Package ‘kfre’

May 8, 2026

Type Package

Title Kidney Failure Risk Equation (KFRE) Tools

Version 0.0.2

Description Implements the Kidney Failure Risk Equation (KFRE; Tangri and colleagues (2011) <doi:10.1001/jama.2011.451>; Tangri and colleagues (2016) <doi:10.1001/jama.2015.18202>) to compute 2- and 5-year kidney failure risk using 4-, 6-, and 8-variable models. Includes helpers to append risk columns to data frames, classify chronic kidney disease (CKD) stages and end-stage renal disease (ESRD) outcomes, and evaluate and plot model performance.

License MIT + file LICENSE

URL `https://github.com/lshpaner/kfre_r`, `https://lshpaner.github.io/kfre_r/`

BugReports `https://github.com/lshpaner/kfre_r/issues`

Depends R (>= 3.6)

Imports ggplot2, grDevices, R6

Suggests devtools, knitr, readxl, rmarkdown, rprojroot, spelling, svglite, testthat (>= 3.0.0)

Config/testthat/edition 3

Encoding UTF-8

RoxygenNote 7.3.2

VignetteBuilder knitr

Language en-US

NeedsCompilation no

Author Leonid Shpaner [aut, cre] (ORCID: <`https://orcid.org/0009-0007-5311-8095`>, URL: https://www.leonshpaner.com)

Maintainer Leonid Shpaner <`lshpaner@ucla.edu`>

Repository CRAN

Date/Publication 2025-08-28 07:40:12 UTC

Contents

`add_kfre_risk_col` *Add KFRE risk columns to a data frame*

Description

Adds KFRE risk columns for selected model sizes and horizons using the 4, 6, or 8 variable equations.

Usage

```
add_kfre_risk_col(
  df,
  age_col = NULL,
  sex_col = NULL,
  eGFR_col = NULL,
  uACR_col = NULL,
  dm_col = NULL,
  htn_col = NULL,
  albumin_col = NULL,
  phosphorous_col = NULL,
  bicarbonate_col = NULL,
  calcium_col = NULL,
  num_vars = 8,
  years = c(2, 5),
  is_north_american = FALSE,
  copy = TRUE,
  precision = NULL
)
```

Arguments

`df`	Data frame with predictor columns.
`age_col`	Column name for age.
`sex_col`	Column name for sex, text or integer accepted.
`eGFR_col`	Column name for eGFR, mL/min/1.73 m^2.
`uACR_col`	Column name for uACR, mg/g.
`dm_col`	Optional column name for diabetes indicator.
`htn_col`	Optional column name for hypertension indicator.
`albumin_col`	Optional column name for serum albumin, g/dL.
`phosphorous_col`	Optional column name for serum phosphorus, mg/dL.
`bicarbonate_col`	Optional column name for bicarbonate, mmol/L.
`calcium_col`	Optional column name for calcium, mg/dL.
`num_vars`	Integer or vector, one of 4, 6, 8.
`years`	Integer or vector, any of 2, 5.
`is_north_american`	Logical, use North American calibration.
`copy`	Logical, if TRUE work on a copy of `df`.
`precision`	Optional integer, digits to round probabilities.

Value

The input data frame with added `kfre_<n>var_<y>year` columns.

References

Tangri, N., Stevens, L. A., Griffith, J., Tighiouart, H., Djurdjev, O., Naimark, D., Levin, A., & Levey, A. S. (2011). A predictive model for progression of chronic kidney disease to kidney failure. *JAMA*, 305(15), 1553–1559. doi:10.1001/jama.2011.451

Tangri, N., Grams, M. E., Levey, A. S., et al. (2016). Multinational assessment of the accuracy of the Kidney Failure Risk Equation in people with chronic kidney disease. *JAMA*, 315(2), 164–174. doi:10.1001/jama.2015.18202

Examples

```
df <- data.frame(
  age = 60L, sex = 1L, eGFR = 30, uACR = 500,
  dm = 1L, htn = 0L, albumin = 40,
  phosphorous = 1.1, bicarbonate = 24, calcium = 9.2
)

add_kfre_risk_col(
  df,
  age_col = "age", sex_col = "sex",
```

```
  eGFR_col = "eGFR", uACR_col = "uACR",
  num_vars = 4, years = 2
)
```

`apply_precision` *Apply precision (round helper)*

Description

Simple wrapper around base `round()` used by tests and examples.

Usage

```
apply_precision(x, n = NULL)
```

Arguments

`x`	Numeric vector.
`n`	Integer number of digits to keep. If NULL, return x unchanged.

Value

Numeric vector rounded to `n`.

