

Package: nephro (via r-universe)

May 28, 2026

Type Package

Version 1.5

Title Utilities for Nephrology

Date 2025-02-10

Maintainer Cristian Pattaro <cristian.pattaro@eurac.edu>

Description Set of functions to estimate kidney function and other traits of interest in nephrology.

License GPL (>= 3)

NeedsCompilation no

Author Cristian Pattaro [aut, cre], Ryosuke Fujii [aut], Janina Herold [aut]

Repository <https://cran.r-universe.dev>

Date/Publication 2025-02-11 11:40:02 UTC

RemoteUrl <https://github.com/cran/nephro>

RemoteRef HEAD

RemoteSha 5d906c2d898597e0bfb2d9731cbcd01f6a8d958a

Contents

nephro-package	2
BCR	5
CG	6
CKDEpi.creat	7
CKDEpi.creat.cys	8
CKDEpi.cys	9
CKDEpi2021.creat	9
CKDEpi2021.creat.cys	10
Convert.mgdL.mmolL	11
Convert.mgdL.umolL	12
EKFC.creat	12
EKFC.cys	13

EKFC_SF.cys	14
FAS.creat	15
FAS.creat.cys	15
FAS.cys	16
MDRD4	17
MDRD6	18
Schwartz.Bedside	19
Stevens.creat.cys	19
Stevens.cys1	20
Stevens.cys2	21
UACR	22
UCR	22
UPCR	23
Virga	24

Index	25
--------------	-----------

nephro-package

Biostatistics utilities for nephrology

Description

Set of tools for the estimation of kidney function and related traits.

Included are the following glomerular filtration rate (GFR) estimating functions: the Modification of Diet in Renal Disease (MDRD) study equations based on four ([MDRD4](#)) or six ([MDRD6](#)) parameters (Levey 1999; Levey 2006); the CKD-Epi equations for serum creatinine with the race coefficient ([CKDEpi.creat](#)) and without the race coefficient ([CKDEpi2021.creat](#)); the CKD-Epi equation for cystatin C ([CKDEpi.cys](#)); the CKD-Epi equation for the combination of creatinine and cystatin C with ([CKDEpi.creat.cys](#)) and without ([CKDEpi2021.creat.cys](#)) the race coefficient (Inker 2012; Inker 2021); the three equations proposed by Stevens 2008 based on cystatin C only ([Stevens.cys1](#)), age- and sex-weighted cystatin C ([Stevens.cys2](#)), and a combination of cystatin C and creatinine ([Stevens.creat.cys](#)); the classic Cockcroft and Gault 1976 equation for creatinine clearance estimation ([CG](#)); the equation by Virga (2007) ([Virga](#)); the race-free equations developed by the European Kidney Function Consortium (EKFC) including sex and age based on serum creatinine ([EKFC.creat](#)) (Pottel 2021) and based on serum cystatin C with ([EKFC.cys](#)) and without ([EKFC_SF.cys](#)) the sex coefficient (Pottel 2023); the full age spectrum (FAS) equations using serum creatinine ([FAS.creat](#)) (Pottel 2016), cystatin C ([FAS.cys](#)), and their combination ([FAS.creat.cys](#)) (Pottel 2017); the Schwartz bedside formula ([Schwartz.Bedside](#)) (Schwartz 2009).

A comparative description of several GFR-estimating functions included in the initial version of the package can be found in Pattaro (2013). Extensive literature does exist that compares the methods described.

Additional serum biomarkers are the blood urea nitrogen (BUN)-to-creatinine ratio ([BCR](#)) and the urea-to-creatinine ratio [UCR](#).

Urine biomarkers included are the albumin-to-creatinine ratio [UACR](#) and the protein-to-creatinine ratio [UPCR](#)

Some unit conversion functions are provided to facilitate operations.

