but it didn’t merge databases. To avoid breaking scripts that expect separate databases, that old version is still available, but it is now called `mkSEERold`.

Initial development of SEERaBomb was supported by the National Cancer Institute and Tufts Integrative Cancer Biology Program under U54CA149233-029689. As of 2014, maintenance and further development has been supported by the Cleveland Clinic Foundation.
Author(s)

Tom Radivoyevitch (<radivot@ccf.org>)

References


See Also

getFields, pickFields, mkSEER, mkSEERold, mkAbomb

csd Cancer risk vs years Since Diagnosis of other cancer

Description

Computes relative risks (RR) of 2nd cancers over specified intervals of times since diagnoses of a 1st cancer. 2D spline fits are used to produce expected cases E controlling for background risk dependence on age and calendar year. RR is then O/E where O is the number of observed cases.

Usage

csd(seerSet, brkst=c(0), brksy=c(1973), brksa=c(0), trts=NULL,
       PLYLong=FALSE, firstS="all", exclUnkSurv=FALSE)

Arguments

seerSet A seerSet object produced by mk2D().

brkst Vector of breaks in years used to form Time intervals/bins since diagnosis. An upper limit of 100, well beyond 40 years of SEER follow up currently available, is assumed/added to brkst internally, and should thus not be in brkst.

brksy Vector of breaks used to form groups of calendar Year at diagnosis intervals/bins. An upper limit of yearEnd (last year in SEER; a seerSet field) is assumed/added to brksy internally.

brksa Vector of breaks used to form groups of Age at diagnosis intervals/bins. An upper limit of 126 is assumed.

trts Character vector of treatments of interest. Default of NULL => all levels in seerSet's canc$trt.

PLYLong Set true if in addition to O and E for each tsd interval you also want PY strips for each individual; having these big dataframes slows saving seerSets, so only fetch if needed.

firstS Character vector of first cancers of interest. Default of "all" sets it to the vector of all cancers in the seerSet field cancerS, which is created when the object is first created by seerSet().
**esd**

**exclunkSurv**  Set true if you wish to exclude all cases with unknown survival times as a marker of bad data.

**Value**

The input with an L component added to it or extended it if it already existed. Each component of L is a nested list of lists that can yield second cancer relative risks as a function of time since 1st cancer diagnosis. The most recent component of L is also provided as a data.frame seerSet$DF produced internally using getDF.

**Note**

This function was developed with support from the Cleveland Clinic Foundation.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

SEERaBomb-package, mk2D, seerSet

**Examples**

```r
## Not run:
library(SEERaBomb)
pm=simSeerSet()
pm=mk2D(pm)
pm$canc
pm=csd(pm,brkst=c(0,5),brksy=c(1973,2000),brksa=c(0,50),trts=c("noRad","rad"))
pm
library(ggplot2)
theme_set(theme_gray(base_size = 16))
theme_update(legend.position = "top")
g=qplot(x=t,y=RR,data=subset(pm$DF,cancer1=="A"&cancer2=="B"),col=trt,geom=c("line","point"),
xlab="Years Since First Cancer Diagnosis",ylab="Relative Risk")
g+facet_grid(yearG~ageG,scales="free")+geom_abline(intercept=1, slope=0)
g+geom_errorbar(aes(ymin=rrL,ymax=rrU,width=.15))

## End(Not run)
```

---

**esd**

*Event vs years Since Diagnosis*

**Description**

Computes relative risks (RR) of second cancers over specified years-since-diagnosis intervals. SEER incidence rates are used to compute background/expected numbers of cases E, sex, age, and calendar year specifically. RR = O/E where O and E are the numbers of observed and expected cases.
Usage

getDF(seerSet, srs=NULL)

Arguments

d
Input data.frame with columns: yrdx, agedx, sex, py at risk (in years), cancer1, and cancer2. Cancer1 and cancer2 should use standard SEERaBomb cancer names, see mapCancs. Cases not ending in a second cancer should have cancer2 set to "none".

srfF
Female incidence surface. Output D of mk2D for females, for cancers in cancer2

srfM
Male incidence surface. Output D of mk2D for males, for cancers in cancer2

brkst
Vector of breaks in years used to form times since diagnosis intervals/bins.

brksy
Vector of breaks of calendar years to show trends. Leave NULL for all in one.

Value

data.frame with observed and expected cases, RR, and RR CI for each time since diagnosis interval.

Note

This function was developed with support from the Cleveland Clinic Foundation.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, mk2D, msd

Description

Creates a data.frame of observed and expected cases for each first and second cancer and treatment. csd() calls this internally for the most recent time series, so it may not need to be called directly.

