

# Package 'egfr'

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**Type** Package

**Title** Estimated Glomerular Filtration Rate (eGFR) Calculators

**Version** 1.1.1

**Description** A comprehensive, vectorised toolkit for estimating glomerular filtration rate (eGFR) and creatinine clearance from serum creatinine, cystatin C, or both. Implements adult, paediatric, and neonatal equations, including the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations (2009, 2012, 2021), the Modification of Diet in Renal Disease (MDRD) Study equation, Cockcroft-Gault, the European Kidney Function Consortium (EKFC) equations, the Full Age Spectrum (FAS) equations, the Lund-Malmoe equations, the Berlin Initiative Study (BIS) equations, the Schwartz bedside equation, the Chronic Kidney Disease in Children Under 25 (CKiD U25) equations, the Caucasian, Asian, Paediatric, and Adult (CAPA) cystatin C equation, and a neonatal equation. Helpers for body surface area, chronic kidney disease (CKD) staging following the Kidney Disease: Improving Global Outcomes (KDIGO) guideline, and unit conversions are included. Methods are described in Levey et al. (2009) <doi:10.7326/0003-4819-150-9-200905050-00006>, Inker et al. (2021) <doi:10.1056/NEJMoa2102953>, and Pottel et al. (2021) <doi:10.7326/M20-4366>. Inspired by the 'kidney.epi' package.

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bsa	<i>Body surface area (BSA)</i>
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---

### Description

Computes body surface area, used to convert between absolute (mL/min) and BSA-normalised (mL/min/1.73m<sup>2</sup>) GFR.

### Usage

```
bsa(weight, height, method = c("dubois", "haycock", "mosteller"))
```

**Arguments**

weight            Numeric vector of body weight in kilograms.  
height            Numeric vector of height in centimetres.  
method            One of "dubois" (Du Bois & Du Bois, default), "haycock", or "mosteller".

**Value**

Numeric vector of body surface area in m<sup>2</sup>.

**References**

Du Bois D, Du Bois EF. Arch Intern Med. 1916;17:863-871. Haycock GB, et al. J Pediatr. 1978;93(1):62-66. Mosteller RD. N Engl J Med. 1987;317(17):1098.

**Examples**

```
bsa(weight = 80, height = 180)
bsa(weight = 20, height = 110, method = "haycock")
```

---

ckd_stage	<i>KDIGO CKD stage from eGFR</i>
-----------	----------------------------------

---

**Description**

Classifies eGFR values into KDIGO GFR categories (G1-G5).

**Usage**

```
ckd_stage(egfr)
```

**Arguments**

egfr              Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**Value**

Character vector of GFR categories: "G1", "G2", "G3a", "G3b", "G4", or "G5".

**References**

Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline. Kidney Int Suppl. 2013.

**Examples**

```
ckd_stage(c(95, 72, 50, 35, 20, 8))
```

---

convert\_creatinine      *Convert serum creatinine between mg/dL and umol/L*

---

**Description**

Convert serum creatinine between mg/dL and umol/L

**Usage**

```
convert_creatinine(creatinine, from = "mg/dl", to = "umol/l")
```

**Arguments**

creatinine      Numeric vector of serum creatinine.  
from, to      Units, either "mg/dl" or "umol/l".

**Value**

Numeric vector of converted creatinine.

**Examples**

```
convert_creatinine(88.4, from = "umol/l", to = "mg/dl")  
convert_creatinine(1.0, from = "mg/dl", to = "umol/l")
```

---

egfr\_bis\_cr      *Berlin Initiative Study (BIS1) creatinine eGFR (2012)*

---

**Description**

Estimates GFR from serum creatinine using the BIS1 equation (Schaeffner et al., 2012), developed in an elderly ( $\geq 70$  years) German cohort.