Details

Package: nephroext
Type: Package
Version: 1.5
Date: 2025-30-01
License: GPLv3

Author(s)

Cristian Pattaro <cristian.pattaro@eurac.edu>, Ryosuke Fujii <ryosuke.fujii@eurac.edu>, Janina Herold <janina.herold@klinik.uni-regensburg.de>

Acknowledgements: Max Plischke, Joao Sabino, Xiao Jiang for bug reporting; Alexander Tolios, Thomas Winkler for input on the software package; Andrew Srisuwananukorn for contributing scripts; the 'nephro' user community for continuous feedback.

References

Citing this package:

- Pattaro C, Riegler P, Stifter G, Modenese M, Minelli C, Pramstaller PP. Estimating the glomerular filtration rate in the general population using different equations: effects on classification and association. *Nephron Clin Pract* 2013; **123**(1-2):102-11.

Formulas:

- Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron* 1976; **16**: 31-41.

- Inker LA, *et al.* Estimating glomerular filtration rate from serum creatinine and cystatin C. *N Engl J Med* 2012; **367**: 20-9.

- Inker LA, *et al.* New Creatinine- and Cystatin C-based Equations to Estimate GFR without Race. *N Engl J Med* 2021; **385**: 1737-1749.

- Levey AS, *et al.* A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group. *Ann Intern Med.* 1999; **130**(6): 461-70.

- Levey AS, *et al.* Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. *Ann Intern Med.* 2006; **145**: 247-54.

- Stevens LA, *et al.* Estimating GFR using serum cystatin C alone and in combination with serum creatinine: a pooled analysis of 3,418 individuals with CKD. *Am J Kidney Dis* 2008; **51**: 395-406.

- Virga G, *et al.* A new equation for estimating renal function using age, body weight and serum creatinine. *Nephron Clin Pract* 2007; **105**: c43-53.

- Pottel H, *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 Intern Med* 2021; **174**: 183-191.

- Pottel H, *et al.* Cystatin C-Based Equation to Estimate GFR without the Inclusion of Race and

Sex. *N Engl J Med* 2023; **388**: 333-343.

- Pottel H, *et al.* An estimated glomerular filtration rate equation for the full age spectrum. *Nephrol Dial Transplant* 2016; **31**:798-806.

- Pottel H, *et al.* Estimating glomerular filtration rate for the full age spectrum from serum creatinine and cystatin C *Nephrol Dial Transplant* 2017; **32**: 497-507.

- Schwartz GJ, *et al.* New equations to estimate GFR in children with CKD. *J Am Soc Nephrol* 2009; **20**:629-637.

On IDMS calibration:

- Levey AS, *et al.* Expressing the Modification of Diet in Renal Disease Study equation for estimating glomerular filtration rate with standardized serum creatinine values. *Clin Chem* 2007; **53**:766-72.

- Matsushita K, *et al.* Comparison of risk prediction using the CKD-EPI equation and the MDRD study equation for estimated glomerular filtration rate. *J Am Med Assoc* 2012; **307**:1941-51.

- Skali H, *et al.* Prognostic assessment of estimated glomerular filtration rate by the new Chronic Kidney Disease Epidemiology Collaboration equation in comparison with the Modification of Diet in Renal Disease Study equation. *Am Heart J* 2011; **162**:548-54.

