Package ‘zscorer’

October 14, 2022

Type Package
Title Child Anthropometry z-Score Calculator
Version 0.3.1
Description A tool for calculating z-scores and centiles for weight-for-age,
length/height-for-age, weight-for-length/height, BMI-for-age,
head circumference-for-age, age circumference-for-age,
subscapular skinfold-for-age, triceps skinfold-for-age based on the
WHO Child Growth Standards.
Depends R (>= 2.10)
Imports shiny
Suggests testthat, knitr, rmarkdown, shinythemes, covr
License AGPL-3
Encoding UTF-8
LazyData true
RoxygenNote 6.1.1
URL https://github.com/nutriverse/zscorer
BugReports https://github.com/nutriverse/zscorer/issues
VignetteBuilder knitr
NeedsCompilation no
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Repository CRAN
Date/Publication 2019-10-19 06:20:02 UTC

R topics documented:

\addWGSR .................................................. 2
\anthro1 .................................................. 4
addWGSR

Add the WHO Growth Reference z-scores to a data frame of anthropometric data for weight, height or length, MUAC, head circumference, sub-scapular skinfold and triceps skinfold.

Description

Add the WHO Growth Reference z-scores to a data frame of anthropometric data for weight, height or length, MUAC, head circumference, sub-scapular skinfold and triceps skinfold.

Usage

addWGSR(data, sex, firstPart, secondPart, thirdPart = NA, index = NA, standing = NULL, output = paste(index, "z", sep = ""), digits = 2)

Arguments

data

A survey dataset as a data.frame object

sex

Name of variable specifying the sex of the subject. This must be coded as 1 = male and 2 = female. Give a quoted variable name as in (e.g.) "sex".

firstPart

Name of variable specifying:

- Weight (kg) for BMI/A, W/A, W/H, or W/L
- Head circumference (cm) for HC/A
- Height (cm) for BMI/A for H/A
- Length (cm) for L/A
- MUAC (cm) for MUAC/A
- Sub-scapular skinfold (mm) for SSF/A
- Triceps skinfold (mm) for TSF/A

Give a quoted variable name as in (e.g.) "weight". Be careful with units (weight in kg; height, length, head circumference, and MUAC in cm, skinfolds in mm).

secondPart

Name of variable specifying:

- Age (days) for H/A, HC/A, L/A, MUAC/A, SSF/A, or TSF/A
- Height (cm) BMI/A or W/H
• Length (cm) for W/L
Give a quoted variable name as in (e.g.) "age". Be careful with units (age in days; height and length in cm).

thirdPart Name of variable specifying age (in days) for BMI/A. Give a quoted variable name as in (e.g.) "age". Be careful with units (age in days).

index The index to be calculated and added to data. One of:
  bfa  BMI for age
  hca  Head circumference for age
  hfa  Height for age
  lfa  Length for age
  mfa  MUAC for age
  ssa  Sub-scapular skinfold for age
  tsa  Triceps skinfold for age
  wfa  Weight for age
  wfh  Weight for height
  wfl  Weight for length
Give a quoted index name as in (e.g.) "wfh".

standing Variable specifying how stature was measured. If NULL then age (for "hfa" or "lfa") or height rules (for "wfh" or "wfl") will be applied. This must be coded as 1 = Standing; 2 = Supine; 3 = Unknown. All other values will be recoded to 3 = Unknown. Give a quoted variable name as in (e.g.) "measured" or a single value (e.g. "measured = 1"). If no value (or NULL) is specified then height and age rules will be applied.

output The name of the column containing the specified index to be added to the dataset. This is an optional parameter. If you do not specify a value for output then the added column will take the name of the specified index with a "z" appended.

digits The number of decimal places for output. Defaults to 2 d.p.

Value
A data.frame of the survey dataset with the calculated z-scores added.

Examples

# Calculate weight-for-height (wfh) for the anthro3 dataset
addWGSR(data = anthro3,
       sex = "sex",
       firstPart = "weight",
       secondPart = "height",
       index = "wfh")

# Calculate weight-for-age (wfa) for the anthro3 dataset
addWGSR(data = anthro3,
       sex = "sex",
       firstPart = "weight",
       secondPart = "age",
       index = "wfa",
       output = "wfa_z")

# Calculate height-for-age (hfa) for the anthro3 dataset
addWGSR(data = anthro3,
       sex = "sex",
       firstPart = "height",
       secondPart = "age",
       index = "hfa",
       output = "hfa_z")