**Usage**

```
egfr_bis_cr(  
  creatinine,  
  age,  
  sex,  
  creatinine_units = "mg/dl",  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Schaeffner ES, Ebert N, Delanaye P, et al. Two novel equations to estimate kidney function in persons aged 70 years or older. *Ann Intern Med.* 2012;157(7):471-481. doi:10.7326/00034819157-720121002000003

**Examples**

```
egfr_bis_cr(creatinine = 1.1, age = 75, sex = "female")
```

---

 egfr\_capa

---

*CAPA paediatric cystatin C eGFR (2014)*


---

**Description**

Estimates GFR from serum cystatin C using the Caucasian, Asian, paediatric, and adult (CAPA) equation (Grubb et al., 2014).

**Usage**

```
egfr_capa(cystatin, age)
```

**Arguments**

cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Grubb A, Horio M, Hansson LO, et al. Generation of a new cystatin C-based estimating equation for GFR by use of 7 assays standardized to the international calibrator. Clin Chem. 2014;60(7):974-986. doi:10.1373/clinchem.2013.220707

## Examples

```
egfr_capa(cystatin = 1.0, age = 12)
```

---

```
egfr_ckdepi_cr_2009    CKD-EPI 2009 creatinine eGFR (with race coefficient)
```

---

## Description

Estimates GFR from serum creatinine using the original CKD-EPI 2009 creatinine equation (Levey et al., 2009), which includes a race coefficient. Retained for historical comparison; the race-free [egfr\\_ckdepi\\_cr\\_2021\(\)](#) is now recommended.

## Usage

```
egfr_ckdepi_cr_2009(
  creatinine,
  age,
  sex,
  ethnicity = NULL,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female",
  label_afroamerican = c("black", "Black")
)
```

## Arguments

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
ethnicity	Optional vector of ethnicity labels. Records matching label_afroamerican receive the Black race coefficient (1.159); all others receive 1.0. If NULL (default) no race coefficient is applied.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".
label_afroamerican	Values in ethnicity denoting Black/African American race. Defaults to c("black", "Black").

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Levey AS, Stevens LA, Schmid CH, et al. A new equation to estimate glomerular filtration rate. *Ann Intern Med.* 2009;150(9):604-612. doi:10.7326/00034819150920090505000006

**Examples**

```
egfr_ckdepi_cr_2009(creatinine = 1.0, age = 50, sex = "female")
egfr_ckdepi_cr_2009(1.0, 50, "female",
  ethnicity = "black", label_afroamerican = "black"
)
```

---

egfr\_ckdepi\_cr\_2021     *CKD-EPI 2021 creatinine eGFR (race-free)*

---

**Description**

Estimates GFR from serum creatinine using the race-free CKD-EPI 2021 creatinine equation (Inker et al., 2021). This is the equation recommended for adults ( $\geq 18$  years) by current US guidelines.

**Usage**

```
egfr_ckdepi_cr_2021(
  creatinine,
  age,
  sex,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female"
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

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(19):1737-1749. doi:10.1056/NEJMoa2102953

**Examples**

```
egfr_ckdepi_cr_2021(creatinine = 1.0, age = 50, sex = "female")
egfr_ckdepi_cr_2021(c(0.8, 1.2), c(40, 65), c("female", "male"))
```

---

```
egfr_ckdepi_cr_cys_2021
```

*CKD-EPI 2021 combined creatinine + cystatin C eGFR (race-free)*

---

**Description**

Estimates GFR using both serum creatinine and cystatin C with the race-free CKD-EPI 2021 combined equation (Inker et al., 2021). This is the most accurate of the CKD-EPI equations when both biomarkers are available.

**Usage**

```
egfr_ckdepi_cr_cys_2021(
  creatinine,
  cystatin,
  age,
  sex,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female"
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Inker LA, Eneanya ND, Coresh J, et al. N Engl J Med. 2021;385(19):1737-1749. doi:10.1056/NEJMoa2102953

## Examples

```
egfr_ckdepi_cr_cys_2021(  
  creatinine = 1.0, cystatin = 0.9,  
  age = 50, sex = "female"  
)
```

---

egfr\_ckdepi\_cys\_2012 *CKD-EPI 2012 cystatin C eGFR*

---

## Description

Estimates GFR from serum cystatin C using the CKD-EPI 2012 cystatin C equation (Inker et al., 2012). The formula is identical to the race-free 2021 cystatin C equation and is retained for backward compatibility.

## Usage

```
egfr_ckdepi_cys_2012(  
  cystatin,  
  age,  
  sex,  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