Examples

```
# Comparison between different equations

creat <- c(0.8, 0.9, 1.0, 1.1, 1.2, 1.3)
cyst <- c(1.1, 0.95, 1.1, 1.0, 1.3, 1.2)
sex <- c(1, 1, 1, 0, 0, 0)
age <- c(60, 65, 43, 82, 71, 55)
ethn <- round(runif(6))
wt <- c(70, 80, 60, 55, 87, 71)

eGFR <- data.frame(creat, cyst)
eGFR$MDRD4 <- MDRD4(creat, sex, age, ethn, 'IDMS')
eGFR$CKDEpi.creat <- CKDEpi.creat(creat, sex, age, ethn)
eGFR$CKDEpi2021.creat <- CKDEpi2021.creat(creat, sex, age)
eGFR$CKDEpi.cys <- CKDEpi.cys(cyst, sex, age)
eGFR$CKDEpi.creat.cys <- CKDEpi.creat.cys(creat, cyst, sex, age, ethn)
eGFR$CKDEpi2021.creat.cys <- CKDEpi2021.creat.cys(creat, cyst, sex, age)
eGFR$Stevens.cys1 <- Stevens.cys1(cyst)
eGFR$Stevens.cys2 <- Stevens.cys2(cyst, sex, age, ethn)
eGFR$Stevens.creat.cys <- Stevens.creat.cys(creat, cyst, sex, age, ethn)
eGFR$cg <- CG(creat, sex, age, wt)
eGFR$virga <- Virga(creat, sex, age, wt)

pairs(eGFR[,3:13])

# For use with non-IDMS calibrated creatinine
# several authors (see references) suggested
# a 5% creatinine adjustment

creat <- c(0.8, 0.9, 1.0, 1.1, 1.2, 1.3)
sex <- c(1, 1, 1, 0, 0, 0)
```

```
age <- c(60, 65, 43, 82, 71, 55)
ethn <- round(runif(6))
gfr <- CKDEpi.creat(0.95*creat, sex, age, ethn)
```

BCR

BUN-to-creatinine ratio

Description

Calculate the plasma or serum BUN-to-creatinine ratio

Usage

```
BCR(BUN, creatinine)
```

Arguments

BUN	Numeric vector in mg/dL
creatinine	Numeric vector in mg/dL; 0s will be automatically converted into NAs

Value

A numeric vector with BCR values.

Author(s)

Cristian Pattaro

References

Dossetor JB. Creatininemia Versus Uremia. The relative significance of blood urea nitrogen and serum creatinine concentrations in azotemia. *Ann Int Med.* 1966; **65**(6): 1287-1299.

See Also

[UCR](#)

CG	<i>Cockcroft and Gault equation</i>
----	-------------------------------------

Description

Creatinine clearance is estimated with the Cockcroft and Gault formula.

Usage

CG(creatinine, sex, age, wt)

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
wt	Numeric vector with weight in kg

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron* 1976; **16**: 31-41.

See Also

[CKDEpi.creat](#), [MDRD4](#), [Virga](#)

CKDEpi.creat	<i>CKD-EPI equation for serum creatinine</i>
--------------	----------------------------------------------

Description

GFR is estimated with the CKD-EPI Study equation based on IDMS serum or plasma creatinine.

Usage

```
CKDEpi.creat(creatinine, sex, age, ethnicity)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Inker LA, *et al.* Estimating glomerular filtration rate from serum creatinine and cystatin C. *N Engl J Med* 2012; **367**: 20-29.

See Also

[CKDEpi.creat.cys](#), [CKDEpi.cys](#), [CKDEpi2021.creat](#)

CKDEpi.creat.cys *CKD-EPI equation for creatinine and cystatin C*

Description

CKD-EPI equation to estimate GFR based on a combination of creatinine and cystatin C

Usage

```
CKDEpi.creat.cys(creatinine, cystatin, sex, age, ethnicity)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
cystatin	Numeric vector with serum or plasma cystatin C values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Inker LA, *et al.* Estimating glomerular filtration rate from serum creatinine and cystatin C. *N Engl J Med* 2012; **367**: 20-29.

See Also

[CKDEpi.creat](#), [CKDEpi.cys](#), [CKDEpi2021.creat.cys](#)

CKDEpi.cys	<i>CKD-EPI equation for cystatin C</i>
------------	----------------------------------------

Description

GFR is estimated with the CKD-EPI equation for cystatin C proposed by Inker et al., *N Engl J Med* 2012

Usage

```
CKDEpi.cys(cystatin, sex, age)
```

Arguments

cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

The function returns a numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Inker LA, *et al.* Estimating glomerular filtration rate from serum creatinine and cystatin C. *N Engl J Med* 2012; **367**: 20-29.