`class_ckd_stages` *Label CKD stages or ESRD outcomes.*

Description

Label CKD stages or ESRD outcomes.

Usage

```
class_ckd_stages(
  df,
  egfr_col = "eGFR",
  stage_col = NULL,
  combined_stage_col = NULL
)
```

Arguments

`df`	Data frame input.
`egfr_col`	Column name for eGFR, mL/min/1.73 m^2.
`stage_col`	Output column name for detailed CKD stages.
`combined_stage_col`	Output column for combined stages 3 to 5.

Value

The modified data frame with added label columns.

Examples

```
df <- data.frame(eGFR = c(92, 58, 42, 28, 12))
class_ckd_stages(df, egfr_col = "eGFR")
```

`class_esrd_outcome` *Label CKD stages or ESRD outcomes.*

Description

Label CKD stages or ESRD outcomes.

Usage

```
class_esrd_outcome(
  df,
  col,
  years,
  duration_col,
  prefix = NULL,
  create_years_col = TRUE
)
```

Arguments

`df`	Data frame with an eGFR column.
`col`	Column name with ESRD event indicator, 0 or 1.
`years`	Integer horizon, 2 or 5.
`duration_col`	Column name with follow up time in days.
`prefix`	Optional prefix for the derived outcome column.
`create_years_col`	Logical, add a `<years>_year_outcome` column.

Value

The modified data frame with added label columns.

Examples

```
df <- data.frame(
  eGFR = c(90, 45, 25, 10),
  esrd = c(0, 0, 1, 0),
  followup_days = c(365, 800, 500, 1200)
)
class_esrd_outcome(
  df,
  col = "esrd",
  years = 2,
  duration_col = "followup_days"
)
```

`eval_kfre_metrics` *Summarize KFRE performance metrics by model size and horizon*

Description

Builds a wide table of Precision, Sensitivity, Specificity, AUC, Brier, and Average Precision for specified KFRE variants at 2 and 5 years.

Usage

```
eval_kfre_metrics(df, n_var_list, outcome_years = 2, decimal_places = 6)
```

Arguments

`df`	Data frame with truth and probability columns.
`n_var_list`	Integer vector of models to evaluate, any of 4, 6, 8.
`outcome_years`	Integer vector of horizons, any of 2, 5.
`decimal_places`	Integer digits to round displayed values.

Value

Data frame of metrics with one column per model-horizon.

`kfre` *kfre: KFRE Risk Prediction Tools (R)*

Description

Implements the Kidney Failure Risk Equation (KFRE; Tangri et al.) to compute 2- and 5-year risk (4-, 6-, and 8-variable models), add risk columns to data frames, classify CKD stages/ESRD outcomes, and evaluate & plot performance.

Key functions

- `risk_pred_core()`
- `add_kfre_risk_col()`
- `eval_kfre_metrics()`, `plot_kfre_metrics()`
- `class_esrd_outcome()`, `class_ckd_stages()`

Author(s)

Leonid Shpaner <`lshpaner@ucla.edu`> (ORCID)
`https://github.com/lshpaner/kfre_r`
`https://www.leonshpaner.com/`

See Also

`https://github.com/lshpaner/kfre_r`

`perform_conversions` *Perform unit and code conversions used by KFRE helpers.*

Description

Perform unit and code conversions used by KFRE helpers.

Usage

```
perform_conversions(
  df,
  reverse = FALSE,
  convert_all = FALSE,
  upcr_col = NULL,
  calcium_col = NULL,
  phosphate_col = NULL,
  albumin_col = NULL
)
```

Arguments

`df`	Data frame with source columns to convert.
`reverse`	Logical, reverse the conversion if `TRUE`.
`convert_all`	Logical, convert all known columns if `TRUE`.
`upcr_col`	Column name for urine protein creatinine ratio.
`calcium_col`	Optional column for serum calcium, mg/dL.
`phosphate_col`	Optional column for serum phosphorus, mg/dL.
`albumin_col`	Optional column for serum albumin, g/dL.

Value

A data frame with converted columns.

Examples

```
df <- data.frame(
  upcr = c(100, 400),         # mg/g (or g/g scaled accordingly)
  albumin = c(40, 38),        # g/L
  phosphorous = c(1.1, 1.3),  # mmol/L
  calcium = c(9.2, 8.8)       # mg/dL
)
perform_conversions(df)
```

`plot_kfre_metrics` *Plot ROC and Precision Recall curves for KFRE variants*

Description

Draws ROC and PR curves for the selected models and horizons. When `mode` is "both", returns a list of ggplot objects. Otherwise, draws the plots and returns `NULL` invisibly.