## Arguments

cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

## Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Inker LA, Schmid CH, Tighiouart H, et al. Estimating GFR from serum creatinine and cystatin C. N Engl J Med. 2012;367(1):20-29. doi:10.1056/NEJMoa1114248

## Examples

```
egfr_ckdepi_cys_2012(cystatin = 0.9, age = 55, sex = "male")
```

---

```
egfr_ckdepi_cys_2021  CKD-EPI 2021 cystatin C eGFR (race-free)
```

---

## Description

Estimates GFR from serum cystatin C using the race-free CKD-EPI 2021 cystatin C equation (Inker et al., 2021). The identical formula was first published in 2012; see [egfr\\_ckdepi\\_cys\\_2012\(\)](#).

## Usage

```
egfr_ckdepi_cys_2021(  
  cystatin,  
  age,  
  sex,  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

## Arguments

cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

## Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Inker LA, Eneanya ND, Coresh J, et al. N Engl J Med. 2021;385(19):1737-1749. doi:10.1056/NEJMoa2102953

## Examples

```
egfr_ckdepi_cys_2021(cystatin = 0.9, age = 55, sex = "male")
```

---

egfr_ckid_u25_cr	<i>CKiD U25 creatinine eGFR</i>
------------------	---------------------------------

---

**Description**

Estimates GFR in children and young adults (ages 1-25) using the CKiD U25 creatinine equation (Pierce et al., 2021). This is the first-choice paediatric equation.

**Usage**

```
egfr_ckid_u25_cr(
  creatinine,
  age,
  sex,
  height,
  creatinine_units = "mg/dl",
  height_units = "cm",
  label_sex_male = "male",
  label_sex_female = "female"
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
height	Numeric vector of height.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
height_units	Units of height: "cm" (default) or "m".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pierce CB, Munoz A, Ng DK, Warady BA, Furth SL, Schwartz GJ. Age- and sex-dependent clinical equations to estimate GFR in children and young adults with CKD. *Kidney Int.* 2021;99(4):948-956. doi:10.1016/j.kint.2020.10.047

**Examples**

```
egfr_ckid_u25_cr(creatinine = 0.6, age = 10, sex = "male", height = 140)
```

---

egfr\_ckid\_u25\_cr\_cys *CKiD U25 combined creatinine + cystatin C eGFR*

---

## Description

Arithmetic mean of the CKiD U25 creatinine (`egfr_ckid_u25_cr()`) and cystatin C (`egfr_ckid_u25_cys()`) estimates.

## Usage

```
egfr_ckid_u25_cr_cys(
  creatinine,
  cystatin,
  age,
  sex,
  height,
  creatinine_units = "mg/dl",
  height_units = "cm",
  label_sex_male = "male",
  label_sex_female = "female"
)
```

## Arguments

<code>creatinine</code>	Numeric vector of serum creatinine.
<code>cystatin</code>	Numeric vector of serum cystatin C in mg/L.
<code>age</code>	Numeric vector of age in years.
<code>sex</code>	Vector of sex labels (see <code>label_sex_male</code> / <code>label_sex_female</code> ).
<code>height</code>	Numeric vector of height.
<code>creatinine_units</code>	Units of creatinine: "mg/dl" (default) or "umol/l".
<code>height_units</code>	Units of height: "cm" (default) or "m".
<code>label_sex_male</code> , <code>label_sex_female</code>	Values in <code>sex</code> that denote male and female records. Defaults to "male"/"female".

## Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Pierce CB, et al. *Kidney Int.* 2021;99(4):948-956. doi:10.1016/j.kint.2020.10.047

**Examples**

```
egfr_ckid_u25_cr_cys(
  creatinine = 0.6, cystatin = 0.8, age = 10,
  sex = "male", height = 140
)
```

---

```
egfr_ckid_u25_cr_extended
      CKiD U25 extended creatinine eGFR (to age 30)
```

---

**Description**

Research extension of `egfr_ckid_u25_cr()` with kappa values that continue to age 30.

