Package 'kidney.epi'

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Title Kidney-Related Functions for Clinical and Epidemiological Research

Version 1.3.0

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Description Contains kidney care oriented functions.
Current version contains functions for calculation of:
- Estimated glomerular filtration rate by CKD-EPI (2021 and 2009), MDRD, CKiD, FAS, EKFC, etc.
- Kidney Donor Risk Index and Kidney Donor Profile Index for kidney transplant donors.
- Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, <https://Scientific-Tools.Org>. <doi:10.32614/CRAN.package.kidney.epi>.

Depends R (>= 3.4.0)

License LGPL (>= 2)

URL https://Scientific-Tools.Org/,
https://www.linkedin.com/in/boris-bikbov/,
https://kidney.Scientific-Tools.Org/r/

Encoding UTF-8

LazyData true

RoxygenNote 7.3.2

Imports readxl, openxlsx, purrr

Suggests knitr, rmarkdown

VignetteBuilder knitr

NeedsCompilation no

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Repository CRAN

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Contents

`ckd.data` *A synthetic dataset contains variables for eGFR calculation.*

Description

A synthetic dataset contains variables for eGFR calculation for 1000 adults and 1000 children.

Usage

```
ckd.data
```

Format

A data frame with 2000 rows (1000 adults and 1000 children/young adults) and 12 variables:

cr Serum creatinine, micromol/L

cys Serum cystatin C, mg/L

age Age, years

sex Sex

ethnicity Ethnicity

height Height, cm

category Indication on whether the generated data refer to adults or children

Details

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Source

Synthetic dataset was generated based on two publications:

- adults: Lamb EJ, Barratt J, Brettell EA et al. Accuracy of glomerular filtration rate estimation using creatinine and cystatin C for identifying and monitoring moderate chronic kidney disease: the eGFR-C study. Health Technol Assess 2024;28(35), doi:10.3310/HYHN1078.
- children/young adults: Pierce CB, Muñoz A, Ng DK et al. Age- and sex-dependent clinical equations to estimate glomerular filtration rates in children and young adults with chronic kidney disease. Kidney International. 2021;99(4):948–956, doi:10.1016/j.kint.2020.10.047.

`egfr.ckdepi.cr` *Alias to the latest eGFR CKD-EPI creatinine-based equation*

Description

Alias to the latest eGFR CKD-EPI creatinine-based equation

Usage

```
egfr.ckdepi.cr(...)
```

Arguments

...	all arguments for the egfr.ckdepi.cr.2021 function.

Details

The function is just an alias to the latest eGFR CKD-EPI creatinine-based equation.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

`egfr.ckdepi.cr.2009` *Calculate eGFR based on CKD-EPI 2009 creatinine-based equation*

Description

Calculate eGFR based on CKD-EPI 2009 creatinine-based equation

Usage

```
egfr.ckdepi.cr.2009(
  creatinine,
  age,
  sex,
  ethnicity = NA,
  creatinine_units = "micromol/l",
  label_afroamerican = c("Afroamerican"),
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

`creatinine`	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
`age`	Numeric vector. Age, in years.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
`ethnicity`	Vector. Ethnicity. If no ethnicity will be defined, the calculation will use coefficients for White subjects. Specify ethnicity if a study includes African-American subjects, and define the the values of variable in the parameter label_afroamerican.
`creatinine_units`	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
`label_afroamerican`	List. Label(s) for Afroamerican ethnicity.
`label_sex_male`	List. Label(s) for definition(s) of male sex.
`label_sex_female`	List. Label(s) for definition(s) of female sex.
`max_age`	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by CKD-EPI 2009 creatinine-based equation.

Reference to the equation: Levey AS, Stevens LA, Schmid CH et al. A New Equation to Estimate Glomerular Filtration Rate. Ann Intern Med 2009;150:604–12.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ckdepi.cr.2009 (creatinine = 1.4, age = 60, sex = "Male", ethnicity = "White",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.ckdepi.cr.2009 (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#   ethnicity = dta$race, creatinine_units = "mg/dl")
```

---

egfr.ckdepi.cr.2021 *Calculate eGFR by the CKD-EPI 2021 creatinine-based equation*

Description

Calculate eGFR by the CKD-EPI 2021 creatinine-based equation

Usage

```
egfr.ckdepi.cr.2021(
  creatinine,
  age,
  sex,
  creatinine_units = "micromol/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
age	Numeric vector. Age, in years.
sex	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
creatinine_units	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
label_sex_male	List. Label(s) for definition(s) of male sex.
label_sex_female	List. Label(s) for definition(s) of female sex.
max_age	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the CKD-EPI 2021 creatinine-based equation.

Reference to the equation: Inker LA, Eneanya ND, Coresh J, et al. New creatinine- and cystatin C–based equations to estimate GFR without race. N Engl J Med. 2021;385:1737-1749.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ckdepi.cr.2021 (creatinine = 1.4, age = 60, sex = "Male",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.ckdepi.cr.2021 (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#  creatinine_units = "mg/dl")
```

