Package 'rspiro'

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Type Package

Title Implementation of Spirometry Equations

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Description Implementation of various spirometry equations
in R, currently the GLI-2012 (Global Lung Initiative;
Quanjer et al. 2012 <doi:10.1183/09031936.00080312>) and the
NHANES3 (National Health and Nutrition Examination Survey;
Hankinson et al. 1999 <doi:10.1164/ajrccm.159.1.9712108>)
equations.
Contains user-friendly functions to calculate predicted
and LLN (Lower Limit of Normal) values for different
spirometric parameters such as FEV1 (Forced Expiratory
Volume in 1 second), FVC (Forced Vital Capacity), etc,
and to convert absolute spirometry measurements
to percent (%) predicted and z-scores.

License GPL (>= 2)

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`rspiro-package` *rspiro: Brief overview of the package*

Description

R package **rspiro** implements multiple spirometry equations: currently the GLI-2012 (Quanjer) and NHANES III (Hankinson), with potentially more to be added later. It offers a convenient interface to calculate predicted or LLN (Lower Limit of Normal) values given demographic data, or to convert absolute spirometry values to percent (predicted or z-scores.

Details

To ensure a consistent interface, package functions are named with a prefix indicating the functionality and a suffix indicating the spirometric equations used, for example `LLN_GLI` calculates Lower Limits of Normal using the GLI-2012 equations. The suffix is currently one of 'GLI' or 'NHANES3'. The prefix is one of 'LLN_', 'pred_', 'pctpred_' or 'zscore_'.

Functions prefixed 'LLN_' or 'pred_' accept as input demographic information (age, gender, height, ethnicity) and calculate the Lower Limit of Normal and the predicted value, respectively, for a given spirometry parameter (FEV1, FVC, etc). Functions prefixed 'pctpred_' or 'zscore_' accept absolute spirometry values (plus demographics) and convert those to percent (z-scores, respectively. Please note the difference between 'pred_' and 'pctpred_' above.

For detailed information, refer to the respective function documentations.

The development version of **rspiro** is available on GitHub `https://github.com/thlytras/rspiro`. To report problems and bugs, or to request a feature, please go there and open an issue. Alternatively, send an email to Theodore Lytras `<thlytras@gmail.com>`.

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LLN_GLI *Calculate LLN of spirometry parameters using GLI-2012 equations*

Description

This function calculates LLNs (Lower Limits of Normal) for the various spirometry parameters, using the GLI-2012 equations. It accepts as input age, height, gender and ethnicity.

Usage

```
LLN_GLI(age, height, gender = 1, ethnicity = 1, param = "FEV1")
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = NE Asian, 4 = SE Asian, 5 = Other/mixed). Default is 1.
param	A character vector, containing one of more of the following parameters (case insensitive): "FEV1", "FVC", "FEV1FVC", "FEF2575", "FEF75", "FEV075", "FEV075FVC"

Details

Arguments age, height, gender and ethnicity are vectors of equal length, or of length one, in which case the value is recycled; if the four vectors are not of equal length, the function stops with an error.

Value

If param has length one, the function returns a numeric vector. If param has length >1, it returns a data.frame with length(param) columns.

Examples

```
# Find LLN of FEV1 and FVC for Caucasian women aged 20 to 70 and with a height of 1.70 meters.
LLN_GLI(20:70, 1.7, 2, param=c("FEV1","FVC"))
```

LLN_NHANES3 *Calculate predicted values of spirometry parameters using NHANES III equations*

Description

This function calculates LLNs (Lower Limits of Normal) for the various spirometry parameters, using the NHANES III equations. It accepts as input age, height, gender and ethnicity.

Usage

```
LLN_NHANES3(age, height, gender = 1, ethnicity = 1, param = "FEV1")
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = Mexican-American). Default is 1.
param	A character vector, containing one of more of the following parameters (case insensitive): "FEV1", "FVC", "FEV1FVC", "PEF", "FEF2575", "FEV6", "FEV1FEV6"

Details

Arguments age, height, gender and ethnicity are vectors of equal length, or of length one, in which case the value is recycled; if the four vectors are not of equal length, the function stops with an error.