Usage

getDF(seerSet, srs=NULL)
getDF

Arguments

seerSet seerSet object produced by csd().

srs Series. The time series of interest. NULL (default) implies the currently active series, which is the most recent. A number i implies the ith series. A string identifies the series by name (numeric vectors will be coerced to such a string via paste0("b",paste(brks,collapse="_.")) where brks = vector of time breakpoints.

Value

A data.frame in long format that can be used by ggplot.

Note

I envision getting away from saving multiseries seerSet objects and instead just saving several DF outputs of getDF. Besides smaller objects, a reason for this is that two L objects out of csd can now be confounded if they have the same time since diagnosis series but a different series for age and/or year of diagnosis.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, csd

Examples

### Not run:
library(SEERaBomb)
load("~/data/SEER/mrgd/cancDef.RData") # load in canc
load("~/data/SEER/mrgd/popsae.RData") # load in popsae
canc=canc%>%select(-reg,-recno,-agerec,-numprims,-COD,
-age19,-age86,-radiatn,-ICD9,-db,-histo3)
popsa=popsae%>%group_by(db,race,sex,age,year)%>%summarize(py=sum(py)) # sum on regs
pm=seerSet(canc,popsa,Sex="male",ageStart=0,ageEnd=100) # pooled (races) male seerSet
pm=mk2D(pm,secondS=c("AML","MDS"))
firstS=c("NHL","MM")
pm=csd(pm,brkst=c(0,1,5),trts=c("rad","noRad"),firstS=firstS)
pm$DF
getDF(pm)

### End(Not run)
getFields  

Get fields from SEER SAS file

Description

Converts the SAS file in the SEER ‘incidence’ directory into a data frame in R.

Usage

getFields(seerHome="~/data/SEER")

Arguments

seerHome  
The directory that contains the SEER ‘population’ and ‘incidence’ directories.

Details

SEER provides a SAS file for reading SEER ASCII data files into SAS. This file is parsed by getFields() to generate a data frame in R that contains all of the SEER fields. This data frame describes these fields in terms of their names (short and long forms), their starting points, and their widths.

Value

A data frame with one row for each field and columns that contain corresponding starting positions, widths, sas names, short names, and expansions thereof.

Author(s)

Tom Radivoyevitch (<radivot@ccf.org>)

See Also

SEERabomb-package, mkSEER, pickFields

Examples

```r
## Not run:
library(SEERaBomb)
(df=getFields())
head(df,20)

## End(Not run)
```
incidAbomb

Computes A-bomb incidences

Description

Creates A-bomb survivor incidence rates and confidence intervals.

Usage

incidAbomb(d)

Arguments

d Tibble, typically grouped, with DG column ending 1st block and py starting the last.

Details

The columns DG and py must exist in d, in that order. Person-year weighted means will be formed of any columns between them. Its OK if none exist. Sums are formed on py and anything to their right. It is assumed that cancer types begin after py, with at most upy and/or subjects intervening them.

Value

A tibble data frame, summarized by groups, with cancers after py in a new cancers column, and new columns O (observed cases), incid and incid 95% CI limits LL and UL.

Author(s)

Tom Radivojevitch (radivot@ccf.org)

See Also

SEERaBomb-package

incidSEER

Computes SEER incidences

Description

Creates SEER incidence rates and confidence intervals.

Usage

incidSEER(canc,popsae,cancers)
Arguments

canc        data frame of cancer cases
popsae      data frame of person years at risk
cancers     character vector of cancer types

Details

This left joins popsae and cancers in canc.

Value

A data frame with observed cases (O), incid, and incid 95% CI limits LL and UL.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERabomb-package

---

mapCancs  Map ICD9 and ICD-O3 codes to cancers

Description

Adds a factor cancer with easily recognizable levels to a SEER cancer data.frame.

Usage

mapCancs(D)

Arguments

D     A data frame that includes ICD9 and histo3 as columns.

Value

The input data frame with an additional cancer column added on.

Note

This is used by mkSEER() when it generates R binaries of the SEER data. Otherwise it provides current cancer definitions (seen by looking at the function definition).

Author(s)

Tom Radivoyevitch (radivot@ccf.org)
mapCODs

See Also

SEERaBomb-package, mapRegs

Examples

library(SEERaBomb)
mapCancs # shows default definitions

mapCODs  Map CODs to strings

Description

Maps integer cause of death (COD) codes in COD of a SEER cancer data frame to a factor CODS with recognizable levels. This is a bit slow, so it is called within mkSEER.