`egfr.ckdepi.cr_cys.2021` *Calculate eGFR by the CKD-EPI 2021 creatinine-cystatin-based equation*

Description

Calculate eGFR by the CKD-EPI 2021 creatinine-cystatin-based equation

Usage

```
egfr.ckdepi.cr_cys.2021(
  creatinine,
  cystatin,
  age,
  sex,
  creatinine_units = "micromol/l",
  cystatin_units = "mg/L",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

`creatinine`	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
`cystatin`	Numeric vector. Serum cystatin, could be expressed in "mg/L" or "nanomol/L". Units of measurement should be defined in variable cystatin_units (if not defined explicitly by user, the default value is "mg/L").
`age`	Numeric vector. Age, in years.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
`creatinine_units`	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
`cystatin_units`	Character string. Units in which serum cystatin is expressed. Could be one of the following: "mg/L" or "nanomol/L"
`label_sex_male`	List. Label(s) for definition(s) of male sex.
`label_sex_female`	List. Label(s) for definition(s) of female sex.
`max_age`	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the CKD-EPI 2021 creatinine-cystatin-based equation.

Reference to the equation: Inker LA, Eneanya ND, Coresh J, et al. New creatinine- and cystatin C–based equations to estimate GFR without race. N Engl J Med. 2021;385:1737-1749.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ckdepi.cr_cys.2021 (creatinine = 1.4, cystatin = 0.8, age = 60,
   sex = "Male", creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.ckdepi.cr_cys.2021 (creatinine = dta$scr, cystatin = dta$cys,
#  age = dta$age, sex = dta$sex, creatinine_units = "mg/dl")
```

---

egfr.ckid_u25.cr *Calculate eGFR by CKiD U25 creatinine-based equation (for children and young adults less then 25 years old)*

Description

Calculate eGFR by CKiD U25 creatinine-based equation (for children and young adults less then 25 years old)

Usage

```
egfr.ckid_u25.cr(
  creatinine,
  age,
  sex,
  height_cm = 0,
  height_ft = 0,
  height_inch = 0,
  creatinine_units = "micromol/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0)
)
```

Arguments

creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
age	Numeric vector. Age, in years.
sex	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
height_cm	Numeric vector. Could be defined either as height_cm if is measured in cm, or as height_ft and height_inch if is measured in feet and inches. If the parameter height_cm is greater than 0, the function uses cm, otherwise - feet and inches.
height_ft	see height_cm
height_inch	see height_cm
creatinine_units	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
label_sex_male	List. Label(s) for definition(s) of male sex.
label_sex_female	List. Label(s) for definition(s) of female sex.

Details

Calculate estimated glomerular filtration rate (eGFR) by creatinine-based CKiD U25 equation.

Reference to the equation: Pierce CB, Muñoz A, Ng DK, Warady BA, Furth SL, Schwartz GJ. Age- and sex-dependent clinical equations to estimate glomerular filtration rates in children and young adults with chronic kidney disease. Kidney International. 2021;99(4):948–956. doi:10.1016/j.kint.2020.10.047.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ckid_u25.cr (creatinine = 1.4, age = 10, height_cm = 90, sex = "Male",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.ckid_u25.cr (creatinine = dta$scr, age = dta$age, height_cm = dta$ht,
#  sex = dta$sex, creatinine_units = "mg/dl")
```

`egfr.ckid_u25.cys` *Calculate eGFR by CKiD U25 cystatin-based equation (for children and young adults less then 25 years old)*

Description

Calculate eGFR by CKiD U25 cystatin-based equation (for children and young adults less then 25 years old)

Usage

```
egfr.ckid_u25.cys(
  cystatin,
  age,
  sex,
  cystatin_units = "mg/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0)
)
```

Arguments

`cystatin`	Numeric vector. Serum cystatin, could be expressed in "mg/L" or "nanomol/L". Units of measurement should be defined in variable cystatin_units (if not defined explicitly by user, the default value is "mg/L").
`age`	Numeric vector. Age, in years. Age does not accounted in Schwartz equation, but used in the function to check whether Schwartz equation could be applied to a given patient.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
`cystatin_units`	Character string. Units in which serum cystatin is expressed. Could be one of the following: "mg/L" or "nanomol/L"
`label_sex_male`	List. Label(s) for definition(s) of male sex.
`label_sex_female`	List. Label(s) for definition(s) of female sex.

Details

Calculate estimated glomerular filtration rate (eGFR) by cystatin-based CKiD U25 equation.

Reference to the equation: Pierce CB, Muñoz A, Ng DK, Warady BA, Furth SL, Schwartz GJ. Age- and sex-dependent clinical equations to estimate glomerular filtration rates in children and young adults with chronic kidney disease. Kidney International. 2021;99(4):948–956. doi:10.1016/j.kint.2020.10.047.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ckid_u25.cys (cystatin = 0.8, age = 10, sex = "Male",
  cystatin_units = "mg/l")
# for a dataset - see vignettes for details
# egfr.ckid_u25.cys (cystatin = dta$cystatin, age = dta$age,
#  sex = dta$sex, cystatin_units = "mg/l")
```

