# Package ‘LARisk’

**Type** Package  

**Title** Estimation of Lifetime Attributable Risk of Cancer from Radiation Exposure  

**Version** 1.0.0  

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**License** LGPL-3  

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incid2010  Cancer incidence table of Korea 2010

Description

A dataset containing the crude incidence rate of death by age, cancer site and gender.

Usage

incid2010

Format

A data frame with 1919 rows and 4 variables:

Site cancer site
Age age
Rate_m crude incidence rate for male
Rate_f crude incidence rate for female

Source

### incid2018

**Cancer incidence table of Korea 2018**

**Description**

A dataset containing the crude incidence rate of death by age, cancer site and gender.

**Usage**

incid2018

**Format**

A data frame with 1919 rows and 4 variables:
- Site  cancer site
- Age  age
- Rate_m  crude incidence rate for male
- Rate_f  crude incidence rate for female

**Source**

KOSIS(Ministry of Health and Welfare, Cancer Registration Statistics) [https://kosis.kr/](https://kosis.kr/)

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### LAR

**Estimate Lifetime Attributable Risk for one person**

**Description**

LAR is used to estimate lifetime attributable radiation-related cancer risk for data with one person.

**Usage**

```r
LAR(
data, basedata, sim = 300, seed = 99, current = as.numeric(substr(Sys.Date(), 1, 4)), ci = 0.9, weight = NULL, DDREF = TRUE, basepy = 1e+05
)
```
Arguments

data  data frame containing demographic information and exposure information. See 'Details'.
basedata  a list of the data of lifetime table and incidence rate table. The first element is lifetime table and the second is incidence rate table.
sim  number of iteration of simulation.
seed  a random seed number.
current  a current year. default is year of the system time.
ci  confidence level of the confidence interval.
weight  a list containing the value between 0 and 1 which is a weight on ERR model. See 'Details'.
DDREF  logical. Whether to apply the dose and dose-rate effectiveness factor.
basepy  number of base person-years

Details

The maximum age in LAR is set as 100. If the data contains birth which makes attained age (=current - birth) exceed 100, the result has no useful value.

data should include information which includes gender, year of birth, year of exposure, sites where exposed, exposure rate, distribution of dose and dose parameters of exosed radiation. The name of each variables must be sex, birth, exposure, site, exposure_rate, dosedist, dose1, dose2, dose3.

For some variables, there is a fixed format. sex can have the component 'male' or 'female'. site can have the component 'stomach', 'colon', 'liver', 'lung', 'breast', 'ovary', 'uterus', 'prostate', 'bladder', 'brain/cns', 'thyroid', 'remainder', 'oral', 'oesophagus', 'rectum', 'gallbladder', 'pancreas', 'kidney', 'leukemia'. exposure_rate can have the component 'acute' or 'chronic'. dosedist can have the component 'fixedvalue', 'lognormal', 'normal', 'triangular', 'logtriangular', 'uniform', 'loguniform'.

dose1, dose2, dose3 are parameters of dose distribution. The parameters for each distribution are that:

fixedvalue  dose value (dose1)
lognormal  median (dose1), geometric standard deviation (dose2)
normal  mean (dose1), standard deviation (dose2)
triangular or logtriangular  minimum (dose1), mode (dose2), maximum (dose3)
uniform or loguniform  minimum (dose1), maximum (dose2)
weight

Value

LAR returns an object of "LAR" class.
An object of class "LAR" is a list containing the following components:

LAR  Lifetime attributable risk (LAR) from the time of exposure to the end of the expected lifetime.
LAR

F_LAR  Future attributable risk from current to the expected lifetime.
LBR   Lifetime baseline risk.
BFR   Baseline future risk.
LFR   Lifetime fractional risk.
TFR   Total future risk.
current  Current year.
ci     Confidence level.
pinfo Information of the person.

