Package ‘pedbp’

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Title  Pediatric Blood Pressure
Version  1.0.0
Description  Data and utilities for estimating pediatric blood pressure percentiles by sex, age, and optionally height (stature).

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Data Sets Informing Blood Pressure Percentile Estimates

**Description**

A collection of data sets from multiple sources used to inform blood pressure percentiles for pediatrics patients by sex, age, and height (if known).

**Usage**

- lo2013
- gemelli1990
- nhlbi_bp_norms
- bp_parameters

**Format**

- An object of class `data.frame` with 30 rows and 6 columns.
- An object of class `data.frame` with 8 rows and 6 columns.
- An object of class `data.frame` with 952 rows and 6 columns.
- An object of class `data.frame` with 276 rows and 8 columns.

**Details**

Data sets are named to reflect the source.

For all the data sets provided units are uniform:

- **age**: Patient age; months
- **height**: length/height/stature; cm
- **weight**: kilograms
- **male**: integer value; 1 = male, 0 = female
- **sbp**: systolic blood pressure; mmHg
- **dbp**: diastolic blood pressure; mmHg
Columns with a name such as sbp is a point observations. Summary statistics are appended to the variable as needed, e.g., sbp_mean and sbp_sd for the reported mean and standard deviation of systolic blood pressure.

CDC ages represent whole month but reported at the half month. That is, age = 12.5 is short-hand for 12 <= age < 13. The exception is birth; age = 0 is birth and not a range.

bp_parameters has the estimated mean and standard deviations for estimating percentiles using a Gaussian distribution for a given sex, age (in months), and height (if known/applicable).

References


See Also

vignette("bp-distributions", package = "pedbp")

bp_cdf

Plot the CDF for Blood Pressure

Description

Plot the CDF for blood pressure given age, sex, and height.

Usage

bp_cdf(
  age,
  male,
  height = NA,
  height_percentile = 0.5,
  sbp = NA,
  dbp = NA,
  ...)

---

`bp_cdf`
bp_distribution

Arguments

- **age**: numeric age, in months
- **male**: integer value, 1 = male, 0 = female, indicating sex of the patient
- **height**: numeric, in centimeters, can be missing. This is the length for patients under three years of age
- **height_percentile**: default height percentile to use if height is missing.
- **sbp, dbp**: observed values to plot on the CDF
- **...**: not currently used

Value

A ggplot2 graphic showing the CDF for diastolic and systolic blood pressures with vertical and horizontal lines highlighting the percentile for the given inputs.

Examples

```r
bp_cdf(age = 96, male = 1, sbp = 103, dbp = 55)
```

---

bp_distribution  

*Estimate Pediatric Blood Pressure Distribution*

**Description**

Percentile and quantile functions for pediatric blood pressure.

**Usage**

```r
p_bp(q_sbp, q_dbp, age, male, height = NA, height_percentile = 0.5, ...)
q_bp(p_sbp, p_dbp, age, male, height = NA, height_percentile = 0.5, ...)
```

**Arguments**

- **q_sbp**: a vector of systolic blood pressures
- **q_dbp**: a vector of diastolic blood pressures
- **age**: numeric age, in months
- **male**: integer value, 1 = male, 0 = female
- **height**: numeric, in centimeters, can be missing.
- **height_percentile**: default height percentile to use if height is missing.
- **...**: not currently used
- **p_sbp**: a vector of systolic blood percentiles
- **p_dbp**: a vector of diastolic blood percentiles
Value

A pedbp_bp object. This is a list of two numeric vectors: sbp_percentile (systolic blood pressure) and dbp_percentile (diastolic blood pressure). Additionally, the bp_params attribute provides details on the data source and parameters used in the percentile estimates.

See Also

vignette("bp-distribution", package = "pedbp")

Examples

```r
x <- p_bp( q_sbp = 100, q_dbp = 60, age = 8, male = 0)
x
str(x)

x <- p_bp(q_sbp = c(NA, 82), q_dbp = c(60, 72), age = 9.2, male = 0)
x
str(x)

x <- p_bp(q_sbp = c(NA, 82), q_dbp = c(60, 72), age = 29.2, male = 0, height = 82.8)
x
str(x)

x <- q_bp(p_sbp = 0.78, p_dbp = 0.65, age = 8, male = 0)
x
str(x)
```

# Working with multiple patients records
```
d <- read.csv(system.file("example_data", "for_batch.csv", package = "pedbp"))
d

bp_percentiles <-
p_bp(  
  q_sbp = d$sbp..mmHg.
  , q_dbp = d$dbp..mmHg.
  , age = d$age_months
  , male = d$male
)
bp_percentiles

q_bp(
  p_sbp = bp_percentiles$sbp_percentile
  , p_dbp = bp_percentiles$dbp_percentile
  , age = d$age_months
  , male = d$male
)```
**est_norm**  
*Estimate Normal Distribution Given Set of Quantile Values*

**Description**

With at least two quantile values find the mean and standard deviation of a normal distribution to match up with empirical values provided.

**Usage**