---

egfr.ekfc.cr *Calculate eGFR by the EKFC creatinine-based equation*

Description

Calculate eGFR by the EKFC creatinine-based equation

Usage

```
egfr.ekfc.cr(
  creatinine,
  age,
  sex,
  ethnicity = NA,
  creatinine_units = "micromol/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  label_african = c("African"),
  max_age = 100
)
```

Arguments

creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
age	Numeric vector. Age, in years.
sex	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.

`ethnicity` Vector. Ethnicity. If no ethnicity will be defined, the calculation will use coefficients for White European subjects. Specify ethnicity if a study includes African and Black European subjects, and define the values of variable in the parameter label_african.

`creatinine_units` Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".

`label_sex_male` List. Label(s) for definition(s) of male sex.

`label_sex_female` List. Label(s) for definition(s) of female sex.

`label_african` List. Label(s) for African ethnicity.

`max_age` Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the EKFC creatinine-based equation.

References to the equation:

- Initial creatinine-based equation was reported in Pottel H, Björk J, Courbebaisse M, et al. Development and validation of a modified full age spectrum creatinine-based equation to estimate glomerular filtration rate. a cross-sectional analysis of pooled data. Ann Int Med. 2021;174:183–192 doi:10.7326/M20-4366.
- Subsequent definition of Q coefficients for African and Black European subjects was reported in Pottel H, Björk J, Rule AD, et al. Cystatin C–based equation to estimate GFR without the inclusion of race and sex. N Engl J Med. 2023;388:333-343 doi: 10.1056/NEJMoa22037.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ekfc.cr (creatinine = 1.4, age = 60, sex = "Male",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.ekfc.cr (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#  creatinine_units = "mg/dl")
```

egfr.ekfc.cys *Calculate eGFR by the EKFC cystatin-based equation*

Description

Calculate eGFR by the EKFC cystatin-based equation

Usage

```
egfr.ekfc.cys(cystatin, age, cystatin_units = "mg/L", max_age = 100)
```

Arguments

cystatin	Numeric vector. Serum cystatin, could be expressed in "mg/L" or "nanomol/L". Units of measurement should be defined in variable cystatin_units (if not defined explicitly by user, the default value is "mg/L").
age	Numeric vector. Age, in years.
cystatin_units	Character string. Units in which serum cystatin is expressed. Could be one of the following: "mg/L" or "nanomol/L"
max_age	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the EKFC cystatin-based equation.

Reference to the equation: Pottel H, Björk J, Rule AD, et al. Cystatin C–based equation to estimate GFR without the inclusion of race and sex. N Engl J Med. 2023;388:333-343 doi: 10.1056/NEJMoa22037.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.ekfc.cys (cystatin = 0.8, age = 60)
# for a dataset - see vignettes for details
# egfr.ekfc.cys (cystatin = dta$cys, age = dta$age)
```

`egfr.fas.cr` *Calculate eGFR by the Full age spectrum (FAS) creatinine-based equation*

Description

Calculate eGFR by the Full age spectrum (FAS) creatinine-based equation

Usage

```
egfr.fas.cr(
  creatinine,
  age,
  sex,
  creatinine_units = "micromol/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

`creatinine`	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
`age`	Numeric vector. Age, in years.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
`creatinine_units`	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
`label_sex_male`	List. Label(s) for definition(s) of male sex.
`label_sex_female`	List. Label(s) for definition(s) of female sex.
`max_age`	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the Full age spectrum (FAS) creatinine-based equation.

Reference to the equation: Pottel H, Hoste L, Dubourg L et al. An estimating glomerular filtration rate equation for the full age spectrum. Nephrol Dial Transplant 2016; 31:798–806 doi:10.1093/ndt/gfv454.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.fas.cr (creatinine = 1.4, age = 60, sex = "Male",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.fas.cr (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#  creatinine_units = "mg/dl")
```

---

egfr.fas.cr_cys *Calculate eGFR by the Full age spectrum (FAS) creatinine-cystatin-based equation*