# Calculate head circumference-for-age (hca) for the anthro3 dataset
addWGSR(data = anthro3,
       sex = "sex",
       firstPart = "head circumference",
       secondPart = "age",
       index = "hca",
       output = "hca_z")
# Calculate height-for-age (hfa) for the anthro3 dataset
addWGSR(data = anthro3,
        sex = "sex",
        firstPart = "height",
        secondPart = "age",
        index = "hfa")

# Calculate MUAC-for-age (mfa) for the anthro4 dataset
## Convert age in anthro4 from months to days
testData <- anthro4
testData$age <- testData$agemons * (365.25 / 12)
addWGSR(data = testData,
        sex = "sex",
        firstPart = "muac",
        secondPart = "age",
        index = "mfa")

---

**anthro1**

*Anthropometric data from a SMART survey in Kabul, Afghanistan.*

**Description**

Anthropometric data from a SMART survey in Kabul, Afghanistan.

**Usage**

anthro1

**Format**

A data frame with 873 observations and 11 variables

- **psu** Primary sampling unit
- **age** Age of child (months)
- **sex** Gender of child
- **weight** Weight of child (kgs)
- **height** Height of child (cm)
- **muac** Mid-upper arm circumference (mm)
- **oedema** Presence or absence of oedema
- **haz** Height-for-age z-score
- **waz** Weight-for-age z-score
- **whz** Weight-for-height z-score
- **flag** Data quality flag
**anthro2**

*Anthropometric data from a single state from a Demographic and Health Survey (DHS) of a West African country.*

**Description**

Anthropometric data from a single state from a Demographic and Health Survey (DHS) of a West African country.

**Usage**

*anthro2*

**Format**

A data frame with 796 observations and 6 variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>psu</td>
<td>Primary sampling unit</td>
</tr>
<tr>
<td>age</td>
<td>Age (months)</td>
</tr>
<tr>
<td>sex</td>
<td>Gender</td>
</tr>
<tr>
<td>wt</td>
<td>Weight (kg)</td>
</tr>
<tr>
<td>ht</td>
<td>Height (cm)</td>
</tr>
<tr>
<td>oedema</td>
<td>Presence or absence of oedema</td>
</tr>
</tbody>
</table>

**anthro3**

*Anthropometric data from a Rapid Assessment Method (RAM) survey from Burundi.*

**Description**

Anthropometric data from a Rapid Assessment Method (RAM) survey from Burundi.

**Usage**

*anthro3*

**Format**

A data frame with 221 observations and 7 variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>psu</td>
<td>Primary sampling unit</td>
</tr>
<tr>
<td>age</td>
<td>Age (months)</td>
</tr>
<tr>
<td>sex</td>
<td>Gender</td>
</tr>
<tr>
<td>weight</td>
<td>Weight (kg)</td>
</tr>
</tbody>
</table>
height  Height (cm)
muac  Mid-upper arm circumference (cm)
oedema  Presence or absence of oedema

---

**anthro4**

*A subset of mid-upper arm circumference data from study conducted to create MUAC-for-age z-scores*

**Description**

A subset of mid-upper arm circumference data from study conducted to create MUAC-for-age z-scores

**Usage**

`anthro4`

**Format**

A data.frame with 257 observations and 4 variables

- **pk_serial** Unique identifier
- **muac** Mid-upper arm circumference in centimetres
- **agemons** Age in months
- **sex** Sex; 1 = Male; 2 = Female

**Source**

Mramba Lazarus, Ngari Moses, Mwangome Martha, Muchai Lilian, Bauni Evasius, Walker A Sarah et al. A growth reference for mid upper arm circumference for age among school age children and adolescents, and validation for mortality: growth curve construction and longitudinal cohort study BMJ 2017; 358 :j3423 [https://doi.org/10.1136/bmj.j3423](https://doi.org/10.1136/bmj.j3423)

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**getAllWGS**

*Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a single child data.*

**Description**

Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a single child data.

**Usage**

`getAllWGS(data = NULL, sex, weight, height, age, index)`
getAllWGS

Arguments

data  Data frame containing corresponding data on sex, weight, height, and age of children. Default is NULL. If specified, parameters for sex, weight, height and age should be provided as character values of the names of variables in data corresponding to the parameters required.

sex  Either numeric values (1 = male; 2 = female) indicating sex of child (default) or character value (if data is specified) indicating variable name in data containing information on sex of child/children (1 = male; 2 = female).

weight  Either numeric values for weight in kg with at least 1 decimal place (default) or character value (if data is specified) indicating variable name in data containing information on weight of child/children.

height  Either numeric values for height in cm with at least 1 decimal place (default) or character value (if data is specified) indicating variable name in data containing information on height of child/children.

age  Either numeric values for age in whole months (default) or character value (if data is specified) indicating variable name in data containing information on age of child/children.

index  One of "wfh", "hfa", "wfa" (specifies the required index) or "all" to calculate all three indices

Value

Either a single numeric value for z-score of the anthropometric index selected if data is for single child or a data frame of numeric values for z-scores of each anthropometric index if data is for multiple children and more than one anthropometric index selected.