```r
est_norm(q, p, weights = rep(1, length(p)), ...)
```

**Arguments**

- `q` quantile values.
- `p` probabilities corresponding to the `q` quantiles.
- `weights` relative weight of each quantile. The higher the weight the better the approximated distribution will be at fitting that quantile.
- `...` passed to `optim`.

**Details**

For $X \sim N(\mu, \sigma)$, $\Pr[X \leq q] = p$

Given the set of quantiles and probabilities, `est_norm` uses `optim` to find the preferable mean and standard deviation of a normal distribution to fit the provided quantiles.

Use the `weights` argument to emphasize which, if any, of the provided quantiles needs to be approximated closer than others. By default all the quantiles are weighted equally.

**Value**

A `pedbp_est_norm` object. This is a list with elements:

- `para` named numeric vector with the mean and standard deviation for a Gaussian distribution
- `qpa` numeric matrix with two columns built from the input values of `q` and `p`
- `weights` the weights used
- `call` the call made
- `optim` the result from calling `optim`

**Examples**

```r
# Example 1
q <- c(-1.92, 0.1, 1.89) * 1.8 + 3.14
p <- c(0.025, 0.50, 0.975)

x <- est_norm(q, p)
```
pediatric_vital_sign_distributions

str(x)
x

plot(x)

# Example 2 -- build with quantiles that are easy to see unlikely to be from
# a Normal distribution
q <- c(-1.92, 0.05, 0.1, 1.89) * 1.8 + 3.14
p <- c(0.025, 0.40, 0.50, 0.975)

# with equal weights
x <- est_norm(q, p)
x
plot(x)

# weight to ignore one of the middle value and make sure to hit the other
x <- est_norm(q, p, weights = c(1, 2, 0, 1))
x
plot(x)

# equal weight the middle, more than the tails
x <- est_norm(q, p, weights = c(1, 2, 2, 1))
x
plot(x)

pediatric_vital_sign_distributions

Pediatric Vital Sign Distributions

Description

Based on the data provided by the CDC, provide the distribution function, quantile function, and a
z-score function for one of eight vital signs by another vital sign, e.g., weight for age. Values are
based on an LMS approach.

Usage

p_bmi_for_age(q, age, male)
q_bmi_for_age(p, age, male)
z_bmi_for_age(q, age, male)
p_head_circ_for_age(q, age, male)
q_head_circ_for_age(p, age, male)
z_head_circ_for_age(q, age, male)
p_length_for_age_inf(q, age, male)
q_length_for_age_inf(p, age, male)
z_length_for_age_inf(q, age, male)
p_stature_for_age(q, age, male)
q_stature_for_age(p, age, male)
z_stature_for_age(q, age, male)
p_weight_for_age_inf(q, age, male)
q_weight_for_age_inf(p, age, male)
z_weight_for_age_inf(q, age, male)
p_weight_for_age(q, age, male)
q_weight_for_age(p, age, male)
z_weight_for_age(q, age, male)
p_weight_for_length_inf(q, length, male)
q_weight_for_length_inf(p, length, male)
z_weight_for_length_inf(q, length, male)
p_weight_for_stature(q, height, male)
q_weight_for_stature(p, height, male)
z_weight_for_stature(q, height, male)

Arguments

q  a vector of quantities
age numeric age, in months
male integer value, 1 = male, 0 = female
p  a vector of probabilities
length length, in cm, of the patient (age under 3 years)
height height, in cm, of the patient (age 2 - 20 years)
Value

The `p_` method return values from the estimated distribution function. `q_` methods return values from the estimated quantile function. `z_` methods return standard scores, equivalent to `qnorm`.

References

https://www.cdc.gov/growthcharts/percentile_data_files.htm

Examples

```r
# BMI for Age

# A BMI of 18.2 for a 18.1 year old female is in the 1st percentile.
p_bmi_for_age(q = 18.2, age = 18.1 * 12, male = 0)
# The z-score is the same as qnorm(p)
qnorm(p = p_bmi_for_age(q = 18.2, age = 18.1 * 12, male = 0))

# The 70th percentile of BMI for 15.4 year old males is
q_bmi_for_age(p = 0.70, age = 15.4 * 12, male = 1)

# Stature/Lenght/Height for Age

# length_for_age_inf is for Infants are from 0 to 3 years (36 months)
# stature_for_age is for pediatrics from 2 years (24 months) to 20 years
# (240 months)
# The overlap between these functions will produce slightly different values
# the kids between 24 and 36 months of age.
p_length_for_age_inf(q = 87, age = 28, male = 0)
p_stature_for_age(q = 87, age = 28, male = 0)
p_length_for_age_inf(q = 87, age = 28, male = 0)

# Multiple patients, the age and male, length, height arguments can also be
# vectors
p_length_for_age_inf(q = c(87, 90), age = c(28, 30), male = c(0, 1))
```
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