Description

Calculate eGFR by the Full age spectrum (FAS) creatinine-cystatin-based equation

Usage

```
egfr.fas.cr_cys(
  creatinine,
  cystatin,
  age,
  sex,
  alpha = 0.5,
  creatinine_units = "micromol/l",
  cystatin_units = "mg/L",
  equation_type = "precise",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
cystatin	Numeric vector. Serum cystatin, could be expressed in "mg/L" or "nanomol/L". Units of measurement should be defined in variable cystatin_units (if not defined explicitly by user, the default value is "mg/L").

age	Numeric vector. Age, in years.
sex	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
alpha	Numeric vector. Alpha coefficient for the combined creatinine-cystatin equation. By default is equal to 0.5.
creatinine_units	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
cystatin_units	Character string. Units in which serum cystatin is expressed. Could be one of the following: "mg/L" or "nanomol/L"
equation_type	Character string. Whether to use "precise" or "simplified" equation.
label_sex_male	List. Label(s) for definition(s) of male sex.
label_sex_female	List. Label(s) for definition(s) of female sex.
max_age	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the Full age spectrum (FAS) creatinine-cystatin-based equation.

Reference to the equation: Pottel H, Delanaye P, Schaeffner E et al. Estimating glomerular filtration rate for the full age spectrum from serum creatinine and cystatin C. Nephrol Dial Transplant 2017; 32:497–507 doi:10.1093/ndt/gfw425.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.fas.cr_cys (creatinine = 1.4, cystatin = 0.8, age = 60,
   sex = "Male", creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.fas.cr_cys (creatinine = dta$scr, cystatin = dta$cys,
#  age = dta$age, sex = dta$sex, creatinine_units = "mg/dl")
```

`egfr.fas.cys` *Calculate eGFR by the Full age spectrum (FAS) cystatin-based equation*

Description

Calculate eGFR by the Full age spectrum (FAS) cystatin-based equation

Usage

```
egfr.fas.cys(
  cystatin,
  age,
  cystatin_units = "mg/L",
  equation_type = "precise",
  max_age = 100
)
```

Arguments

`cystatin`	Numeric vector. Serum cystatin, could be expressed in "mg/L" or "nanomol/L". Units of measurement should be defined in variable cystatin_units (if not defined explicitly by user, the default value is "mg/L").
`age`	Numeric vector. Age, in years.
`cystatin_units`	Character string. Units in which serum cystatin is expressed. Could be one of the following: "mg/L" or "nanomol/L"
`equation_type`	Character string. Whether to use "precise" or "simplified" equation.
`max_age`	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the Full age spectrum (FAS) cystatin-based equation.

Reference to the equation: Pottel H, Delanaye P, Schaeffner E et al. Estimating glomerular filtration rate for the full age spectrum from serum creatinine and cystatin C. Nephrol Dial Transplant 2017; 32:497–507 doi:10.1093/ndt/gfw425.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.fas.cys (cystatin = 0.8, age = 60)
# for a dataset - see vignettes for details
# egfr.fas.cys (cystatin = dta$cys, age = dta$age)
```

`egfr.lm.cr` *Calculate eGFR by the revised Lund-Malmö creatinine-based equation*

Description

Calculate eGFR by the revised Lund-Malmö creatinine-based equation

Usage

```
egfr.lm.cr(
  creatinine,
  age,
  sex,
  creatinine_units = "micromol/l",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

`creatinine`	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
`age`	Numeric vector. Age, in years.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
`creatinine_units`	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
`label_sex_male`	List. Label(s) for definition(s) of male sex.
`label_sex_female`	List. Label(s) for definition(s) of female sex.
`max_age`	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by the revised Lund-Malmö creatinine-based equation.

Reference to the equation: Björk J, Grubb A, Sterner G, Nyman U. Revised equations for estimating glomerular filtration rate based on the Lund-Malmö Study cohort. Scand J Clin Lab Invest. 2011;71: 232-239.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.lm.cr (creatinine = 1.4, age = 60, sex = "Male",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.lm.cr (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#  creatinine_units = "mg/dl")
```

---

egfr.mdrd4 *Calculate estimated glomerular filtration rate (eGFR) by MDRD equation*

Description

Calculate estimated glomerular filtration rate (eGFR) by MDRD equation

Usage