References


See Also

LAR_batch, LAR_group

Examples

```r
## example with lifetime and incidence rate table in 2010 Korea.
organ2 <- split(organ, organ$ID)[[1]]  # data of one person.

## default
lar1 <- LAR(organ2, basedata = list(life2010, incid2010))
summary(lar1)

## change the weight for ERR and EAR models
weight_list <- list("rectum" = 0.5)
lar2 <- LAR(organ2, basedata = list(life2010, incid2010), weight = weight_list)
supply(lar2)

## change the DDREF option (DDREF=FALSE)
lar3 <- LAR(organ2, basedata = list(life2010, incid2010), DDREF = FALSE)
supply(lar3)
```
LAR_batch

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAR_batch is used to estimate lifetime attributable radiation-related cancer risk for data with several people.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAR_batch(</td>
</tr>
<tr>
<td>data,</td>
</tr>
<tr>
<td>pid,</td>
</tr>
<tr>
<td>basedata,</td>
</tr>
<tr>
<td>sim = 300,</td>
</tr>
<tr>
<td>seed = 99,</td>
</tr>
<tr>
<td>current = as.numeric(substr(Sys.Date(), 1, 4)),</td>
</tr>
<tr>
<td>ci = 0.9,</td>
</tr>
<tr>
<td>weight = NULL,</td>
</tr>
<tr>
<td>DDREF = TRUE,</td>
</tr>
<tr>
<td>basepy = 1e+05</td>
</tr>
<tr>
<td>)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arguments</th>
</tr>
</thead>
<tbody>
<tr>
<td>data data frame containing demographic information and exposure information. See 'Details'.</td>
</tr>
<tr>
<td>pid a vector which distinguish each person.</td>
</tr>
<tr>
<td>basedata a list of the data of lifetime table and incidence rate table. The first element is lifetime table and the second is incidence rate table.</td>
</tr>
<tr>
<td>sim number of iteration of simulation.</td>
</tr>
<tr>
<td>seed a random seed number.</td>
</tr>
<tr>
<td>current a current year. default is year of the system time.</td>
</tr>
<tr>
<td>ci confidence level of the confidence interval.</td>
</tr>
<tr>
<td>weight a list containing the value between 0 and 1 which is a weight on ERR model. See 'Details'.</td>
</tr>
<tr>
<td>DDREF logical. Whether to apply the dose and dose-rate effectiveness factor.</td>
</tr>
<tr>
<td>basepy number of base person-years</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAR_batch returns an object of multiple classes &quot;LAR_batch&quot;, &quot;LAR&quot;. An object of class LAR_batch is a list of LAR class objects which names of elements are ID of each person.</td>
</tr>
</tbody>
</table>
References


See Also

LAR, LAR_group

Examples

```r
## example with lifetime and incidence rate table in 2010 Korea.
lar1 <- LAR_batch(nuclear, pid=nuclear$ID, basedata = list(life2010, incid2010))
summary(lar1)
```

---

**LAR_group**

### Average Estimated Lifetime Attributable Risk by Group

**Description**

LAR_group is used to estimate lifetime attributable radiation-related cancer risk by group.

**Usage**

```r
LAR_group(
  data,
  pid,
  group,
  basedata,
  sim = 300,
  seed = 99,
  current = as.numeric(substr(Sys.Date(), 1, 4)),
  ci = 0.9,
  weight = NULL,
  DDREF = TRUE,
  basepy = 1e+05
)
```
**Arguments**

- **data**: data frame containing demographic information and exposure information. See 'Details'.
- **pid**: a vector which distinguish each person.
- **group**: a vector or list of vectors which distinguish each group.
- **basedata**: a list of the data of lifetime table and incidence rate table. The first element is lifetime table and the second is incidence rate table.
- **sim**: number of iteration of simulation.
- **seed**: a random seed number.
- **current**: a current year. default is year of the system time.
- **ci**: confidence level of the confidence interval.
- **weight**: a list containing the value between 0 and 1 which is a weight on ERR model. See 'Details'.
- **DDREF**: logical. Whether to apply the dose and dose-rate effectiveness factor.
- **basepy**: number of base person-years

**Value**

`LAR_group` returns an object of multiple classes "LAR_group", "LAR". An object of class `LAR_group` is a list of `LAR` class objects which names of elements are `group` of each groups.