See Also

[CKDEpi.creat](#), [CKDEpi.creat.cys](#)

CKDEpi2021.creat	<i>Race-free CKD-EPI equation for serum creatinine</i>
------------------	--------------------------------------------------------

Description

GFR is estimated with the CKD-EPI Study equation based on serum creatinine without the ethnicity coefficient.

Usage

```
CKDEpi2021.creat(creatinine, sex, age)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

A numeric vector with eGFR values in $\text{ml}/\text{min}/1.73 \text{ m}^2$.

Author(s)

Ryosuke Fujii

References

Inker LA, *et al.* New creatinine- and cystatin C-based equations to estimate GFR without race. *N Engl J Med* 2021; **385**: 1737-1749.

See Also

[CKDEpi.creat](#), [CKDEpi.creat.cys](#), [CKDEpi.cys](#), [CKDEpi2021.creat.cys](#)

CKDEpi2021.creat.cys *Race-free CKD-EPI equation for serum creatinine and cystatin C*

Description

CKD-EPI equation to estimate GFR based on a combination of creatinine and cystatin C without the ethnicity coefficient

Usage

```
CKDEpi2021.creat.cys(creatinine, cystatin, sex, age)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

A numeric vector with eGFR values in $\text{ml}/\text{min}/1.73 \text{ m}^2$.

Author(s)

Ryosuke Fujii

References

Inker LA, *et al.* New creatinine- and cystatin C-based equations to estimate GFR without race. *N Engl J Med* 2021; **385**: 1737-1749.

See Also

[CKDEpi.creat](#), [CKDEpi.creat.cys](#), [CKDEpi.cys](#), [CKDEpi2021.creat](#)

Convert.mgdL.mmolL *Conversion formula to change from mg/dL to mmol/L and vice versa*

Description

mg/dL <-> mmol/L conversion

Usage

```
Convert.mgdL.mmolL(mg.dL, mmol.L)
## If your variable X is expressed in mg/dL, use: Convert.mgdL.mmolL(mg.dL=X)
## If your variable X is expressed in mmol/L, use: Convert.mgdL.mmolL(mmol.L=X)
```

Arguments

mg.dL	Provide a numeric vector in mg/dL to be converted into mmol/L
mmol.L	Provide a numeric vector in mmol/L to be converted into mg/dL

Value

A numeric vector with the converted values.

Author(s)

Cristian Pattaro

See Also

[Convert.mgdL.umolL](#)

Convert.mgdL.umolL *Conversion formula to change from mg/dL to umol/L and vice versa*

Description

mg/dL <-> umol/L conversion

Usage

```
Convert.mgdL.umolL(mg.dL, umol.L)
## If your variable X is expressed in mg/dL, use: Convert.mgdL.mmolL(mg.dL=X)
## If your variable X is expressed in umol/L, use: Convert.mgdL.mmolL(umol.L=X)
```

Arguments

mg.dL	Provide a numeric vector in mg/dL to be converted into umol/L
umol.L	Provide a numeric vector in umol/L to be converted into mg/dL

Value

A numeric vector with the converted values.

Author(s)

Cristian Pattaro

See Also

[Convert.mgdL.umolL](#)

EKFC.creat *EKFC equation for serum creatinine*

Description

EKFC equation for serum creatinine modified from FAS equation

Usage

```
EKFC.creat(creatinine, sex, age)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

The function returns a numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H, *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. *N Engl J Med* 2021; **174**: 183-191.

See Also

[EKFC.cys](#), [CKDEpi.creat](#)

EKFC.cys

EKFC equation for cystatin C

Description

EKFC equation for cystatin C that includes the sex coefficient, as proposed by Pottel et al., *N Engl J Med* 2023

Usage

