

Package ‘mortAAR’

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Type Package

Title Analysis of Archaeological Mortality Data

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Maintainer Nils Mueller-Scheessel <nils.mueller-scheessel@ufg.uni-kiel.de>

Description A collection of functions for the analysis of archaeological mortality data (on the topic see e.g. Chamberlain 2006

<https://books.google.de/books?id=nG5FoO_becAC&lpg=PA27&ots=LG0b_xrx6O&dq=life%20table%20archaeology&

It takes demographic data in different formats and displays the result in a standard life table as well as plots the relevant indices (percentage of deaths, survivorship, probability of death, life expectancy, percentage of population).

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LazyData true

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NeedsCompilation no

Author Nils Mueller-Scheessel [aut, cre, cph],

Martin Hinz [aut],

Clemens Schmid [aut],

Christoph Rinne [aut],

Daniel Knitter [aut],

Wolfgang Hamer [aut],

Dirk Seidensticker [aut],

Franziska Faupel [aut],

Carolin Tietze [aut],

Nicole Grunert [aut]

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aiterhofen_oedmuehlen

aiterhofen_oedmuehlen: Life table example

Description

A life table from *Kokkotidis/Richter 1991, 228*.

Format

A data frame with 13 rows and 11 variables.

- **Alter** (age)
- **a** (added to the original dataset)
- **Dx**
- **Sx**
- **qx**
- **lx**
- **dx**
- **Lx**
- **Tx**
- **ex**
- **rel.Bevx**

For further information about the values see the documentation of `life.table`.

Details

The life table is compiled from the Linear pottery burial site Aiterhofen Ödmühle (Lower Bavaria). More information can be found in *Baum 1990*.

References

Kokkotidis KG, Richter J (1991). "Graeberfeld-Sterbetafeln." *Archaeologische Informationen. Mitteilungen zur Ur- und Fruehgeschichte*, **14**(2), 219–241.

Baum N (1990). "Aiterhofen-Oedmuehle - Palaeodontologie Eines Bandkeramischen Graeberfeldes in Niederbayern." *Praehistorische Zeitschrift*, **65**, 157–203.

See Also

Other lifetables: odagsen_cm, odagsen_mo, schleswig_ma

gallery_graves

gallery_graves: Life table example

Description

A dataset from *Czarnetzki 1966*.

Format

A data frame with 128 rows and 4 variables.

- **indnr**: ID of the individual represented by a skull.
- **sex**: sex determination, w -> female, m -> male.
- **age**: age class.
- **site**: collective grave.

Details

Skulls from four different collective graves. This dataset is not well prepared and needs some adjustment.

References

Czarnetzki A (1966). "Die menschlichen Skelettreste aus vier neolithischen Steinkisten Hessens und Niedersachsens." Dissertation at the University of Tuebingen.

See Also

Other training: magdalenenberg, muensingen

is	<i>Checks if a variable is of class <code>mortaar_life_table</code> or <code>mortaar_life_table_list</code></i>
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Description

Checks class membership.

Usage

```
is.mortaar_life_table_list(x, ...)
```

```
is.mortaar_life_table(x, ...)
```

Arguments

x	a variable.
...	further arguments passed to or from other methods.

Value

true if x is a `mortaar_life_table_list`, otherwise false.

Examples

```
# Create a mortaar_life_table from a prepared dataset.
class(schleswig_ma)
is.mortaar_life_table(schleswig_ma)

schleswig_1 <- life.table(schleswig_ma[c("a", "Dx")])

class(schleswig_1)
is.mortaar_life_table(schleswig_1)

# Create a mortaar_life_table_list from two datasets.
odagsen <- life.table(list(
  "corpus mandibulae" = odagsen_cm[c("a", "Dx")],
  "margo orbitalis" = odagsen_mo[c("a", "Dx")]
))
is.mortaar_life_table_list(odagsen)
```

life.table	<i>Calculates a life table</i>
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Description

life.table calculates life table(s)¹. The algorithm is optimised for deceased populations encountered in archaeological research. See *Chamberlain 2006, 27ff.*, *Herrmann et. al 1990, 303ff.*, *Kokkotidis/Richter 1991*, *Keyfitz et al. 2005* for selected literature.