```
egfr.mdrd4(
  creatinine,
  age,
  sex,
  ethnicity,
  creatinine_units = "micromol/l",
  creatinine_method = "non-IDMS",
  label_afroamerican = c("Afroamerican"),
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0),
  max_age = 100
)
```

Arguments

creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
age	Numeric vector. Age, in years.
sex	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female.
ethnicity	Vector. Ethnicity, specify in case of African-American patients. The value of variable refers to the parameter label_afroamerican.
creatinine_units	Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".
creatinine_method	Character string. Creatinine standartisation method in a laboratory. Could be either "IDMS" or "non-IDMS". If not explicitly defined by user, the default assumption is "non-IDMS".
label_afroamerican	List. Label(s) for Afroamerican ethnicity.
label_sex_male	List. Label(s) for definition(s) of male sex.
label_sex_female	List. Label(s) for definition(s) of female sex.
max_age	Numeric. Maximal age suitable for the equation application, in years. By default is 100 years, but change this value in case you would like to apply equation to older persons.

Details

Calculate estimated glomerular filtration rate (eGFR) by MDRD equation.

Reference to the equation: Levey AS, Coresh J, Greene T, et al. Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. Annals of Internal Medicine 2006;145:247–54.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.mdrd4 (creatinine = 1.4, age = 60, sex = "Male", ethnicity = "White",
  creatinine_units = "mg/dl")
# for a dataset - see vignettes for details
# egfr.mdrd4 (creatinine = dta$scr, age = dta$age, sex = dta$sex,
#  ethnicity = dta$race, creatinine_units = "mg/dl")
```

`egfr.schwartz` *Calculate eGFR by Schwartz equation (for children only, both "classic" and "quadratic")*

Description

Calculate eGFR by Schwartz equation (for children only, both "classic" and "quadratic")

Usage

```
egfr.schwartz(
  creatinine,
  age,
  sex,
  height_cm = 0,
  height_ft = 0,
  height_inch = 0,
  creatinine_units = "micromol/l",
  equation_type = "classic",
  label_sex_male = c("Male", 1),
  label_sex_female = c("Female", 0)
)
```

Arguments

`creatinine`	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").
`age`	Numeric vector. Age, in years. Age does not accounted in Schwartz equation, but used in the function to check whether Schwartz equation could be applied to a given patient.
`sex`	Vector. The value of variable refers to the parameters label_sex_male and label_sex_female. Required only in case of quadratic Schwartz equation.
`height_cm`	Numeric vector. Could be defined either as height_cm if is measured in cm, or as height_ft and height_inch if is measured in feet and inches. If the parameter height_cm is greater than 0, the function uses cm, otherwise - feet and inches.
`height_ft`	see height_cm
`height_inch`	see height_cm

`creatinine_units`
: Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".

`equation_type`
: Character string. Define whether to calculate eGFR either by classic Schwartz or quadratic Schwartz equation. Could be one of the following: "classic", "quadratic". If not explicitly defined by user, the default assumption is "classic".

`label_sex_male`
: List. Label(s) for definition(s) of male sex.

`label_sex_female`
: List. Label(s) for definition(s) of female sex.

Details

Calculate estimated glomerular filtration rate (eGFR) by Schwartz equation.

Reference to the equation: Gao A, Cachat F, Faouzi M et al. Comparison of the glomerular filtration rate in children by the new revised Schwartz formula and a new generalized formula. Kidney International 2013;83:524–30.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

numeric eGFR expressed in ml/min/1.73m^2.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
egfr.schwartz (creatinine = 1.4, age = 10, height_cm = 90, sex = "Male",
  creatinine_units = "mg/dl")
egfr.schwartz (creatinine = 1.4, age = 10, height_cm = 90, sex = "Male",
  creatinine_units = "mg/dl", equation_type = "quadratic")
# for a dataset - see vignettes for details
# egfr.schwartz (creatinine = dta$scr, age = dta$age, height_cm = dta$ht,
#  sex = dta$sex, creatinine_units = "mg/dl")
```

---

ktx.data *A sample dataset with kidney transplant patients.*

Description

A dataset contains 10 records for kidney transplant patients, including information about deceased donors.

Usage

```
ktx.data
```

Format

A data frame with 10 rows and 12 variables:

ptid patient identifier

rec.age age of the recipient, in years

don.age age of the donor, in years

don.height height of the donor, in cm

don.weight weight of the donor, in kg

don.ethnicity ethnicity of the donor

don.hypertension history of hypertension for the donor

don.diabetes history of diabetes for the donor

don.causeofdeath cause of death for the donor

don.creatinine serum creatinine of the donor, in mg/dL

don.hcv hepatitis c virus status of the donor

don.dcdstatus donation after circulatory death status of the donor

don.sex sex of the donor

Source

Generation from different patients' records

---

ktx.kdpi.optn *Calculate KDRI and KDPI for deceased kidney donor*

Description

Calculate KDRI and KDPI for deceased kidney donor

Usage

```
ktx.kdpi.optn(
  age,
  height_cm = 0,
  height_ft = 0,
  height_inch = 0,
  weight_kg = 0,
  weight_lb = 0,
  ethnicity,
  hypertension,
```