Usage

mapCODs(D)

Arguments

D  A data frame that includes COD as a column.

Value

The input data frame with an additional CODS column added on.

Note

Typing mapCODs dumps the function definition and thus the mapping used.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, mapRegs

Examples

library(SEERaBomb)
mapCODs # shows default definitions
mapRegs

Map registry codes to acronyms

Description
Maps codes for SEER registries to 2-letter acronyms and corresponding descriptions.

Usage
mapRegs(code=NA)

Arguments
code Full SEER codes as found in SEER Cancer files. Add 1500 to population file codes get such cancer file codes. If this argument is missing (the default) a full dataframe of symbols and descriptions is returned.

Value
A dataframe of SEER registry symbols and descriptions with rownames such as "1501" for sf (san francisco) and "1520" for dM (detroit Michigan), or just the symbol if the rowname is given. Note that city characters are in lower case and state characters are in upper case.

Note
This function is used by mkSEER when it generates merged R binaries. It is exposed to provide quick access to registry acronym definitions.

Author(s)
Tom Radivoyevitch (radivot@ccf.org)

See Also
SEERaBomb-package, mapCancs

Examples
library(SEERaBomb)
mapRegs(1501)
mapRegs()
mapTrts  Map treatment codes to factor

Description

Uses SEER codes in the SEER field radiatn to add a factor named trt with levels "noRad","rad", and "unk" to a cancer data frame.

Usage

mapTrts(D)

Arguments

D  A SEER cancer data frame that includes the field radiatn as a column.

Value

The input data frame with an additional trt column added to its end.

Note

This function is used by mkSEER when it generates merged R binaries. It is exposed to state the default definition of trt and, by way of example, to show how to override it.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, mapTrts

Examples

library(SEERaBomb)
mapTrts # exposes default definition of trt
**mk2D**

*Make 2D-spline fits of incidences*

**Description**

Produces two dimensional (2D) spline fits of cancer incidence versus age and calendar year, with interactions. In conjunction with person years (PY) at risk, this is used in csd() to produce expected numbers of cases under a null hypothesis that prior cancers do not impact subsequent cancer risks.

**Usage**

```r
mk2D(seeSet, knots=5, write=FALSE, outDir="~/Results", txt=NULL, secondS=NULL)
```

**Arguments**

- **seeSet**: Object of class seerSet, i.e. output list of seerSet().
- **knots**: Base number of knots; overrides are in place for some cancers.
- **write**: TRUE = write 2D fits to files. The fits can be >300 MB and take >60 seconds to write, so leave FALSE unless you need it.
- **outDir**: Folder that will hold the output files.
- **txt**: Additional text to distinguish files with different cancer lists. This may be useful during spline fit development.
- **secondS**: Character vector of second cancers of interest (note: I often capitalize the final S of vectors of Strings).

**Value**

The input seerSet with an additional data frame D added to this list. D holds background/expected incidences over a 1-year resolution age-year grid.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

- SEERaBomb-package, plot2D, seerSet

**Examples**

```r
## Not run:
library(SEERaBomb)
(pm=simSeerSet())
(pm=mk2D(pm))
names(pm)
head(pm$D)
tail(pm$D)
```
### mkAbomb

**Description**

Converts Abomb files `lsshempy.csv` and `lssinc07.csv` into tibbles `heme` and `solid` in the file `abomb.RData`, which also contains descriptions of columns in tibbles `hemeDesc` and `solidDesc`.

**Usage**

```r
mkAbomb(AbompHome="~/data/abomb")
```

**Arguments**

- `AbompHome` Directory with Abomb files. Should be writable by user.

**Details**

This function also creates an SQLite database `abomb.db` with tables `heme`, `solid`, `hemeDesc` and `solidDesc`.

**Value**

None. This function is called for its side-effect of producing the files `abomb.RData` and `abomb.db`.

**Author(s)**

Tom Radivoyevitch (<radivot@ccf.org>)

**See Also**

`SEERaBomb-package`, `mkSEER`

**Examples**

```r
## Not run:
library(SEERaBomb)
mkAbomb()
load("~/data/abomb/abomb.RData")
hemeDesc
heme

## End(Not run)
```
mkDemographics 

Make Demographics Tables

Description

Provides, in an Excel file, quartiles of age at diagnoses in one sheet and median overall survival times on a second. Many tables are placed in each sheet. One Excel file is produced per cancer type.

Usage

mkDemographics(canc, outDir="~/Results/SEERaBomb")

Arguments

canc A dataframe that includes cancer, age at diagnosis (agedx), age (grouped agedx), race, sex, year (grouped), COD, surv, and trt.
outdir Folder of the Excel file(s) that will be generated.