The function takes an individual data.frame or a list of data.frames and returns an object of class mortaar_life_table or mortaar_life_table_list, for which specialised summary, print and plot functions exist.

Usage

```
life.table(neclist, agecor = TRUE, agecorfac = c(),
           option_spline = NULL)
```

Arguments

neclist	single data.frame or list of data.frames with the columns 'x', 'a', 'Dx'. <ul style="list-style-type: none"> • x: age interval identifier, optional. - Otherwise determined from a. • a: years within x. • Dx: number of deaths within x.
agecor	logical, optional. If set TRUE, the average number of years lived within a given age class of individuals having died in this class can be adjusted via agecorfac. If set FALSE, it is assumed that they died in the middle of this class. Due to the higher mortality rates of infants, this assumption is certainly inaccurate for individuals <= 5 years. Default setup is: TRUE.
agecorfac	numeric vector, optional. Only applies if agecor == TRUE. Given values replace the standard values from the first age interval onward. Default setup is 1/3 for every age class <= 5 life years, and 1/2 for the others.
option_spline	integer, optional. If > 0, values for adults will be interpolated by a monotonic cubic spline. Usual options will be '10' or '20' which will interpolate the values for individuals of an age of 20 or older by 10- or 20- year cumulated values. To be used carefully, as diagnostic features of the life table might be smoothed and essentially removed. Only available when the methods 'Standard' or 'Equal5' in prep.life.table have been chosen.

¹https://en.wikipedia.org/wiki/Life_table

Value

An object of class `mortaar_life_table` or `mortaar_life_table_list`. Each `mortaar_life_table` contains the following variables:

- **x**: age interval.
- **a**: years within x.
- **Ax**: average number of years lived by an individual that died within a specific age class x :

$$A_x = a_x * agecorfac_x$$
- **Dx**: number of deaths within x.
- **dx**: proportion of deaths within x (percent) :

$$d_x = \frac{D_x}{\sum_{i=1}^n D_i} * 100$$
- **lx**: survivorship within x (percent) :

$$l_{x+1} = l_x - d_x \text{ with } l_0 = 100$$
- **qx**: probability of death within x (percent) :

$$q_x = \frac{d_x}{l_x} * 100$$
- **Lx**: number of years lived within x by those that died within x and those that reached the next age class :

$$L_x = (a_x * l_x) - ((a_x - A_x) * d_x)$$
- **Tx**: sum of years lived within current and remaining x :

$$T_{x+1} = T_x - L_x \text{ with } T_0 = \sum_{i=1}^n L_i$$
- **ex**: average years of life remaining (average life expectancy at mean(x)) :

$$e_x = \frac{T_x}{l_x}$$
- **relpopx**: percentage of L(x) of the sum of L(x) :

$$relpopx_x = \frac{L_x}{\sum_{i=1}^n L_i} * 100$$

References

Chamberlain AT (2006). *Demography in archaeology*, Cambridge Manuals in Archaeology. Cambridge University Press. <https://doi.org/10.1017/CBO9780511607165>.

Herrmann B, Grupe G, Hummel S, Piepenbrink H, Schutkowski H (1990). *Praehistorische Anthropologie: Leitfaden der Feld- und Labormethoden*. Springer, Berlin. ISBN 978-3-540-52541-7 978-0-387-52541-9, <http://d-nb.info/900699124>.

Keyfitz N, Caswell H (2005). *Applied Mathematical Demography*. Springer. <http://www.springer.com/gp/book/9780387225371>.

Kokkotidis KG, Richter J (1991). "Graeberfeld-Sterbetafel." *Archaeologische Informationen. Mitteilungen zur Ur- und Fruehgeschichte*, **14**(2), 219–241.