```
  diabetes,
  causeofdeath,
  creatinine,
  hcv,
  dcdstatus,
  creatinine_units = "micromol/l",
  return_output_type = "KDPI",
  mapping_values_year = "latest",
  label_afroamerican = c("Afroamerican"),
  label_hypertension_positive = c("yes"),
  label_hypertension_unknown = "NA",
  label_diabetes_positive = c("yes"),
  label_diabetes_unknown = "NA",
  label_causeofdeath = c("cva"),
  label_hcv_positive = c("positive"),
  label_hcv_unknown = "NA",
  label_dcdstatus = c("yes")
)
```

Arguments

age	Numeric vector. Age, in years.
height_cm	Numeric vector. Could be defined either as height_cm if is measured in cm, or as height_ft and height_inch if is measured in feet and inches. If the parameter height_cm is greater than 0, the function uses cm, otherwise - feet and inches.
height_ft	see height_cm
height_inch	see height_cm
weight_kg	Numeric vector. Could be defined either as weight_kg if measured in kg, or as weight_lb if is measured in pounds. If the parameter weight_kg is greater than 0, the function uses kg, otherwise - pounds.
weight_lb	see weight_kg
ethnicity	Vector. Ethnicity, specify in case of African-American donors which have special coefficient in the regression equation. The value of variable refers to the parameter label_afroamerican.
hypertension	Vector. History of hypertension, specify in case of hypertensive donors which have special coefficient in the regression equation. The value of variable refers to the parameters label_hypertension_positive and label_hypertension_unknown.
diabetes	Vector. History of diabetes, specify in case of donors with diabetes which have special coefficient in the regression equation. The value of variable refers to the parameters label_diabetes_positive and label_diabetes_unknown.
causeofdeath	Vector. Cause of death, specify whether death was due to cerebrovascular disease, or other reasons.
creatinine	Numeric vector. Serum creatinine, could be expressed in "micromol/L", "mmol/L" or "mg/dL". Units of measurement should be defined in variable creatinine_units (if not defined explicitly by user, the default value is "micromol/L").

`hcv` Vector. Hepatitis C virus status. The value of variable refers to the parameters label_hcv_positive and label_hcv_unknown.

`dcdstatus` Vector. Donation after circulatory death status. Specify whether organ was from a donor after circulatory death or not. The value of variable refers to the parameter label_dcdstatus.

`creatinine_units`
Character string. Units in which serum creatinne is expressed. Could be one of the following: "micromol/L", "mmol/L" or "mg/dL".

`return_output_type`
Character string. Specify which calculated parameter to return from the function: "KDRI_Rao" - Raw Kidney Donor Risk Index, "KDRI_median" - scaled to the median Kidney Donor Risk Index, or "KDPI" - Kidney Donor Profile Index.

`mapping_values_year`
Numeric value or character string. Specify which year to take for the OPTN mapping table, as well as KDRI scaling factor and chances of hypertension and diabetes in case if they were unknown for donor.

By default the value is "latest", and the function takes the latest available OPTN mapping table and coefficients from the internal dataframes ktx.kdpi_mapping_table and ktx.kdpi_coefficients_table.

But if necessary, a user could define the exact year (i.e. mapping_values_year = 2015).

For a list of available years run the following: ktx.kdpi.optn.show.years().

`label_afroamerican`
List. Label(s) for Afroamerican ethnicity.

`label_hypertension_positive`
List. Label(s) for a positive history of hypertension.

`label_hypertension_unknown`
List. Label(s) for donors with unknown history of hypertension.

`label_diabetes_positive`
List. Label(s) for a positive history of diabetes.

`label_diabetes_unknown`
List. Label(s) for donors with unknown history of diabetes.

`label_causeofdeath`
List. Label(s) for a cause of death due to cerebrovascular/stroke.

`label_hcv_positive`
List. Label(s) for a positive HCV status.

`label_hcv_unknown`
List. Label(s) for an unknown, not done, indeterminate, or pending HCV status.

`label_dcdstatus`
List. Label(s) for a donor after circulatory death status.

Details

Calculate Kidney Donor Risk Index (KDRI) and Kidney Donor Profile Index (KDPI) based on the algorithm of US Organ Procurement and Transplantation Network. The Kidney Donor Profile Index (KDPI) is a numerical measure that combines ten donor factors to summarize into a single

number the quality of deceased donor kidneys relative to other recovered kidneys. *KDRI could be calculated only for a deceased donor*!

More reading:

- OPTN web-based calculator
- Guide to calculating and interpreting KDPI
- Latest data for mapping table, scaling factor, etc

Citation: Bikbov B. R open source programming code for calculation of the Kidney Donor Profile Index and Kidney Donor Risk Index. Kidney Diseases, 2018; 4:269–272. DOI: 10.1159/000492427

Value

numeric One of the following values based on the return_output_type argument: Raw Kidney Donor Risk Index (KDRI), Scaled to the median Kidney Donor Risk Index (KDRI), or Kidney Donor Profile Index (KDPI).

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
ktx.kdpi.optn (age = 60, height_cm = 168, weight_kg = 93, ethnicity = "White",
  hypertension = "yes", diabetes = "no", causeofdeath = "roadinjury",
  creatinine = 1.4, hcv = "negative", dcdstatus = "no",
  creatinine_units = "mg/dl", return_output_type = "KDRI_Rao")
ktx.kdpi.optn (age = 30, height_cm = 176, weight_kg = 82, ethnicity = "White",
 hypertension = "NA", diabetes = "no", causeofdeath = "roadinjury", # note that NA is in the quotes
  creatinine = 150, hcv = "negative", dcdstatus = "no", return_output_type = "KDPI")
# for a dataset - see vignettes for details
```

---

ktx.kdpi.optn.show.years

Shows which years are available in the R package for the OPTN mapping table, KDRI scaling factor, etc.