```
EKFC.cys(cystatin, sex, age)
```

Arguments

cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

The function returns a numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H, *et al.* Cystatin C-Based Equation to Estimate GFR without the Inclusion of Race and Sex. *N Engl J Med* 2023; **388**: 333-343.

See Also[EKFC_SF.cys](#)

`EKFC_SF.cys`*Sex-free EKFC equation for cystatin C*

Description

EKFC equation for cystatin C without the sex coefficient as proposed by Pottel et al., *N Engl J Med* 2023

Usage`EKFC_SF.cys(cystatin, age)`**Arguments**

<code>cystatin</code>	Numeric vector with serum or plasma cystatin C values in mg/l
<code>age</code>	Numeric vector with age in years

Value

The function returns a numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H, *et al.* Cystatin C-Based Equation to Estimate GFR without the Inclusion of Race and Sex. *N Engl J Med* 2023; **388**: 333-343.

See Also[EKFC.cys](#)

FAS.creat	<i>FAS equation for serum creatinine</i>
-----------	------------------------------------------

Description

Full age spectrum (FAS) equation to estimate GFR based on serum creatinine

Usage

```
FAS.creat(creatinine, sex, age)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H., *et al.* An estimated glomerular filtration rate equation for the full age spectrum. *Nephrol Dial Transplant.* 2016; **5**: 798-806.

See Also

[FAS.creat.cys](#), [FAS.cys](#)

FAS.creat.cys	<i>FAS equation for creatinine and cystatin C</i>
---------------	---------------------------------------------------

Description

Full age spectrum (FAS) GFR estimation based on serum creatinine and cystatin C

Usage

```
FAS.creat.cys(creatinine, cystatin, sex, age)
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

The function returns a numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H., *et al.* An estimated glomerular filtration rate equation for the full age spectrum from serum creatinine and cystatin C. *Nephrol Dial Transplant.* 2017; **32**: 497-507.

See Also

[FAS.cys](#)

FAS.cys

FAS equation for cystatin C

Description

Full age spectrum (FAS) GFR estimation based on cystatin C

Usage

FAS.cys(cystatin, sex, age)

Arguments

cystatin	Numeric vector with serum or plasma cystatin values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Janina Herold

References

Pottel, H., *et al.* An estimated glomerular filtration rate equation for the full age spectrum from serum creatinine and cystatin C. *Nephrol Dial Transplant.* 2017; **32**: 497-507.

See Also

[FAS.creat](#), [FAS.creat.cys](#)

MDRD4

Four-parameter MDRD study equation

Description

GFR is estimated with the 4-parameter Modification of Diet in Renal Disease (MDRD) study equation.

Usage

```
MDRD4(creatinine, sex, age, ethnicity, method = "IDMS")
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals
method	Defaults is 'IDMS' for IDMS-traceable creatinine; write 'other' if not IDMS

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Levey AS, *et al.* A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group. *Ann Intern Med.* 1999; **130**(6): 461-70.

Levey AS, *et al.* Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. *Ann Intern Med.* 2006; **145**: 247-254.

See Also

[CKDEpi.creat](#), [MDRD6](#), [CG](#)

MDRD6

*Six-parameter MDRD study equation***Description**

GFR is estimated with the 6-parameter Modification of Diet in Renal Disease (MDRD) study equation.

Usage

```
MDRD6(creatinine, sex, age, albumin, BUN, ethnicity, method = 'IDMS')
```

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
albumin	Numeric vector with serum or plasma albumin in g/dl
BUN	Numeric vector with blood urea nitrogen levels in mg/dl
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals
method	Defaults is 'IDMS' for IDMS-traceable creatinine; write 'other' if not IDMS

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Levey AS, *et al.* A more accurate method to estimate glomerular filtration rate from serum creatinine: a new prediction equation. Modification of Diet in Renal Disease Study Group. *Ann Intern Med.* 1999; **130**(6): 461-70.