Examples

```
# Create a mortaar_life_table from a prepared dataset.
schleswig_1 <- life.table(schleswig_ma[c("a", "Dx")])
print(schleswig_1)
plot(schleswig_1, display = "lx")
```

```
# Create a mortaar_life_table_list from two datasets.
odagsen <- life.table(list(
  "corpus mandibulae" = odagsen_cm[c("a", "Dx")],
  "margo orbitalis" = odagsen_mo[c("a", "Dx")]
))
print(odagsen)
plot(odagsen, display = "ex")

# Prepare a real world dataset and create a mortaar_life_table.
library(magrittr)
magdalenberg %>%
  replace(. == "60-x", "60-70") %>%
  tidyr::separate(a, c("from", "to")) %>%
  dplyr::mutate(from = as.numeric(from), to = as.numeric(to)) %>%
  prep.life.table(
    dec = "Dx",
    agebeg = "from",
    ageend = "to",
    method = "Standard",
    agerange = "excluded"
  ) %>%
  life.table()
```

magdalenberg

magdalenberg: Life table example

Description

A data set from *zaeuner_wahl_magdalenberg_2013*.

Format

A data frame with 13 rows and 2 variables.

- **a**: age range.
- **Dx**: number of deceased.

Details

Anthropological data from a large burial mound of the Early Iron Age in southwestern Germany. It is already pooled for constructing a life table.

References

Zäuner S, Wahl J (2013). “Zur demographischen Struktur der Bestattungen im späthallstattzeitlichen Grabhügel vom Magdalenberg.” *Fundberichte aus Baden-Württemberg*, **33**, 133–145.

See Also

Other vignette: `muensingen`

Other training: `gallery_graves`, `muensingen`

`mortaar_life_table` **mortaar_life_table** and **mortaar_life_table_list**

Description

The **mortaar_life_table** is the central data structure of the `mortAAR` package. It's a `data.frame` with set of custom methods and variables. Please see `mortAAR::life.table` for a description of the variables. Further available variables are ignored.

If an object is of class `data.frame` or `tibble` (`tbl` & `tbl_df`), it can be converted to an object of class `mortaar_life_table`. The only requirement is that it contains at least the essential columns **a** and **Dx**. The `as` function adds the string "mortaar_life_table" to the classes vector.

The **mortaar_life_table_list** is a list of `mortaar_life_tables`. It can contain the additional attribute `group` that stores a string with the name of the grouping variable relevant for the separation of the different `mortaar_life_tables` in the list. The `group` variable is only relevant for plot and print aesthetics.

Usage

```
as.mortaar_life_table_list(x, ...)

as.mortaar_life_table(x, ...)

## S3 method for class 'mortaar_life_table_list'
x[i]

## S3 replacement method for class 'mortaar_life_table_list'
x[i] <- value

## S3 replacement method for class 'mortaar_life_table_list'
x[[i]] <- value

## S3 replacement method for class 'mortaar_life_table_list'
x$i <- value
```

Arguments

<code>x</code>	an object
<code>...</code>	further arguments passed to or from other methods
<code>i</code>	an index (name or number)
<code>value</code>	an object of class <code>mortaar_life_table</code> or <code>mortaar_life_table_list</code> to replace the indexed value

Examples

```
# a mortaar_life_table can be put together manually:
as.mortaar_life_table(data.frame(a = c(20, 20, 20), Dx = c(10, 15, 20)))

# a mortaar_life_table_list can be constructed from multiple mortaar_life_tables
schleswig <- as.mortaar_life_table_list(
  list(
    "schleswig data 1" = life.table(schleswig_ma[c("a", "Dx")]),
    "schleswig data 2" = life.table(schleswig_ma[c("a", "Dx")])
  )
)

# you can add new mortaar_life_tables to plot them with the others
schleswig$`schleswig data 3` <- life.table(schleswig_ma[c("a", "Dx")])
schleswig[["schleswig data 4"]] <- life.table(schleswig_ma[c("a", "Dx")])

# and you can create arbitrary subsets of mortaar_life_table_lists
schleswig_data_3 <- schleswig$`schleswig data 3`
schleswig_data_1_3_4 <- schleswig[c(1,3,4)]
```

muensingen

muensingen: Life table example

Description

A data set from *moghaddam_et_al_muensingen_2016*.