Description

Shows which years are available in the R package for the OPTN mapping table, KDRI scaling factor, etc.

Usage

```
ktx.kdpi.optn.show.years()
```

Details

Service function which shows for user for which year(s) the OPTN mapping table, as well as KDRI scaling factor and chances of hypertension and diabetes in case if they were unknown for donor in the ktx.kdpi_mapping_table and ktx.kdpi_coefficients_table. This years could be used for the argument *mapping_values_year* of the ktx.kdpi.optn function.

This function has no arguments.

Value

numeric List of years which could be used for the argument mapping_values_year of the ktx.kdpi.optn function.

`matrix.cross_table` *Creates a named matrix from two variables.*

Description

Creates a named matrix from two variables.

Usage

```
matrix.cross_table(var1, var2, predefined_levels = NA)
```

Arguments

`var1`	Character vector. Values representing first variable.
`var2`	Character vector. Values representing second variable.
`predefined_levels`	Character vector. Levels for var1 and var2. If omitted, the variables just coded according to the levels they have. If contains vector, the variables are coded according to predefined_levels values, the latter could be useful if var1 and var2 contain not all levels of interest

Details

Creates a named matrix from two variables.

Value

matrix with cross-tabulation of var1 and var2.

`matrix.get_named_matrix_value`
Access matrix cells by row and column names

Description

Access matrix cells by row and column names

Usage

```
matrix.get_named_matrix_value(matrix_data, row_name, col_name)
```

Arguments

`matrix_data`	matrix. Matrix with data.
`row_name`	character. Row name in the matrix.
`col_name`	character. Column name in the matrix.

Details

Access matrix cells by row and column names.

Value

vector. Matrix value.

`matrix.read_excel_to_named_matrix`
Read Excel file and convert it to matrix with row and column names.

Description

Read Excel file and convert it to matrix with row and column names.

Usage

```
matrix.read_excel_to_named_matrix(file_path, sheet_name = NULL)
```

Arguments

`file_path`	character. Path to Excel file.
`sheet_name`	character. Name of Excel sheet. Optional, if there is only one sheet with data, the function will read it with no need to specifying the sheet name.

Details

Read Excel file and convert it to matrix with row and column names.

Value

Excel file saved to a specified folder.

`matrix.save_named_matrix_to_excel`
Save a named matrix as an Excel file.

Description

Save a named matrix as an Excel file.

Usage

```
matrix.save_named_matrix_to_excel(
  matrix_data,
  file_path,
  sheet_name = "Sheet1",
  save_type = "new"
)
```

Arguments

`matrix_data`	matrix. Matrix for saving.
`file_path`	character. Path to the Excel file.
`sheet_name`	character. Name of the Excel sheet.
`save_type`	character. Defines whether the Excel file should be created or overwritten (save_type = "new"), or new sheet should be added to the existing Excel file (save_type = "add").

Details

Save a named matrix as an Excel file.

Value

Excel file saved to a specified folder.

`nephro.albuminuria_category` *Calculate albuminuria categories*

Description

Calculate albuminuria categories

Usage

```
nephro.albuminuria_category(
  albuminuria,
  albuminuria_units = "mg/g",
  semiquantitative_values = "forbidden"
)
```

Arguments

`albuminuria`	Numeric vector. Urine albumin, could be expressed in "mg/day" (24-hour urine collection), "mg/mmol" (UACR) or "mg/g" (UACR). Units of measurement should be defined in variable albuminuria_units (if not defined explicitly by user, the default value is "mg/g").
`albuminuria_units`	Character string. Units in which urine albumin is measured. Could be one of the following: "mg/day", "mg/mmol" or "mg/g".
`semiquantitative_values`	Character string. Defines whether semiquantitative values are allowed in the data. If "any", all semiquantitative values ('<30', '30-300', '>300') and any numeric values (29, 30, 35, etc) will be classified into A categories (NB! both '30-300' and '30-299' will be classified as A2). If "only_limits", only limiting semiquantitative values ('<30', '>300') will be classified into A categories, but middle semiquantitative values ('30-300') will be omitted; but numeric values (29, 30, 35, etc) will be classified into A categories. If "forbidden", only numeric values will be classified into A categories.