**Usage**

```
egfr_ckid_u25_cr_extended(
  creatinine,
  age,
  sex,
  height,
  creatinine_units = "mg/dl",
  height_units = "cm",
  label_sex_male = "male",
  label_sex_female = "female"
)
```

**Arguments**

<code>creatinine</code>	Numeric vector of serum creatinine.
<code>age</code>	Numeric vector of age in years.
<code>sex</code>	Vector of sex labels (see <code>label_sex_male</code> / <code>label_sex_female</code> ).
<code>height</code>	Numeric vector of height.
<code>creatinine_units</code>	Units of creatinine: "mg/dl" (default) or "umol/l".
<code>height_units</code>	Units of height: "cm" (default) or "m".
<code>label_sex_male</code> , <code>label_sex_female</code>	Values in <code>sex</code> that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pierce CB, et al. *Kidney Int.* 2021;99(4):948-956. doi:10.1016/j.kint.2020.10.047

**Examples**

```
egfr_ckid_u25_cr_extended(
  creatinine = 1.0, age = 28, sex = "female",
  height = 165
)
```

---

egfr_ckid_u25_cys	<i>CKiD U25 cystatin C eGFR</i>
-------------------	---------------------------------

---

**Description**

Estimates GFR in children and young adults (ages 1-25) using the CKiD U25 cystatin C equation (Pierce et al., 2021).

**Usage**

```
egfr_ckid_u25_cys(
  cystatin,
  age,
  sex,
  label_sex_male = "male",
  label_sex_female = "female"
)
```

**Arguments**

cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pierce CB, et al. *Kidney Int.* 2021;99(4):948-956. doi:10.1016/j.kint.2020.10.047

**Examples**

```
egfr_ckid_u25_cys(cystatin = 0.8, age = 10, sex = "male")
```

---

egfr\_cockcroft\_gault *Cockcroft-Gault creatinine clearance*

---

### Description

Estimates creatinine clearance (not BSA-normalised eGFR) using the Cockcroft-Gault equation (Cockcroft & Gault, 1976). Commonly used for drug dosing.

### Usage

```
egfr_cockcroft_gault(  
  creatinine,  
  age,  
  sex,  
  weight,  
  creatinine_units = "mg/dl",  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

### Arguments

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
weight	Numeric vector of body weight in kilograms.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

### Value

Numeric vector of creatinine clearance in mL/min.

### References

Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron*. 1976;16(1):31-41. doi:10.1159/000180580

### Examples

```
egfr_cockcroft_gault(creatinine = 1.0, age = 50, sex = "male", weight = 80)
```

egfr\_ekfc\_cr

*EKFC creatinine eGFR (2021)***Description**

Estimates GFR from serum creatinine using the European Kidney Function Consortium (EKFC) creatinine equation (Pottel et al., 2021). Valid across the full age spectrum (2-120 years).

**Usage**

```
egfr_ekfc_cr(
  creatinine,
  age,
  sex,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female",
  q = NULL
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".
q	Optional numeric vector of the reference creatinine Q value (median creatinine for the age/sex, in mg/dL). When NULL (the default) the built-in EKFC reference Q is used; supply a value to use a population-, assay-, or individual-specific Q. Recycled to the length of the other inputs.

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pottel H, Bjork J, Courbebaisse M, et al. Development and validation of a modified full age spectrum creatinine-based equation to estimate glomerular filtration rate. *Ann Intern Med.* 2021;174(2):183-191. doi:[10.7326/M204366](https://doi.org/10.7326/M204366)

**Examples**

```
egfr_ekfc_cr(creatinine = 1.0, age = 50, sex = "female")
egfr_ekfc_cr(0.5, 8, "male")
egfr_ekfc_cr(1.0, 50, "female", q = 0.72)
```

---

egfr_ekfc_cr_cys	<i>EKFC combined creatinine + cystatin C eGFR (2023)</i>
------------------	--

---

**Description**

Arithmetic mean of the EKFC creatinine (`egfr_ekfc_cr()`) and EKFC cystatin C (`egfr_ekfc_cys()`) estimates.