Value

If param has length one, the function returns a numeric vector. If param has length >1, it returns a data.frame with length(param) columns.

Examples

```
# Find LLN of FEV1 and FVC for Caucasian women aged 20 to 70 and with a height of 1.70 meters.
LLN_NHANES3(20:70, 1.7, 2, param=c("FEV1","FVC"))
```

pctpred_GLI *Convert spirometric values to % predicted using GLI-2012 equations*

Description

This function takes absolute spirometry measurements (FEV1, FVC, etc) in lt plus demographic data (age, height, gender and ethnicity) and converts them to percent (%) predicted based on the GLI-2012 equations.

Usage

```
pctpred_GLI(
  age,
  height,
  gender = 1,
  ethnicity = 1,
  FEV1 = NULL,
  FVC = NULL,
  FEV1FVC = NULL,
  FEF2575 = NULL,
  FEF75 = NULL,
  FEV075 = NULL,
  FEV075FVC = NULL
)
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = NE Asian, 4 = SE Asian, 5 = Other/mixed). Default is 1.
FEV1	Forced Expiratory Volume in 1 second (lt)
FVC	Forced Vital Capacity (lt)
FEV1FVC	FEV1 / FVC ratio
FEF2575	Forced Expiratory Flow between 25% and 75% of FVC (lt/s)
FEF75	Forced Expiratory Flow at 75% of FVC (lt/s)
FEV075	Forced Expiratory Volume in 0.75 sec (lt)
FEV075FVC	FEV0.75 / FVC ratio

Details

At least one of the spirometric measurement arguments must be set (i.e. be non-NULL). Arguments age, height, gender and ethnicity must be vectors of length equal to the length of the spirometric measurement vector(s), or of length one, in which case their value is recycled. If any input vector is not of equal length, the function stops with an error.

Value

If only one spirometry argument is supplied, the function returns a numeric vector. If more are supplied, the function returns a data.frame with the same number of columns.

Examples

```
# Random data, 4 patients, one parameter supplied (FEV1)
pctpred_GLI(age=seq(25,40,5), height=c(1.8, 1.9, 1.75, 1.85),
      gender=c(2,1,2,1), FEV1=c(3.5, 4, 3.6, 3.9))
```

---

pctpred_NHANES3 *Convert spirometric values to % predicted using NHANES III equations*

Description

This function takes absolute spirometry measurements (FEV1, FVC, etc) in lt plus demographic data (age, height, gender and ethnicity) and converts them to percent (%) predicted based on the NHANES III equations.

Usage

```
pctpred_NHANES3(
  age,
  height,
  gender = 1,
  ethnicity = 1,
  FEV1 = NULL,
  FVC = NULL,
  FEV1FVC = NULL,
  PEF = NULL,
  FEF2575 = NULL,
  FEV6 = NULL,
  FEV1FEV6 = NULL
)
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = Mexican-American). Default is 1.
FEV1	Forced Expiratory Volume in 1 second (lt)
FVC	Forced Vital Capacity (lt)
FEV1FVC	FEV1 / FVC ratio
PEF	Peak Expiratory Flow (lt)
FEF2575	Forced Expiratory Flow between 25% and 75% of FVC (lt/s)
FEV6	Forced Expiratory Volume in 6 seconds (lt)
FEV1FEV6	FEV1 / FEV6 ratio

Details

At least one of the spirometric measurement arguments must be set (i.e. be non-NULL). Arguments age, height, gender and ethnicity must be vectors of length equal to the length of the spirometric measurement vector(s), or of length one, in which case their value is recycled. If any input vector is not of equal length, the function stops with an error.

Value

If only one spirometry argument is supplied, the function returns a numeric vector. If more are supplied, the function returns a data.frame with the same number of columns.

Examples

```
# Random data, 4 patients, one parameter supplied (FEV1)
pctpred_NHANES3(age=seq(25,40,5), height=c(1.8, 1.9, 1.75, 1.85),
      gender=c(2,1,2,1), FEV1=c(3.5, 4, 3.6, 3.9))
```

---

pred_GLI *Calculate predicted values of spirometry parameters using GLI-2012 equations*

Description

This function calculates the mean normal (predicted) values for the various spirometry parameters, using the GLI-2012 equations. It accepts as input age, height, gender and ethnicity.