**References**


**Examples**

```r
## example with lifetime and incidence rate table in 2010 Korea.
lar1 <- LAR_group(nuclear, pid=nuclear$ID, group=nuclear$distance, 
                   basedata = list(life2010, incid2010))
summary(lar1)

lar2 <- LAR_group(nuclear, pid=nuclear$ID, group=list(nuclear$sex, nuclear$distance),
                   basedata = list(life2010, incid2010))
summary(lar2)
```
life2010

*Lifetime table of Korea 2010*

**Description**

A dataset containing the probability of death by age and gender.

**Usage**

`life2010`

**Format**

A data frame with 101 rows and 3 variables:

- **Age** age
- **Prob_d_m** probability of death for male
- **Prob_d_f** probability of death for female

**Source**

KOSIS(Statistics Korea, Life Tables By Province) [https://kosis.kr/](https://kosis.kr/)

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life2018

*Lifetime table of Korea 2018*

**Description**

A dataset containing the probability of death by age and gender.

**Usage**

`life2018`

**Format**

A data frame with 101 rows and 3 variables:

- **Age** age
- **Prob_d_m** probability of death for male
- **Prob_d_f** probability of death for female

**Source**

KOSIS(Statistics Korea, Life Tables By Province) [https://kosis.kr/](https://kosis.kr/)
nuclear

**Description**

nuclear is simulated dataset for acute exposure event. The scenario assumes that the people exposure the radiation at 2011.

**Usage**

nuclear

**Format**

A data frame with 100 observation of 11 variables:

- **ID** person ID.
- **sex** gender
- **birth** birth-year
- **exposure** exposed year to radiation
- **site** organ where exposed to radiation
- **exposure_rate** exposure rate
- **dosedist** distribution of dose
- **dose1** dose parameter
- **dose2** dose parameter
- **dose3** dose parameter
- **distance** distance from the hyper

organ

**Description**

organ is simulated dataset from the data of workers at interventional radiology departments.

**Usage**

organ
Format

A data frame with 971 observations of 11 variables:

- ID: person ID.
- sex: gender
- birth: birth-year
- exposure: exposed year to radiation
- site: organ where exposed to radiation
- exposure_rate: exposure rate
- dosedist: distribution of dose
- dose1: dose parameter
- dose2: dose parameter
- dose3: dose parameter
- occup: occupation

References


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print.LAR

Description

*print.LAR* is the basic function for printing class "LAR".

Usage

```r
## S3 method for class 'LAR'
print(x, digits = 4, ...)  
## S3 method for class 'LAR_batch'
print(x, digits = 4, max.id = 50, ...)  
## S3 method for class 'LAR_group'
print(x, digits = 4, max.id = 50, ...)
```

Arguments

- **x**  'LAR', 'LAR_batch' or 'LAR_group' object.
- **digits**  the number of decimal points to print.
- **...**  further arguments to be passed from or to other methods.
- **max.id**  the number of maximum of printing LAR results.
**summary.LAR**  
*Summarize estimated Lifetime Attributable Risk for one person*

**Description**

summary.LAR is the function for printing class "LAR".

**Usage**

```r
## S3 method for class 'LAR'
summary(object, digits = 4, ...)

## S3 method for class 'LAR_batch'
summary(object, digits = 4, max.id = 50, ...)

## S3 method for class 'LAR_group'
summary(object, digits = 4, max.id = 50, ...)
```

**Arguments**

- `object`: object of class 'LAR_batch' or LAR'.
- `digits`: the number of decimal points to print.
- `...`: further arguments to be passed from or to other methods.
- `max.id`: the number of maximum of printing LAR results.

**write_LAR**  
*Write a LAR object*

**Description**

Write 'LAR' object to CSV file

**Usage**

```r
write_LAR(x, filename)

## S3 method for class 'LAR'
write_LAR(x, filename)

## S3 method for class 'LAR_batch'
write_LAR(x, filename)

## S3 method for class 'LAR_group'
write_LAR(x, filename)
```
**write_LAR**

**Arguments**

- \( x \)  
  a `LAR` object.

- `filename`  
  a string naming the file to save (.csv file)

**Methods (by class)**

- `LAR`: write an `LAR` class object
- `LAR_batch`: write an `LAR_batch` class object
- `LAR_group`: write an `LAR_group` class object
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