**Usage**

```
egfr_ekfc_cr_cys(
  creatinine,
  cystatin,
  age,
  sex,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female",
  q_cr = NULL,
  q_cys = NULL
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
sex	Vector of sex labels (see <code>label_sex_male</code> / <code>label_sex_female</code> ).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".
q_cr	Optional numeric vector of the reference creatinine Q value (median creatinine, in mg/dL) passed to <code>egfr_ekfc_cr()</code> . NULL (default) uses the built-in EKFC reference Q.
q_cys	Optional numeric vector of the reference cystatin C Q value (median cystatin C, in mg/L) passed to <code>egfr_ekfc_cys()</code> . NULL (default) uses the built-in EKFC reference Q.

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pottel H, Bjork J, Rule AD, et al. N Engl J Med. 2023;388(4):333-343. doi:10.1056/NEJMoa2203769

**Examples**

```
egfr_ekfc_cr_cys(creatinine = 1.0, cystatin = 0.9, age = 50, sex = "female")
```

---

egfr_ekfc_cys	<i>EKFC cystatin C eGFR (2023)</i>
---------------	------------------------------------

---

**Description**

Estimates GFR from serum cystatin C using the sex- and race-free EKFC cystatin C equation (Pottel et al., 2023).

**Usage**

```
egfr_ekfc_cys(cystatin, age, q = NULL)
```

**Arguments**

cystatin	Numeric vector of serum cystatin C in mg/L.
age	Numeric vector of age in years.
q	Optional numeric vector of the reference cystatin C Q value (median cystatin C, in mg/L). When NULL (the default) the built-in age-based EKFC reference Q is used; supply a value to use a population- or individual-specific Q. Recycled to the length of the other inputs.

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pottel H, Bjork 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(4):333-343. doi:10.1056/NEJMoa2203769

**Examples**

```
egfr_ekfc_cys(cystatin = 0.9, age = 50)
egfr_ekfc_cys(0.9, 50, q = 0.85)
```

---

`egfr_fas_cr`*Full Age Spectrum (FAS) creatinine eGFR*

---

**Description**

Estimates GFR from serum creatinine using the Full Age Spectrum equation (Pottel et al., 2016). Uses adult reference Q values (male 0.90, female 0.70 mg/dL) across all ages.

**Usage**

```
egfr_fas_cr(  
  creatinine,  
  age,  
  sex,  
  creatinine_units = "mg/dl",  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

**Arguments**

<code>creatinine</code>	Numeric vector of serum creatinine.
<code>age</code>	Numeric vector of age in years.
<code>sex</code>	Vector of sex labels (see <code>label_sex_male</code> / <code>label_sex_female</code> ).
<code>creatinine_units</code>	Units of creatinine: "mg/dl" (default) or "umol/l".
<code>label_sex_male</code> , <code>label_sex_female</code>	Values in <code>sex</code> that denote male and female records. Defaults to "male"/"female".

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Pottel H, Hoste L, Dubourg L, et al. An estimated glomerular filtration rate equation for the full age spectrum. *Nephrol Dial Transplant*. 2016;31(5):798-806. doi:10.1093/ndt/gfv454

**Examples**

```
egfr_fas_cr(creatinine = 1.0, age = 50, sex = "female")
```

---

egfr\_lund\_malmo      *Lund-Malmo Revised creatinine eGFR (2011)*

---

### Description

Estimates GFR from serum creatinine using the revised Lund-Malmo equation (Bjork et al., 2011). Piecewise-linear in plasma creatinine (umol/L) with sex-specific knots.

### Usage

```
egfr_lund_malmo(  
  creatinine,  
  age,  
  sex,  
  creatinine_units = "mg/dl",  
  label_sex_male = "male",  
  label_sex_female = "female"  
)
```

### Arguments

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".

### Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

### References

Bjork J, Grubb A, Sterner G, Nyman U. Revised equations for estimating glomerular filtration rate based on the Lund-Malmo Study cohort. *Scand J Clin Lab Invest.* 2011;71(3):232-239. [doi:10.3109/00365513.2011.557086](https://doi.org/10.3109/00365513.2011.557086)

### Examples

```
egfr_lund_malmo(creatinine = 1.0, age = 50, sex = "female")
```

egfr\_mdrd

*MDRD 4-variable eGFR (IDMS-standardised)***Description**

Estimates GFR from serum creatinine using the IDMS-traceable 4-variable MDRD Study equation (Levey et al., 2006). Historical; superseded by CKD-EPI for clinical use.