The function fails messily when secondPart is outside of the range given in the WGS reference (i.e. 45 to 120 cm for height and 0 to 60 months for age). It is up to you to check the ranges of your data.

The reference data for W/H assumes supine length is used for children with a standing height below 85 cm

Heights should be specified in cm to the nearest mm (i.e. to 1 d.p.)

Ages should be specified in whole months

Weights should be specified in kg to available precision

The function requires reference data wgsData included in this package

Examples

# apply \code{getAllWGS()} to a make believe 52 month old male child with weight of 14.6 kg and height of 98.0 cm
waz <- getAllWGS(sex = 1,  # 1 = Male / 2 = Female
                weight = 14.6,  # Weight in kilograms
                height = 98,  # Height in centimetres
                age = 52,  # Age in whole months
                index = "wfa")  # Anthropometric index (weight-for-age)

waz
getCohortWGS

Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a cohort or sample of children.

description

Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a cohort or sample of children.
getCohortWGS

Usage

getCohortWGS(data, FUN = getWGS, sexObserved, firstPart, secondPart, index)

Arguments

data Data frame containing the variables needed for calculation
FUN Function to apply; default to getWGS()
sexObserved Sex of child (1 = Male; 2 = Female)
firstPart Weight (kg; for WHZ and WAZ) or height (cm; for HAZ)
secondPart Age (months; for HAZ and WAZ) or height (cm; for WHZ)
index One of "wfh", "hfa", "wfa" (specifies the required index)

Value

Numeric vector of z-scores of the anthropometric index selected

The function fails messily when secondPart is outside of the range given in the WGS reference (i.e. 45 to 120 cm for height and 0 to 60 months for age). It is up to you to check the ranges of your data.

The reference data for W/H assumes supine length is used for children with a standing height below 85cm
Heights should be specified in cm to the nearest mm (i.e. to 1 d.p.)
Ages should be specified in whole months
Weights should be specified in kg to available precision
The function requires reference data wgsData included in this package

Examples

# apply getWGS to first child in sample data anthro1
wazAll <- getCohortWGS(data = anthro1,
                        sexObserved = "sex",
                        firstPart = "weight",
                        secondPart = "age",
                        index = "wfa")

wazAll

hazAll <- getCohortWGS(data = anthro1,
                        sexObserved = "sex",
                        firstPart = "height",
                        secondPart = "age",
                        index = "hfa")

hazAll

whzAll <- getCohortWGS(data = anthro1,
                        sexObserved = "sex",
                        firstPart = "weight",
                        secondPart = "height",
**getWGS**

*Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a single child data.*

**Description**

Calculate z-scores for WHZ, HAZ, WAZ using the WHO Growth Reference (2006) for a single child data.

**Usage**

`getWGS(sexObserved, firstPart, secondPart, index)`

**Arguments**

- `sexObserved`: Sex of child (1 = Male; 2 = Female)
- `firstPart`: Weight (in kg for WHZ and WAZ) or height (in cm for HAZ)
- `secondPart`: Age (in months for HAZ and WAZ) or height (in cm for WHZ)
- `index`: One of "wfh", "hfa", "wfa" (specifies the required index)

**Value**

z-score of the anthropometric index selected

**Warning**

The function fails messily when `secondPart` is outside of the range given in the WGS reference (i.e. 45 to 120 cm for height and 0 to 60 months for age). It is up to you to check the ranges of your data.

**Reminders**

The reference data for W/H assumes supine length is used for children with a standing height below 85cm

Heights should be specified in cm to the nearest mm (i.e. to 1 d.p.)

Ages should be specified in whole months

Weights should be specified in kg to available precision

The function requires reference data `wgsData` included in this package
Note
This is a legacy function from the first CRAN release of zscorer which focused mainly on the calculation of z-scores for weight-for-age, weight-for-height and height-for-age. This function has been kept in the package to ensure that existing analysis workflows implemented using the function continue to work.

Examples

```r
# apply \code{getWGS()} to a make believe 52 month old male child with weight of 14.6 kg and height of 98.0 cm
waz <- getWGS(sexObserved = 1, # 1 = Male / 2 = Female
             firstPart = 14.6, # Weight in kilograms
             secondPart = 52, # Age in whole months
             index = "wfa") # Anthropometric index (weight-for-age)
waz

haz <- getWGS(sexObserved = 1,
             firstPart = 98, # Height in centimetres
             secondPart = 52,
             index = "hfa") # Anthropometric index (height-for-age)
haz

whz <- getWGS(sexObserved = 1,
             firstPart = 14.6,
             secondPart = 98,
             index = "wfh") # Anthropometric index (weight-for-height)
whz
```

getWGSR

*Calculate WHO Growth Reference z-score for a given anthropometric measurement.*

Description

This function is usually called by the \code{addWGSR()} function but could be used as a stand-alone calculator for getting z-score for a given anthropometric measurement.