Value

Returned invisibly is a list of data frames corresponding to tables of the Excel file(s).

Author(s)

Tom Radivojевич (radivot@ccf.org)

See Also

SEERaBomb-package

Examples

## Not run:
library(SEERaBomb)
rm(list=ls())
load("~/data/SEER/mrgd/cancDef.RData")
canc$year=cut(canc$yrdx,c(1973,2003,2009,2015),include.lowest = T,dig.lab=4)
canc$age=cut(canc$agedx,c(0,40,50,60,70,80,90,126),include.lowest = T)
canc=canc>%filter(surv<9999)
canc=canc>%select(-age86,-radiatn,-chemo,-db,-casenum,-modx,-seqnum,-yrbrth,-ICD9,-reg,-histo3)
canc=canc>%filter(cancer%in%c("AML","MDS","MPN"))
head(canc,3)
mkDemographics(canc)

## End(Not run)
mkExcelCsd  

Make RR Excel file from csd output

Description

Provides relative risks (RR) organized by 1st and 2nd cancers, times since 1st cancer diagnoses, and 1st cancer treatment. RR = O/E where O = observed cases and E = cases expected under a null hypothesis that prior cancers do not impact subsequent risks. If flip = FALSE (default), sheets = 1st cancers and rows = 2nd cancers, else sheets = 2nd cancers and rows = 1st cancers; columns are always intervals of years since diagnosis, in 1st cancer treatment blocks. RR CI and observed numbers are included in each data cell.

Usage

mkExcelCsd(seerSet, tsdn, biny="[1973,2016]", bina="(0,126]", outDir="/~/Results", outName=NULL, flip=FALSE)

Arguments

seerSet  
A seerSet list after it has been processed by csd().

tsdn  
Name of set of times since diagnosis. This is based on the brkst argument to csd(). If length >1 a brkst vector is assumed and coerced/collapsed to a tsdn string.

biny  
Year at DX interval.

bina  
Age at DX interval.

outDir  
Folder of the Excel file that will be generated.

outName  
if null (default), Excel file name = seerSet base file name (bfn) + tsdn, else it is outName. Eitherway, "Flipped" is appended to the name if flip is TRUE.

flip  
If FALSE, sheets are first cancers, rows seconds. If TRUE, sheets are second cancers, rows firsts.

Value

Returned invisibly, a list of data frames corresponding to sheets of the Excel file.

Note

Outputs are for a given sex. Races are typically pooled.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, mk2D, seerSet
Examples

```r
## Not run:
library(SEERaBomb)
pm=seerSet()
lab=mkt2D(pm)
mybrks=c(0,1,5,10)
lab=csd(pm,brkst=mybrks,trts="noRad","rad")
(l=mkExcelCsd(pm,lab))
(l=mkExcelCsd(pm,lab,flip=TRUE))

## End(Not run)
```

#### mkMrt

*Make mortality binaries*

**Description**

Gets mortality data from the Human Mortality Database and puts it in the file `mrt.Rdata`.

**Usage**

```r
mkMrt(username, passwd, country="USA", mrtHome="~/data/usMort")
```

**Arguments**

- **username**: Username of Human Mortality Database account.
- **passwd**: Password of Human Mortality Database account.
- **country**: This should probably stay at its default of USA.
- **mrtHome**: Directory that will contain the mortality data binary. Should be writable by user.

**Value**

None. This function is called for its side-effect of producing `mrt.Rdata`.

**Author(s)**

Tom Radivoyevitch (<radivot@ccf.org>)

**See Also**

`SEERaBomb-package`, `mkSEER`
Examples

```r
## Not run:
library(SEERabomb)
mkmr("username", "password")# sub in your personal account info
load("~/data/usMort/mrt.RData")
head(mrt$Female)

## End(Not run)
```

---

**mkSEER**

*Make R binaries of SEER data.*

---

**Description**

Converts SEER ASCII text files into large R binaries that include all cancer types and registries combined.

**Usage**

```r
mkSEER(df, seerHome="~/data/SEER", outDir="mrgd", outFile="cancDef",
       indices = list(c("sex","race"), c("histo3","seqnum"), "ICD9"),
       writePops=TRUE, writeRData=TRUE, writeDB=FALSE)
```

**Arguments**

- **df**
  - A data frame that was the output of `pickFields()`. This determines which fields to transfer. Using the output of `getFields()` is a common mistake that must be avoided.

- **seerHome**
  - The directory that contains the SEER ‘population’ and ‘incidence’ directories. This should be writable by the user.