Levey AS, *et al.* Using standardized serum creatinine values in the modification of diet in renal disease study equation for estimating glomerular filtration rate. *Ann Intern Med.* 2006; **145**: 247-254.

See Also

[MDRD4](#)

Schwartz.Bedside *Bedside IDMS-traceable Schwartz GFR Calculator for Children*

Description

GFR is estimated with the Bedside Schwartz equation for Children based on IDMS serum or plasma creatinine.

This equation is valid in the 1-17 years age range.

Usage

Schwartz.Bedside(creatinine, ht, age)

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
ht	Numeric vector with height in cm
age	Numeric vector with age in years

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Andrew Srisuwananukorn

References

Schwartz GJ, *et al.* New equations to estimate GFR in children with CKD. *J Am Soc Nephrol* 2009; **20**: 629-637.

Stevens.creat.cys *Stevens' formula for a combination of serum creatinine and cystatin C*

Description

GFR estimation using the 3rd formula proposed by Stevens et al. (*Am J Kidney Dis* 2008), which combines creatinine and cystatin C

Usage

Stevens.creat.cys(creatinine, cystatin, sex, age, ethnicity)

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals

Value

The function returns a numeric vector with eGFR values in $\text{ml}/\text{min}/1.73 \text{ m}^2$.

Author(s)

Cristian Pattaro

References

Stevens LA, *et al.* Estimating GFR using serum cystatin C alone and in combination with serum creatinine: a pooled analysis of 3,418 individuals with CKD. *Am J Kidney Dis* 2008; **51**: 395-406.

See Also

[CKDEpi.creat.cys](#)

Stevens.cys1

GFR estimation using serum cystatin C

Description

GFR is estimated with the 1st formula proposed by Stevens et al. (Am J Kidney Dis 2008), i.e.: as a simple transformation of cystatin C, without using any other information

Usage

```
Stevens.cys1(cystatin)
```

Arguments

cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
----------	---------------------------------------------------------------

Value

A numeric vector with eGFR values in $\text{ml}/\text{min}/1.73 \text{ m}^2$.

Author(s)

Cristian Pattaro

References

Stevens LA, *et al.* Estimating GFR using serum cystatin C alone and in combination with serum creatinine: a pooled analysis of 3,418 individuals with CKD. *Am J Kidney Dis* 2008; **51**: 395-406.

See Also

[Stevens.cys2](#), [Stevens.creat.cys](#), [CKDEpi.cys](#)

Stevens.cys2

Stevens' formula for serum cystatin C, age, and sex

Description

GFR is estimated with the 2nd formula proposed by Stevens et al. (*Am J Kidney Dis* 2008), where cystatin C is weighted by sex and age

Usage

`Stevens.cys2(cystatin, sex, age, ethnicity)`

Arguments

cystatin	Numeric vector with serum or plasma cystatin C values in mg/l
sex	Numeric vector with 0 for females and 1 for males
age	Numeric vector with age in years
ethnicity	Numeric vector with 0 for non-Black and 1 for Black individuals

Value

A numeric vector with eGFR values in ml/min/1.73 m².

Author(s)

Cristian Pattaro

References

Stevens LA, *et al.* Estimating GFR using serum cystatin C alone and in combination with serum creatinine: a pooled analysis of 3,418 individuals with CKD. *Am J Kidney Dis* 2008; **51**: 395-406.

See Also

[Stevens.cys1](#), [Stevens.creat.cys](#), [CKDEpi.cys](#)

UACR

Urinary albumin-to-creatinine ratio

Description

Calculate the urinary albumin-to-creatinine ratio

Usage

UACR(u.albumin, u.creatinine)

Arguments

u.albumin Numeric vector in mg/dL

u.creatinine Numeric vector in mg/dL; 0s will be automatically converted into NAs

Value

A numeric vector with UACR values.