Usage

```r
getWGSR(sex, firstPart, secondPart, index = NA, standing = NA, thirdPart = NA)
```

Arguments

- **sex**: Sex of the subject. This must be coded as 1 = male and 2 = female.
- **firstPart**: Name of variable specifying:
  - Weight (kg) for BMI/A, W/A, W/H, or W/L
• Head circumference (cm) for HC/A
• Height (cm) for BMI/A for H/A
• Length (cm) for L/A
• MUAC (cm) for MUAC/A
• Sub-scapular skinfold (mm) for SSF/A
• Triceps skinfold (mm) for TSF/A

Give a quoted variable name as in (e.g.) "weight". Be careful with units (weight in kg; height, length, head circumference, and MUAC in cm, skinfolds in mm).

secondPart Name of variable specifying:
• Age (days) for H/A, HC/A, L/A, MUAC/A, SSF/A, or TSF/A
• Height (cm) BMI/A or W/H
• Length (cm) for W/L

Give a quoted variable name as in (e.g.) "age". Be careful with units (age in days; height and length in cm).

index The index to be calculated and added to data. One of:
  bfa  BMI for age
  hca  Head circumference for age
  hfa  Height for age
  lfa  Length for age
  mfa  MUAC for age
  ssa  Sub-scapular skinfold for age
  tsa  Triceps skinfold for age
  wfa  Weight for age
  wfh  Weight for height
  wfl  Weight for length

Give a quoted index name as in (e.g.) "wfh".

standing Variable specifying how stature was measured. If NULL then age (for "hfa" or "lfa") or height rules (for "wfh" or "wfl") will be applied. This must be coded as 1 = Standing; 2 = Supine; 3 = Unknown. All other values will be recoded to 3 = Unknown. Give a quoted variable name as in (e.g.) "measured" or a single value (e.g. "measured = 1"). If no value (or NULL) is specified then height and age rules will be applied. zz

thirdPart Name of variable specifying age (in days) for BMI/A. Give a quoted variable name as in (e.g.) "age". Be careful with units (age in days).

Value
A numeric value or vector of z-scores for the specified index.

Examples
# Given a male child 10 months old with a weight of 5.7 kgs, height of 64.2
# cms, and MUAC of 125 mm:
#
# Calculate weight-for-height
getWGSR(sex = 1,
       firstPart = 5.7,
       secondPart = 64.2,
       index = "wfh",
       standing = 3)

# calculate weight-for-age
getWGSR(sex = 1,
       firstPart = 5.7,
       secondPart = 10,
       index = "wfa",
       standing = 3)

# calculate height-for-age
getWGSR(sex = 1,
       firstPart = 64.2,
       secondPart = 10,
       index = "hfa",
       standing = 3)

# Calculate MUAC-for-age z-score for a girl
getWGSR(sex = 1,
       firstPart = 20,
       secondPart = 62 \times (365.25 / 12),
       index = "mfa")

---

**run_zscorer**

*Initialise built-in Shiny application*

**Description**

Initialise built-in Shiny application

**Usage**

run_zscorer()

**Examples**

if(interactive()) run_zscorer()
Description
World Health Organization (WHO) Growth Reference (2006) data

Usage
wgsData

Format
A data frame with 6 columns and 2338 rows.

- **indicator**: One of weight-for-age (waz), height-for-age (haz), or weight-for-height (whz) anthropometric indicators
- **sex**: Sex of child (1 = Male; 2 = Female)
- **given**: Variable to which standardisation is to be made. For waz and haz, given is age in months. For whz, given is height in cm
- **L**: L component of the LMS method for normalising growth centile standards. L is the trend in the optimal power to obtain normality
- **M**: M component of the LMS method for normalising growth centile standards. M is the trend in the mean
- **S**: S component of the LMS method for normalising growth centile standards. S is the trend in the coefficient of variation

Source
Index

* datasets
  anthro1, 4
  anthro2, 5
  anthro3, 5
  anthro4, 6
  wgsData, 14

addWGSR, 2
anthro1, 4
anthro2, 5
anthro3, 5
anthro4, 6

getAllWGS, 6
getCohortWGS, 8
getWGS, 10
getWGSR, 11

run_zscorer, 13

wgsData, 14