- **outDir**
  - `seerHome` subdirectory to write to. Default is ‘mrgd’ for all registries merged together.

- **outFile**
  - Base name of the SQLite database and cancer binary. Default = `cancDef` (Cancer Default).

- **indices**
  - Passed to `copy_to()` in `dplyr`.

- **writePops**
  - TRUE if you wish to write out the population data frame binaries. Doing so takes ~10 seconds, so savings of FALSE are small.

- **writeRData**
  - TRUE if you wish to write out the cancer data frame binary. Writing files takes most of the time.

- **writeDB**
  - TRUE if you wish to write cancer, popga, popsa, and popsae data frames to SQLite database tables.
Details

This function uses the R package **LaF** to access the fixed-width format data files of SEER. **LaF** is fast, but it requires knowledge of all the widths of columns wanted, as well as the the widths of unwanted stretches in between. This knowledge is produced by `getFields()` and `pickFields()` combined. It is passed to `mkSEER()` via the argument `df`.

Value

None, it produces R binary files of the SEER data.

Note

This takes a substantial amount of RAM (it works on a Mac with 16 GB of RAM) and time (~3 minutes using default fields).

Author(s)

Tom Radivoyevitch (<radivot@ccf.org>)

See Also

`SEERaBomb-package, getFields, pickFields`

Examples

```r
## Not run:
library(SEERaBomb)
(df=getFields())
(df=pickFields(df))
# the following will take a several minutes, but may only need
# to be done roughly once per year, with each release.
mkSEER(df)

## End(Not run)
```

msd  

*Mortality vs years Since Diagnosis*

Description

Computes relative risks (RR) of death over specified years-since-diagnosis intervals. US mortality rates obtained via the R package `demography` are used to compute background death dependence on age and calendar year. RR is then O/E where O and E are the number of observed and expected cases.

Usage

`msd(canc,mrt,brkst=c(0,2,5),brksy=NULL)`
Arguments

canc Input data.frame with columns: yrdx, agedx, sex, surv (in years), and status (1=dead).
mrt List with male and female fields, each matrices with mortality rates vs year and age.
brkst Vector of breaks in years used to form Times since diagnosis intervals/bins.
brksy Vector of breaks of calendar Years to show mortality trends. Leave NULL for all in one.

Value
data.frame with observed and expected cases, RR, and RR CI for each tsd interval.

Note
This function was developed with support from the Cleveland Clinic Foundation.

Author(s)
Tom Radivoyevitch (radivot@ccf.org)

See Also
SEERaBomb-package, mk2D, seerSet

Examples

## Not run:
library(SEERaBomb)
load("~/data/SEER/mrgd/cancDef.RData") # loads in canc
lu=canc%>%filter(cancer="lung")
lu=lu%>%mutate(status=as.numeric(COD>0))%>%select(yrdx,agedx,sex,surv,status)
lu=lu%>%mutate(surv=round((surv+0.5)/12,3))#convert surv to years

# library(demography)
# d=hmd.mx("USA", "username", "password") # make an account and put your info in here
# mrt=d$rate
# save(mrt,file="~/data/usMort/mrt.RData")
load("~/data/usMort/mrt.RData"); object.size(mrt)# 250kb
brks=c(0,0.5,3,6,10,15,20,25)
(dlu=msd(lu,mrt,brkst=brks))

## End(Not run)
**Description**

US mortality rates (probability of death that year) in 2010; report published Nov. 2014.

**Usage**

`nvsr`

**Format**

A data frame with the following columns.

- `age` Single-year resolution ages up to 99.5.
- `p` Pooled sexes and races.
- `pm` Pooled races, males.
- `pf` Pooled races, females.
- `w` Whites, sexes pooled.
- `b` Blacks, sexes pooled.
- `o` Others, sexes pooled.
- `wm` White males.
- `wf` White females.
- `bm` Black males.
- `bf` Black females.
- `om` Other males.
- `of` Other females.

**References**


**Examples**

```r
library(SEERaBomb)
head(nvsr)
```
Description

US mortality rates (probability of death that year) in 2001 (Report 52_14).

Usage

nvsr01

Format

A data frame with the following columns.

- **age**: Single-year resolution ages up to 99.5.
- **p**: Pooled sexes and races.
- **pm**: Pooled races, males.
- **pf**: Pooled races, females.
- **wm**: White males.
- **wf**: White females.
- **bm**: Black males.
- **bf**: Black females.

Details

This data is used to extrapolate PY at risk in SEER population files from 85+ to older ages.