Format

A data frame with 71 rows and 4 variables.

- **age:** age range of the individual.
- **sex:** sex of the individual.
- **latene_phase:** archaeological phasing.
- **grave_goods:** did the grave contain grave goods?

Details

Anthropological data from one of the largest Latene burial grounds of Central Europe. Besides age and sex of each individual, it comprises the archaeological phasing (A, B or C) and the information if the respective burial contained grave goods (yes or no).

References

Moghaddam N, Müller F, Hafner A, Lösch S (2016). "Social stratigraphy in Late Iron Age Switzerland: stable carbon, nitrogen and sulphur isotope analysis of human remains from Münsingen." *Archaeological and Anthropological Sciences*, **8**, 149–160. <https://link.springer.com/article/10.1007/s12520-014-0221-4>.

See Also

Other vignette: magdalenenberg

Other training: gallery_graves, magdalenenberg

odagsen_cm

odagsen_corpus.mandibulae: Life table example

Description

A life table from *Grupe/Herrmann 1986, 51*.

Format

A data frame with 11 rows and 9 variables.

- **age.group:** inf.I, inf.II -> Infans I, II juv -> juvenil; fa, ma, sa -> früh-, mittel-, spätadult; fm, mm, sm -> früh-, mittel-, spätmatur; s -> senil
- **x**
- **a**
- **Dx**
- **dx**
- **lx**
- **qx**
- **Lx**
- **ex**

In contrast to the general convention **Lx** represents the remaining survivors of each age interval ("Zahl der Lebenden bezogen auf die theoretische Ausgangspopulation zwischen zwei aufeinanderfolgenden Intervallen"). For further information about the values see the documentation of `life.table`.

Details

The life table is compiled from the mandibulae of the late neolithic collective burial # from Odagsen, Einbeck district Northeim (3.250 - 2.950 cal BC). The calculated values show minor adjustments in comparison to the published original data in *Grupe/Herrmann 1986*.

References

Grupe G, Herrmann B (1986). "Die Skelettreste aus dem neolithischen Kollektivgrab von Odagsen, Stadt Einbeck, Ldkr. Northeim." *Nachrichten aus Niedersachsens Urgeschichte*, **55**, 41–91.

Rinne C (2012). "Das Kollektivgrab Odagsen I." *Journal of Neolithic Archaeology*. ISSN 2197-649X, doi: 10.12766/jna.2002.52², <http://www.jna.uni-kiel.de/index.php/jna/article/view/52>.

²<https://doi.org/10.12766/jna.2002.52>

See Also

Other lifetables: aiterhofen_oedmuehlen, odagsen_mo, schleswig_ma

 odagsen_mo

odagsen_margo.orbitalis: Life table example

Description

A life table from *Grube/Herrmann 1986, 51*.

Format

A data frame with 11 rows and 9 variables.

- **age.group:** inf.I, inf.II -> Infans I, II juv -> juvenil; fa, ma, sa -> früh-, mittel-, spätadult; fm, mm, sm -> früh-, mittel-, spätmatur; s -> senil
- **x**
- **a**
- **Dx**
- **dx**
- **lx**
- **qx**
- **Lx**
- **ex**

In contrast to the general convention **Lx** represents the remaining survivors of each age interval ("Zahl der Lebenden bezogen auf die theoretische Ausgangspopulation zwischen zwei aufeinanderfolgenden Intervallen"). For further information about the values see the documentation of `life.table`.

Details

The life table is compiled from the orbital margin of skulls from the late neolithic collective burial from Odagsen, Einbeck district Northeim (3.250 - 2.950 cal BC). More information can be found in *Grube/Herrmann 1986*.