Details

Calculate albuminuria categories (A1, A2, A3) based on albuminuria values.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

string albuminuria category.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
nephro.albuminuria_category (albuminuria = 25, albuminuria_units = "mg/g")
# for a dataset - see vignettes for details
# nephro.albuminuria_category (albuminuria = dta$alb, albuminuria_units = "mg/g")
```

---

nephro.gfr_category *Calculate eGFR categories*

Description

Calculate eGFR categories

Usage

```
nephro.gfr_category(gfr)
```

Arguments

gfr	Numeric vector. eGFR, expressed in "ml/min/1.73m2".

Details

Calculate eGFR categories (G1, G2, G3a, G3b, G4, G5) based on eGFR values.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

string gfr category.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
nephro.gfr_category (gfr = 25)
# for a dataset - see vignettes for details
# nephro.gfr_category (gfr = dta$egfr)
```

nephro.kdigo_risk_category *Calculate KDIGO risk categories*

Description

Calculate KDIGO risk categories

Usage

```
nephro.kdigo_risk_category(gfr_cat, alb_cat)
```

Arguments

gfr_cat	Character vector. eGFR categories coded as G1, G2, G3a, G3b, G4, G5.
alb_cat	Character vector. Albuminuria categories coded as A1, A2, A3.

Details

Calculate KDIGO risk of complications categories (Low, Moderate, High, Very high) based on eGFR and albuminuria grades.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

string risk category.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
nephro.kdigo_risk_category (gfr_cat = "G2", alb_cat = "A3")
# for a dataset - see vignettes for details
# nephro.kdigo_risk_category (gfr_cat = dta$gfr_cat, alb_cat = dta$alb_cat)
```

`nephro.proteinuria_category` *Calculate proteinuria categories*

Description

Calculate proteinuria categories

Usage

```
nephro.proteinuria_category(
  proteinuria,
  proteinuria_units = "mg/g",
  semiquantitative_values = "forbidden"
)
```

Arguments

`proteinuria`	Numeric vector. Urine protein, could be expressed in "mg/day" (24-hour urine collection), "mg/mmol" (UPCR) or "mg/g" (UPCR). Units of measurement should be defined in variable proteinuria_units (if not defined explicitly by user, the default value is "mg/g").
`proteinuria_units`	Character string. Units in which urine protein is measured. Could be one of the following: "mg/day", "mg/mmol" or "mg/g".
`semiquantitative_values`	Character string. Defines whether semiquantitative values are allowed in the data. If "any", all semiquantitative values ('<30', '30-300', '>300') and any numeric values (29, 30, 35, etc) will be classified into A categories (NB! both '30-300' and '30-299' will be classified as A2). If "only_limits", only limiting semiquantitative values ('<30', '>300') will be classified into A categories, but middle semiquantitative values ('30-300') will be omitted; but numeric values (29, 30, 35, etc) will be classified into A categories. If "forbidden", only numeric values will be classified into A categories.

Details

Calculate albuminuria categories (A1, A2, A3) based on proteinuria values.

Citation: Bikbov B. kidney.epi: Kidney-Related Functions for Clinical and Epidemiological Research. Scientific-Tools.Org, https://Scientific-Tools.Org. DOI: 10.32614/CRAN.package.kidney.epi

Value

string albuminuria category.

Author(s)

Programming: Boris Bikbov https://www.linkedin.com/in/boris-bikbov.

Examples

```
# for a single patient
nephro.proteinuria_category (proteinuria = 25, proteinuria_units = "mg/g")
# for a dataset - see vignettes for details
# nephro.proteinuria_category (proteinuria = dta$alb, proteinuria_units = "mg/g")
```

`service.convert_creatinine` *Convert creatinine values between measurement units.*

Description

Convert creatinine values between measurement units.

Usage

```
service.convert_creatinine(
  creatinine,
  creatinine_units,
  creatinine_reference_units = "mg/dl"
)
```

Arguments

`creatinine`	Numeric. The creatinine value from a data set.
`creatinine_units`	Character. Creatinine mesurement units in a data set.
`creatinine_reference_units`	Character. Creatinine measurement units as a desired output (mg/dl by default).

Details

Service function which check measurement units and convert creatinine values to selected by user.

Value

numeric Creatinine values converted into reference measurement units.

service.convert_cystatin *Convert cystatin C values between measurement units.*

Description

Convert cystatin C values between measurement units.

Usage

```
service.convert_cystatin(cystatin, cystatin_units)
```

Arguments

cystatin	Numeric. The cystatin C values from a data set.
cystatin_units	Character. Cystatin C measurement units in a data set.

Details

Service function which check measurement units and convert cystatin C values to mg/l.

Value

numeric Cystatin C values converted in mg/l.

Index