**Usage**

```
egfr_mdrd(
  creatinine,
  age,
  sex,
  ethnicity = NULL,
  creatinine_units = "mg/dl",
  label_sex_male = "male",
  label_sex_female = "female",
  label_afroamerican = c("black", "Black")
)
```

**Arguments**

creatinine	Numeric vector of serum creatinine.
age	Numeric vector of age in years.
sex	Vector of sex labels (see label_sex_male/label_sex_female).
ethnicity	Optional vector of ethnicity labels. Records matching label_afroamerican receive the Black race coefficient (1.159); all others receive 1.0. If NULL (default) no race coefficient is applied.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
label_sex_male, label_sex_female	Values in sex that denote male and female records. Defaults to "male"/"female".
label_afroamerican	Values in ethnicity denoting Black/African American race. Defaults to c("black", "Black").

**Value**

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

**References**

Levey AS, Coresh J, Greene T, et al. Using standardized serum creatinine values in the MDRD study equation. *Ann Intern Med.* 2006;145(4):247-254. doi:[10.7326/00034819145420060815000004](https://doi.org/10.7326/00034819145420060815000004)

## Examples

```
egfr_mdrd(creatinine = 1.2, age = 60, sex = "male")
```

---

egfr_neonatal	<i>Neonatal creatinine eGFR (2022)</i>
---------------	--

---

## Description

Estimates GFR in term-born neonates using the equation of Smeets et al. (2022). Requires IDMS-standardised creatinine.

## Usage

```
egfr_neonatal(  
  creatinine,  
  height,  
  creatinine_units = "mg/dl",  
  height_units = "cm"  
)
```

## Arguments

creatinine	Numeric vector of serum creatinine.
height	Numeric vector of height.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
height_units	Units of height: "cm" (default) or "m".

## Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

## References

Smeets NJL, IntHout J, van der Burgh MJP, et al. SCr- and cystatin C-based equations to estimate GFR in term-born neonates. *J Am Soc Nephrol.* 2022;33(7):1277-1292. doi:10.1681/ASN.2021111453

## Examples

```
egfr_neonatal(creatinine = 0.5, height = 50)
```

---

egfr_schwartz	<i>Schwartz bedside paediatric eGFR (2009)</i>
---------------	--

---

### Description

Estimates GFR in children using the bedside Schwartz equation (Schwartz et al., 2009). Requires IDMS-standardised creatinine.

### Usage

```
egfr_schwartz(  
  creatinine,  
  height,  
  creatinine_units = "mg/dl",  
  height_units = "cm"  
)
```

### Arguments

creatinine	Numeric vector of serum creatinine.
height	Numeric vector of height.
creatinine_units	Units of creatinine: "mg/dl" (default) or "umol/l".
height_units	Units of height: "cm" (default) or "m".

### Value

Numeric vector of eGFR in mL/min/1.73m<sup>2</sup>.

### References

Schwartz GJ, Munoz A, Schneider MF, et al. New equations to estimate GFR in children with CKD. J Am Soc Nephrol. 2009;20(3):629-637. doi:10.1681/ASN.2008030287

### Examples

```
egfr_schwartz(creatinine = 0.5, height = 120)
```

---

gfr_bsa_adjust	<i>Normalise or de-normalise GFR using body surface area</i>
----------------	--

---

**Description**

Converts between absolute creatinine clearance (mL/min) and BSA-normalised GFR (mL/min/1.73m<sup>2</sup>).

**Usage**

```
gfr_bsa_adjust(gfr, bsa, to = c("normalized", "absolute"))
```

**Arguments**

gfr	Numeric vector of GFR values.
bsa	Numeric vector of body surface area in m <sup>2</sup> (e.g. from <a href="#">bsa()</a> ).
to	Either "normalized" (absolute -> per 1.73m <sup>2</sup> , the default) or "absolute" (per 1.73m <sup>2</sup> -> absolute).

**Value**

Numeric vector of converted GFR.

**Examples**

```
gfr_bsa_adjust(100, bsa = 2.0, to = "normalized")  
gfr_bsa_adjust(90, bsa = 2.0, to = "absolute")
```

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