References


Examples

```r
library(SEERaBomb)
head(nvsr01)
```
Description

Using a SEER data frame, this function computes times between primary and secondary cancers. In the resulting data frame, surv and status can be analyzed at the individual level, e.g. using Cox regression.

Usage

p2s(canc,firstS,secondS,yrcut=2010)

Arguments

canc Data frame produced by mkSEER().
firstS Vector of names (as Strings) of first cancers you wish to consider.
secondS Vector of names of second cancers you wish to consider.
yrcut Only cases diagnosed in yrcut or newer are analyzed. The default of 2010 is the year AML cases after MDS began to be entered into SEER as second cancers; before they were considered to be part of the first cancer. This function facilitates studies of the rate at which myeloid neoplasms such as MDS progress to AML.

Value

Data frame with a row for each primary (first cancer) diagnosed on or after yrcut. The surv column holds the time in months to last follow up or death (status=0), or to the time of diagnosis of the second cancer (status=1).

Author(s)

Remco J. Molenaar (r.j.molenaar@amc.uva.nl)

See Also

SEERaBomb-package, mk2D, seerSet

Examples

## Not run:
#

## End(Not run)
pickFields

Description
Reduces the full set of SEER data fields to a smaller set of interest. SEER fields are rows of the input and output dataframes of this function. The output dataframe differs from the input dataframe not only in there being fewer rows but also in there being an additional column needed by mkSEER() downstream.

Usage
pickFields(sas,picks=c("casenum","reg","race","sex","agedx",
"yrbrth","seqnum","modx","yrdx","histo3",
"ICD9","COD","surv","radiatn","chemo"))

Arguments
sas A data frame created by getFields() using the SAS file found in the ‘incidence’ directory of seerHome, the root of the SEER ASCII data installation.
picks Vector of names of variables of interest. This set should not be smaller than the default.

Details
R binaries become too large if all of the fields are selected. SEERaBomb is faster than SEER*Stat because it tailors/streamlines the database to your interests. The default picks are a reasonable place to start; if you determine later that you need more fields, you can always rebuild the binaries. Grabbing all fields is discouraged, but if you want this anyway, note that you still need pickFields() to create a data type column, i.e. you cannot bypass pickFields() by sending the output of getFields() straight to mkSEER().

Value
The SAS-based input data frame sas, shortened to just the rows of picks, and expanded to include spacer rows of fields of no interest pooled into single strings: the width of such a spacer row is equal to the distance in bytes between the fields of interest above and below it. This data frame is then used by laf_open_fwf() of LaF in mkSEER() to read the SEER files. Proper use of this function, and of the SEER data in general, requires an understanding of the contents of ‘seerdic.pdf’ in the ‘incidence’ directory of seerHome.

Author(s)
Tom Radivoyevitch (radivot@ccf.org)

See Also
SEERaBomb-package, getFields, pickFields, mkSEER
Examples

```r
## Not run:
library(SEERaBomb)
(df=getFields())
(df=pickFields(df))

## End(Not run)
```

---

**plot2D**

*Plot 2D cancer incidence splines*

**Description**

Plots splines of incidence versus age and calendar year produced by mk2D.

**Usage**

```r
plot2D(seerSet, write=TRUE,outDir="/Results/plots",col="red")
```

**Arguments**

- `seerSet`: seerSet object after it is processed by mk2D.
- `write`: TRUE if you want to write images to a seerSet subfolder. The name of this subfolder is the basefilename (bfn) of the seerSet.
- `outDir`: Parent folder of seerSet subfolders.
- `col`: Color of surface plot.

**Details**

A plot will be produced for each cancer fitted by mk2D. For the first of these, RGL will open a new X11 window. Adjustments of size and angle of this first plot will hold for all subsequent plots. After each plot, the user hits any key to write the plot to a file and advance through the list of cancers.

**Value**

None, results go to the screen and to png files.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

SEERaBomb-package, mk2D, seerSet
Examples

## Not run:
library(SEERaBomb)
n=simSeerSet()
n=mk2D(n)
plot2D(n)

## End(Not run)

### riskVsAge
Risk vs age after first cancer

Description
Computes absolute risk of 2nd cancers as a function of attained age after first cancer.

Usage

```r
riskVsAge(canc,firstS=c("NHL","HL","MM"),
          secondS=c("AML","MDS"),brksa=c(0,30,50,60,70,80))
```

Arguments
- `canc`: canc made by mkSEER().
- `firstS`: Character vector of first cancers of interest.
- `secondS`: Character vector of second cancers of interest.
- `brksa`: Vector of breaks in years used to form attained age intervals.

Value
data.frame with incidence vs age.