Usage

```
pred_GLI(age, height, gender = 1, ethnicity = 1, param = "FEV1")
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = NE Asian, 4 = SE Asian, 5 = Other/mixed). Default is 1.
param	A character vector, containing one of more of the following parameters (case insensitive): "FEV1", "FVC", "FEV1FVC", "FEF2575", "FEF75", "FEV075", "FEV075FVC"

Details

Arguments age, height, gender and ethnicity are vectors of equal length, or of length one, in which case the value is recycled; if the four vectors are not of equal length, the function stops with an error.

Value

If param has length one, the function returns a numeric vector. If param has length >1, it returns a data.frame with length(param) columns.

Examples

```
# Find LLN of FEV1 and FVC for Caucasian women aged 20 to 70 and with a height of 1.70 meters.
LLN_GLI(20:70, 1.7, 2, param=c("FEV1","FVC"))
```

---

pred_NHANES3 *Calculate predicted values of spirometry parameters using NHANES III equations*

Description

This function calculates the mean normal (predicted) values for the various spirometry parameters, using the NHANES III equations. It accepts as input age, height, gender and ethnicity.

Usage

```
pred_NHANES3(age, height, gender = 1, ethnicity = 1, param = "FEV1")
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = Mexican-American). Default is 1.
param	A character vector, containing one of more of the following parameters (case insensitive): "FEV1", "FVC", "FEV1FVC", "PEF", "FEF2575", "FEV6", "FEV1FEV6"

Details

Arguments age, height, gender and ethnicity are vectors of equal length, or of length one, in which case the value is recycled; if the four vectors are not of equal length, the function stops with an error.

Value

If param has length one, the function returns a numeric vector. If param has length >1, it returns a data.frame with length(param) columns.

Examples

```
# Find predicted FEV1 and FVC for Caucasian women aged 20 to 70 and with a height of 1.70 meters.
pred_NHANES3(20:70, 1.7, 2, param=c("FEV1","FVC"))
```

---

zscore_GLI *Convert spirometric values to z-scores using GLI-2012 equations*

Description

This function takes absolute spirometry measurements (FEV1, FVC, etc) in lt plus demographic data (age, height, gender and ethnicity) and converts them to z-scores based on the GLI-2012 equations.

Usage

```
zscore_GLI(
  age,
  height,
  gender = 1,
  ethnicity = 1,
  FEV1 = NULL,
  FVC = NULL,
  FEV1FVC = NULL,
```

```
  FEF2575 = NULL,
  FEF75 = NULL,
  FEV075 = NULL,
  FEV075FVC = NULL
)
```

Arguments

age	Age in years
height	Height in meters
gender	Gender (1 = male, 2 = female) or a factor with two levels (first = male). Default is 1.
ethnicity	Ethnicity (1 = Caucasian, 2 = African-American, 3 = NE Asian, 4 = SE Asian, 5 = Other/mixed). Default is 1.
FEV1	Forced Expiratory Volume in 1 second (lt)
FVC	Forced Vital Capacity (lt)
FEV1FVC	FEV1 / FVC * 100%
FEF2575	Forced Expiratory Flow between 25% and 75% of FVC (lt/s)
FEF75	Forced Expiratory Flow at 75% of FVC (lt/s)
FEV075	Forced Expiratory Volume in 0.75 sec (lt)
FEV075FVC	FEV0.75 / FVC * 100%

Details

At least one of the spirometric measurement arguments must be set (i.e. be non-NULL). Arguments age, height, gender and ethnicity must be vectors of length equal to the length of the spirometric measurement vector(s), or of length one, in which case their value is recycled. If any input vector is not of equal length, the function stops with an error.

Value

If only one spirometry argument is supplied, the function returns a numeric vector. If more are supplied, the function returns a data.frame with the same number of columns.

Examples

```
# Random data, 4 patients, one parameter supplied (FEV1)
zscore_GLI(age=seq(25,40,5), height=c(1.8, 1.9, 1.75, 1.85),
      gender=c(2,1,2,1), FEV1=c(3.5, 4, 3.6, 3.9))
```

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