Author(s)

Cristian Pattaro

References

Barratt TM, McLaine PN, Soothill JF. Albumin excretion as a measure of glomerular dysfunction in children. *Arch Dis Child*. 1970. **45**(242): 496-501

See Also

[UPCR](#)

UCR

Urea-to-creatinine ratio

Description

Calculate the plasma or serum urea-to-creatinine ratio

Usage

UCR(urea, creatinine)

Arguments

urea Numeric vector in mmol/L
creatinine Numeric vector in umol/L; 0s will be automatically converted into NAs

Value

A numeric vector with UCR values.

Author(s)

Cristian Pattaro

References

Kahn S, *et al.* The significance of serum creatinine and the blood urea/serum creatinine ratio in azotaemia *S. Afr. Med. J.* 1972; **46**: 1828-1832.

See Also

[BCR](#)

UPCR

Urinary protein-to-creatinine ratio

Description

Calculate the urinary protein-to-creatinine ratio

Usage

UPCR(u.protein, u.creatinine)

Arguments

u.protein Numeric vector in mg/dL
u.creatinine Numeric vector in mg/dL; 0s will be automatically converted into NAs

Value

A numeric vector with UPCR values.

Author(s)

Cristian Pattaro

See Also

[UACR](#)

Virga

Virga's formula

Description

Virga's formula is based on serum creatinine, sex, age, and body weight.

Usage

Virga(creatinine, sex, age, wt)

Arguments

creatinine	Numeric vector with serum or plasma creatinine values in mg/dl
sex	Numeric 0/1 vector: 0 for females, 1 for males
age	Numeric vector with age in years
wt	Numeric vector with weight in kg

Value

A numeric vector with eGFR values in $ml/min/1.73 m^2$

Author(s)

Cristian Pattaro

References

Virga G, *et al.* A new equation for estimating renal function using age, body weight and serum creatinine. *Nephron Clin Pract* 2007; **105**: c43-53.

See Also

[CG](#), [MDRD4](#)

Index

- * **BCR**
 - BCR, [5](#)
- * **BUN**
 - BCR, [5](#)
- * **CKD-EPI**
 - CKDEpi.creat, [7](#)
 - CKDEpi.creat.cys, [8](#)
 - CKDEpi.cys, [9](#)
 - CKDEpi2021.creat, [9](#)
 - CKDEpi2021.creat.cys, [10](#)
 - nephro-package, [2](#)
- * **EKFC**
 - EKFC.creat, [12](#)
 - EKFC.cys, [13](#)
 - EKFC_SF.cys, [14](#)
 - FAS.creat.cys, [15](#)
- * **EKFC**
 - nephro-package, [2](#)
- * **FAS**
 - FAS.creat, [15](#)
 - FAS.cys, [16](#)
 - nephro-package, [2](#)
- * **GFR**
 - CKDEpi.cys, [9](#)
 - EKFC.creat, [12](#)
 - EKFC.cys, [13](#)
 - EKFC_SF.cys, [14](#)
 - FAS.creat.cys, [15](#)
 - nephro-package, [2](#)
 - Stevens.creat.cys, [19](#)
 - Stevens.cys1, [20](#)
 - Stevens.cys2, [21](#)
- * **MDRD**
 - CG, [6](#)
 - MDRD4, [17](#)
 - MDRD6, [18](#)
 - nephro-package, [2](#)
- * **Pottel**
 - FAS.creat, [15](#)
 - FAS.cys, [16](#)
- * **Schwartz**
 - Schwartz.Bedside, [19](#)
- * **UACR**
 - nephro-package, [2](#)
 - UACR, [22](#)
- * **UCR**
 - UCR, [22](#)
- * **UPCR**
 - UPCR, [23](#)
- * **Virga**
 - Virga, [24](#)
- * **albuminuria**
 - nephro-package, [2](#)
 - UACR, [22](#)
- * **albumin**
 - MDRD6, [18](#)
 - UACR, [22](#)
- * **azotaemia**
 - nephro-package, [2](#)
- * **blood urea nitrogen**
 - BCR, [5](#)
 - MDRD6, [18](#)
- * **clearance**
 - CG, [6](#)
 - Virga, [24](#)
- * **conversion**
 - Convert.mgdL.mmo1L, [11](#)
 - Convert.mgdL.umolL, [12](#)
- * **creatinine**
 - BCR, [5](#)
 - CG, [6](#)
 - CKDEpi.creat, [7](#)
 - CKDEpi.creat.cys, [8](#)
 - CKDEpi.cys, [9](#)
 - CKDEpi2021.creat, [9](#)
 - CKDEpi2021.creat.cys, [10](#)
 - Convert.mgdL.mmo1L, [11](#)
 - Convert.mgdL.umolL, [12](#)