References

Grube G, Herrmann B (1986). "Die Skelettreste aus dem neolithischen Kollektivgrab von Odagsen, Stadt Einbeck, Ldkr. Northeim." *Nachrichten aus Niedersachsens Urgeschichte*, **55**, 41–91.

Rinne C (2012). "Das Kollektivgrab Odagsen I." *Journal of Neolithic Archaeology*. ISSN 2197-649X, doi: 10.12766/jna.2002.52³, <http://www.jna.uni-kiel.de/index.php/jna/article/view/52>.

³<https://doi.org/10.12766/jna.2002.52>

See Also

Other lifetables: `aiterhofen_oedmuehlen`, `odagsen_cm`, `schleswig_ma`

plot

Plot a `mortaar_life_table` or a `mortaar_life_table_list`

Description

Plot a `mortaar_life_table` or a `mortaar_life_table_list`. There are several different kinds of plots to explore the different variables. The parameter `display` allows to select the variables of interest.

Usage

```
## S3 method for class 'mortaar_life_table'
plot(x, display = c("dx", "qx", "lx", "ex",
  "rel_popx"), prefer.ggplot = TRUE, ...)

## S3 method for class 'mortaar_life_table_list'
plot(x, display = c("dx", "qx", "lx",
  "ex", "rel_popx"), prefer.ggplot = TRUE, ...)
```

Arguments

`x` a `mortaar_life_table` or a `mortaar_life_table_list`.

`display` a character vector. Displays the calculated variables as plots. These must include some of the alternatives `dx` for the proportion of deaths, `qx` for the probability of death, `lx` for the survivorship, `ex` for the life expectancy and `rel_popx` for the population age structure.

`prefer.ggplot` should `ggplot` be preferred, if available. Default to `TRUE`.

`...` further arguments passed to or from other methods.

Examples

```
# Create a mortaar_life_table from a prepared dataset.
schleswig_1 <- life.table(schleswig_ma[c("a", "Dx")])
plot(schleswig_1)
plot(schleswig_1, display = "qx")

# Create a mortaar_life_table_list from two datasets.
odagsen <- life.table(list(
  "corpus mandibulae" = odagsen_cm[c("a", "Dx")],
  "margo orbitalis" = odagsen_mo[c("a", "Dx")]
))
plot(odagsen)
plot(odagsen, display = "lx")
```

```
prep.life.table
```

Creates the input for the function life.table.

Description

Prepares the input for `life.table()`. An individual based approach is supported as well as already pooled data (e. g. from an already existing life table). In the latter case, the user has to specify a numerical variable (**dec**) which defines the count for each age class. If no life table exists, this function will process a dataframe including the age ranges of individuals or groups of individuals to discrete the age classes. The age range is spread to single years. **agebeg** has to be specified for the beginning of an age range, as well as **ageend** for the end of an age range. The **method** defines in which way the single years between the different age classes are split. If the data set comprises a grouping variable (e.g., sex), this can be specified with **group**.

Usage

```
prep.life.table(x, dec = NA, agebeg, ageend, group = NA,
               method = "Standard", agerange = "included")
```

Arguments

<code>x</code>	single dataframe containing sex age and quantity of deceased (individuals or group of individuals).
<code>dec</code>	numeric vector or a column name (as character) of the count of deceased.
<code>agebeg</code>	numeric vector or a column name (as character) for the beginning of an age range.
<code>ageend</code>	numeric vector or a column name (as character) for the end of an age range.
<code>group</code>	numeric vector or a column name (as character) of the grouping field (e.g., sex), optional. Default setup is: NA.
<code>method</code>	character string, optional. Default options is <code>Standard</code> , which will create age classes beginning with 1 year, up to 4 years, followed by steps of 5 years (1,4,5,5,...) until the maximum age is reached. <code>Equal5</code> will create age classes with an even distribution, stepped by 5 years (5,5,...) until the maximum age is reached.
<code>agerange</code>	character string, optional. Default setup is: <code>included</code> . If the age ranges from "20 to 40" and "40 to 60", <code>excluded</code> will exclude the year 40 from "20 to 40", to prevent overlapping age classes. <code>included</code> is for age ranges like "20 to 39" where the year 39 is meant to be counted.