Note
This function was developed with support from the Cleveland Clinic Foundation.

Author(s)
Tom Radivoyevitch (radivot@ccf.org)

See Also
SEERaBomb-package, mkSEER
seerSet

**Join SEER cancers and PY**

**Description**

Creates a sex-specific list of cancer and population person year (PY) data frames, possibly specific to a race and interval of ages at diagnosis.

**Usage**

```r
seerSet(canc,popsa,Sex, Race="pooled",ageStart=15,ageEnd=85)
```

**Arguments**

- `canc` Data frame of cancers that includes agedx, sex, race, yrdx, modx, surv and cancer.
- `popsa` Data frame of population PY at 1-year age resolution.
- `Sex` "male" or "female".
- `Race` "white", "black", "other", or "pooled" (default).
- `ageStart`, `ageEnd` can and popsa will be reduced to ages in ageEnd>age>=ageStart.

**Details**

In the output: 1) 0.5 years is added to ages at diagnosis (agedx) to reverse SEER flooring to integers; 2) 0.5 months is added to survival months (again, to reverse flooring) before dividing by 12 to convert to years; 3) year of diagnosis integers are converted to reals by adding to them the month of diagnosis (modx) - 0.5 divided by 12 (note that a modx of 1 represents anytime in the month of January). If ageEnd>85, popsae (extended to ages up to 99) should be used as the input for popsa. If popsa is used, the age86 column of popsa will be replaced by an age column. The age86 and yrbrth columns of a canc are not used and will be removed if they happen to be present; users should manually remove any other columns not needed to minimize seerSet object sizes. Sex and race columns in inputs are removed from outputs as they are specified in other (scalar) seerSet elements. Also removed from canc are cancer factor levels not present for that sex.

**Value**

A list containing sex specific subsets of canc and popsa and information regarding how they were reduced.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

SEERaBomb-package, mk2D, plot2D
seerStats

Examples

```r
## Not run:
library(SEERaBomb)
simSeerSet() # without data, a simulated seerSet
# else, with data ...
load("~/data/SEER/mrgd/cancDef.RData") # load in canc
go load("~/data/SEER/mrgd/popsae.RData") # load in popsae
# trim columns
library(dplyr)
canc=canc%>%select(-reg,-recno,-agerec,-numprims,-COD,
                 -age19,-age86,-radiatn,-ICD9,-db,-histo3)
popsae=popsae%>%select(-reg,-db)
seerSet(canc,popsae,Sex="male",ageStart=0,ageEnd=100)
```

## End(Not run)

---

seerStats  

**Summarize SEER data.**

Description

Shows numbers of cases per cancer in each SEER database and PY in each registry. Sexes are pooled.

Usage

seerStats(canc,popsa)

Arguments

- **canc**: Data frame of cancers that includes agedx and cancer columns.
- **popsa**: Data frame of population PY at 1-year age resolution.

Value

A list of 2 data.frames with sexes pooled, one of cases with cancer types as rows and as columns, databases, totals, cases >=100 years old or not, and numbers of first-, second-, third- and higher cancers. The second data.frame holds population PY, and PY-weighted ages, per registry.

Author(s)

Tom Radivoyevitch (radivot@ccf.org)

See Also

SEERaBomb-package, mk2D, plot2D
Examples

```r
## Not run:
library(SEERaBomb)
load("~/data/SEER/mrgd/cancDef.RData") # load in canc
load("~/data/SEER/mrgd/popsae.RData") # load in popsae
seerStats(canc, popsae)

## End(Not run)
```

---

**Sigurdson**  
*Chromosome translocation versus age data*

**Description**

This is chromosome translocation versus age data that is pooled across gender and race.

**Usage**

```r
data(Sigurdson)
```

**Format**

A data frame named Sigurdson with the following columns.

- **age**: Age of donor of lymphocytes.
- **tlcn**: Total number of chromosomal translocations per 100 cell equivalents.

**Details**

The data were obtained using FISH, see reference below. This dataset is loaded automatically with `library(SEERaBomb)`. As such, the function `data()` is not needed.

**References**

Sigurdson et al. Mutation Research 652 (2008) 112-121

**Examples**

```r
library(SEERaBomb)
with(Sigurdson, plot(age, tlcn, cex=2, cex.axis=2, cex.lab=2, las=1, cex.main=2,
       ylab="", main="Translocations per 100 cells"))
```
**simSeerSet**

*Simulate SEER cancers and population person years*

**Description**

Simulates data for two cancers, A and B.