- EKFC.creat, [12](#)
 - FAS.creat, [15](#)
 - MDRD4, [17](#)
 - MDRD6, [18](#)
 - nephro-package, [2](#)
 - Schwartz.Bedside, [19](#)
 - Stevens.creat.cys, [19](#)
 - UACR, [22](#)
 - UCR, [22](#)
 - UPCR, [23](#)
 - Virga, [24](#)
 - * cystatin**
 - CKDEpi.creat.cys, [8](#)
 - CKDEpi.cys, [9](#)
 - CKDEpi2021.creat.cys, [10](#)
 - EKFC.cys, [13](#)
 - EKFC_SF.cys, [14](#)
 - FAS.creat.cys, [15](#)
 - FAS.cys, [16](#)
 - nephro-package, [2](#)
 - Stevens.creat.cys, [19](#)
 - Stevens.cys1, [20](#)
 - Stevens.cys2, [21](#)
 - * kidney function**
 - nephro-package, [2](#)
 - * proteinuria**
 - nephro-package, [2](#)
 - UPCR, [23](#)
 - * protein**
 - UPCR, [23](#)
 - * sex**
 - EKFC.cys, [13](#)
 - * urea**
 - BCR, [5](#)
 - UCR, [22](#)
- BCR, [2](#), [5](#), [23](#)
- CG, [2](#), [6](#), [17](#), [24](#)
- CKDEpi.creat, [2](#), [6](#), [7](#), [8–11](#), [13](#), [17](#)
- CKDEpi.creat.cys, [2](#), [7](#), [8](#), [9–11](#), [20](#)
- CKDEpi.cys, [2](#), [7](#), [8](#), [9](#), [10](#), [11](#), [21](#)
- CKDEpi2021.creat, [2](#), [7](#), [9](#), [11](#)
- CKDEpi2021.creat.cys, [2](#), [8](#), [10](#), [10](#)
- Convert.mgdL.mmolL, [11](#)
- Convert.mgdL.umolL, [11](#), [12](#), [12](#)
- EKFC.creat, [2](#), [12](#)
- EKFC.cys, [2](#), [13](#), [13](#), [14](#)
- EKFC_SF.cys, [2](#), [14](#), [14](#)
- FAS.creat, [2](#), [15](#), [17](#)
- FAS.creat.cys, [2](#), [15](#), [15](#), [17](#)
- FAS.cys, [2](#), [15](#), [16](#), [16](#)
- MDRD4, [2](#), [6](#), [17](#), [18](#), [24](#)
- MDRD6, [2](#), [17](#), [18](#)
- nephro (nephro-package), [2](#)
- nephro-package, [2](#)
- Schwartz.Bedside, [2](#), [19](#)
- Stevens.creat.cys, [2](#), [19](#), [21](#)
- Stevens.cys1, [2](#), [20](#), [21](#)
- Stevens.cys2, [2](#), [21](#), [21](#)
- UACR, [2](#), [22](#), [23](#)
- UCR, [2](#), [5](#), [22](#)
- UPCR, [2](#), [22](#), [23](#)
- Virga, [2](#), [6](#), [24](#)