Value

A list of input parameter needed for the function `life.table`.

- **x** or **Age**: age interval.
- **a**: years within **x**.
- **Dx**: number of deaths within **x**.

Examples

```

# Separate age ranges in your data set.
df <- dplyr::mutate(
  tidyr::separate(
    replace(
      magdalenenberg,
      magdalenenberg=="60-x", "60-69"
    ),
    a,
    c("from", "to")
  ),
  from = as.numeric(from),
  to = as.numeric(to)
)

# Apply prep.life.table to a data set containing the age ranges.
magda_prep <- prep.life.table(
  df,
  dec = "Dx",
  agebeg = "from",
  ageend = "to",
  method = "Equal5",
  agerange = "included"
)

# Create a life.table.
life.table(magda_prep)

```

print

Encode and print a mortaar_life_table or a mortaar_life_table_list

Description

Format for pretty printing.

Usage

```

## S3 method for class 'mortaar_life_table_list'
format(x, ...)

## S3 method for class 'mortaar_life_table'
format(x, class_of_deceased = NULL, ...)

## S3 method for class 'mortaar_life_table_list'
print(x, ...)

## S3 method for class 'mortaar_life_table'
print(x, ...)

```

Arguments

`x` a `mortaar_life_table` or a `mortaar_life_table_list`.
`...` further arguments passed to or from other methods.
`class_of_deceased` optional string, specify the class of deceased (male, female, phase, ...).

Value

A string representation of the `mortaar_life_table` or the `mortaar_life_table_list`. For `format.mortaar_life_table_list` each `mortaar_life_table` is formatted by itself and strung together. The names of the elements are used to specify the name in the returned header of the printout.

Examples

```
# Create a mortaar_life_table from a prepared dataset.
schleswig_1 <- life.table(schleswig_ma[c("a", "Dx")])
print(schleswig_1)

# Create a mortaar_life_table_list from two datasets.
odagsen <- life.table(list(
  "corpus mandibulae" = odagsen_cm[c("a", "Dx")],
  "margo orbitalis" = odagsen_mo[c("a", "Dx")])
)
print(odagsen)
```

schleswig_ma

schleswig_ma: Life table example

Description

A life table from *Herrmann et. al 1990, 305*.

Format

A data frame with 11 rows and 9 variables.

- **x**: fa, ma, sa -> früh-, mittel-, spätadult; fm, mm, sm -> früh-, mittel-, spät matur; s -> senil
- **a**
- **Dx**
- **dx**
- **lx**
- **qx**
- **Lx**
- **Tx**
- **ex**

For further information about the values see the documentation of `life.table`.

Details

This lifetable is compiled from a medieval grave collection from Schleswig (11th-13th century). More information can be found in *Grupe 1997*.

References

Herrmann B, Grupe G, Hummel S, Piepenbrink H, Schutkowski H (1990). *Praehistorische Anthropologie: Leitfaden der Feld- und Labormethoden*. Springer, Berlin. ISBN 978-3-540-52541-7 978-0-387-52541-9, <http://d-nb.info/900699124>.

Grupe G (1997). "Die anthropologische Bearbeitung der Skelettreste von Schleswig, Ausgrabung Rathausmarkt. Rekonstruktion einer mittelalterlichen Bevoelkerung und ihrer Beziehungen." In *Kirche und Graeberfeld des 11.-13. Jahrhunderts unter dem Rathausmarkt von Schleswig*, volume 12, 147–210. Wachholtz, Neumuenster. <http://zenon.dainst.org/Record/000999080>.

See Also

Other lifetables: aiterhofen_oedmuehlen, odagsen_cm, odagsen_mo