**Usage**

```r
simSeerSet(N=2e9,yearEnd=2012,ka=1e-5,kb=0.04,Ab=1e-5,
           tauA=10,tauB=1,delay=1,period=4)
```

**Arguments**

- **N** Number of person years to simulate. Default is roughly that of SEER.
- **yearEnd** Most recent SEER year to simulate.
- **ka** Rate at which cancer A incidence increases linearly with age.
- **kb** Exponential aging rate constant for cancer B incidence.
- **Ab** Exponential amplitude for cancer B incidence.
- **tauA** Survival mean in years for cancer A.
- **tauB** Survival mean in years for cancer B.
- **delay** Years until the beginning of the excess risk of B.
- **period** Duration in Years of the excess risk of B.

**Value**

A simulated seerSet object with popsa filled using US 2000 Std population proportions and canc with cancers A and B where the incidence of A increases linearly with age and B increase exponentially in age. Survival times are assumed to be exponentially distributed with means of tauA years for A and tauB years for B. Radiation therapy of A is assumed to increase RR of B to 5 uniformly for period years after delay years.

**Note**

Supported by the Cleveland Clinic Foundation.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

SEERaBomb-package, seerSet.mk2D, plot2D
Examples

```r
## Not run:
library(SEERaBomb)
mybrks=c(0,0.75,0.9,1.1,1.25,2,2.5,3,3.5,4,4.75,4.9,5,5.25,6)
m=tsd(n,brks=mybrks,brks=c("rad","noRad"))
D=mkDF(n)%>%filter(cancer1=="A")%>%select(t,RR,L=rrL,U=rrU,tt)
head(D,2)
library(ggplot2)
theme_update(legend.position = c(.8, .815),
  axis.text=element_text(size=rel(1.2)),
  axis.title=element_text(size=rel(1.3)),
  legend.title=element_text(size=rel(1.2)),
  legend.text=element_text(size=rel(1.2)))
g=qplot(x=t,y=RR,col=tt,data=D,geom=c("line","point"),
xlab="Years Since First Cancer Diagnosis",ylab="Relative Risk")
g+geom_abline(intercept=1, slope=1)+geom_errorbar(aes(ymin=L,ymax=U,width=.05))
## End(Not run)
```

---

**stdUS**  
*The standard population of the US in 2000*

**Description**

The US population in 2000 for ages up to 100 years. Sexes are pooled.

**Usage**

```r
stdUS
```

**Format**

A data frame with the following columns.

- **age**  
  Sigle-year resolution ages up to 100.

- **pop**  
  The population within each age group.

- **prop**  
  Proportion of the total population within each age group.

**Details**

This population data can be used to map age specific incidence rate vectors into summarizing scalars. It allows cancer incidence rates across different SEER registries to be compared without concerns of differences in age distributions of the populations.

**References**

**summary.seerSet**

**Summary of seerSet object**

**Description**

Creates a data.frame of cases and median ages and survival times for each cancer and treatment type.

**Usage**

```r
## S3 method for class 'seerSet'
summary(object, ...)
```

**Arguments**

- `object`  
  seerSet object produced by seerSet().

- `...`  
  Included to match arg list of generic summary.

**Value**

A list that includes: a data.frame of cases, median ages at diagnosis, and survival times, in years, for each cancer and treatment type; a data.frame of person-years by year; and smaller things such as a title, sex, race, and notes. The resulting list is set to class seerSet.summary which has a print method.

**Author(s)**

Tom Radivoyevitch (radivot@ccf.org)

**See Also**

- SEERaBomb-package
- mk2D
- plot2D

**Examples**

```r
library(SEERaBomb)
with(stdUS, plot(age, pop/1e6, type="l", xlab="Age", ylab="People (Millions)", main="US Population in 2000"))
library(dplyr)
stdUS%>%filter(age>=85)%>%summarize(weighted.mean(age,w=pop))
### so ave age >=85.0 is 89.4
```
Examples

```r
## Not run:
library(SEERaBomb)
load("~/data/SEER/mrgd/cancDef.RData") # load in canc
load("~/data/SEER/mrgd/popsae.RData") # load in popsae

canc=canc%>%select(casenum,race:yrdx,surv,cancer,trt,id)
popsa=popsae%>%group_by(db,race,sex,age,year)%>%summarize(py=sum(py)) # sum on regs
pm=seerSet(canc,popsa,Sex="male",ageStart=0,ageEnd=100) # pooled (races) male seerSet
pm # no print method for seerSet object, so we see the list
(x=summary(pm)) # print renders summary and plot of PY
class(x)<-NULL # if you want to see the list as is, kill its class.
x # It then goes through the regular print method for lists.

## End(Not run)
```
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