Arguments

`df`	Data frame containing model probabilities and outcomes.
`num_vars`	Integer vector, KFRE model sizes to plot, any of 4, 6, 8.
`fig_size`	Numeric length 2, plot device width and height.
`mode`	Character, "both" to return plots, otherwise draw only.
`image_path_png`	Optional directory to save PNGs.
`image_path_svg`	Optional directory to save SVGs.
`image_prefix`	Optional filename prefix.
`bbox_inches`	Character, passed through when saving.
`plot_type`	Character, which plots to render.
`save_plots`	Logical, save plots to disk if TRUE.

`show_years`	Integer vector, horizons to show, any of 2, 5.
`plot_combinations`	Logical, if TRUE draw pairwise overlays.
`show_subplots`	Logical, arrange subplots when TRUE.
`decimal_places`	Integer digits for annotations.
`open_new_device`	Logical, open device before plotting.

Value

List of ggplot objects when `mode == "both"`, else `NULL`.

`risk_pred_core` *KFRE risk prediction for a single person*

Description

Computes the Kidney Failure Risk Equation probability at 2 or 5 years.

Usage

```
risk_pred_core(
  age,
  sex,
  eGFR,
  uACR,
  is_north_american,
  dm = NULL,
  htn = NULL,
  albumin = NULL,
  phosphorous = NULL,
  bicarbonate = NULL,
  calcium = NULL,
  years = 2
)
```

Arguments

`age`	Numeric age in years.
`sex`	Integer sex indicator, 1 for male, 0 for female.
`eGFR`	Estimated glomerular filtration rate, mL/min/1.73 m^2.
`uACR`	Urine albumin to creatinine ratio, mg/g.
`is_north_american`	Logical, patient from a North American cohort.
`dm`	Optional integer diabetes indicator, 1 yes, 0 no.

`htn`	Optional integer hypertension indicator, 1 yes, 0 no.
`albumin`	Optional serum albumin, g/dL, required for 8 variable model.
`phosphorous`	Optional serum phosphorus, mg/dL, 8 variable model.
`bicarbonate`	Optional serum bicarbonate, mmol/L, 8 variable model.
`calcium`	Optional serum calcium, mg/dL, 8 variable model.
`years`	Integer, prediction horizon, 2 or 5.

Value

Numeric probability between 0 and 1.

References

Tangri, N., Stevens, L. A., Griffith, J., Tighiouart, H., Djurdjev, O., Naimark, D., Levin, A., & Levey, A. S. (2011). A predictive model for progression of chronic kidney disease to kidney failure. *JAMA*, 305(15), 1553–1559. doi:10.1001/jama.2011.451

Tangri, N., Grams, M. E., Levey, A. S., et al. (2016). Multinational assessment of the accuracy of the Kidney Failure Risk Equation in people with chronic kidney disease. *JAMA*, 315(2), 164–174. doi:10.1001/jama.2015.18202

Examples

```
risk_pred_core(60, 1, 45, 120, TRUE, dm = 1, htn = 1, years = 2)
```

`upcr_uacr` *Convert UPCR to UACR with clinical covariates*

Description

Implements the equation reported by Sumida et al. for converting urine protein–creatinine ratio to urine albumin–creatinine ratio, with adjustments for sex, diabetes, and hypertension.

Usage

```
upcr_uacr(
  df,
  sex_col,
  diabetes_col,
  hypertension_col,
  upcr_col,
  female_str = "female"
)
```

Arguments

`df`	A data.frame containing the required columns.
`sex_col`	Column name with sex labels, character. Example: "sex".
`diabetes_col`	Column name with diabetes indicator, 0 or 1, or logical. Example: "diabetes".
`hypertension_col`	Column name with hypertension indicator, 0 or 1, or logical. Example: "hypertension".
`upcr_col`	Column name with UPCR values. Units should match those used to derive the model in Sumida et al. (mg/g). If your data use different units, convert before calling.
`female_str`	String that denotes female in `sex_col`. Default is "female".

Details

The function applies a piecewise log transformation of UPCR with cut points at 50 and 500, and adds covariate adjustments for sex, diabetes, and hypertension, then exponentiates to return UACR. Valid rows require non missing diabetes and hypertension indicators. Sex is mapped to an indicator using `female_str`.

Value

A numeric vector of UACR values, length `nrow(df)`. Non valid rows return `NA_real_`.

References

Sumida, K., Nadkarni, G. N., Grams, M. E., Sang, Y., Ballew, S. H., Coresh, J., Matsushita, K., Surapaneni, A., Brunskill, N., Chadban, S. J., Chang, A. R., Cirillo, M., Daratha, K. B., Gansevoort, R. T., Garg, A. X., Iacoviello, L., Kayama, T., Konta, T., Kovesdy, C. P., Lash, J., Lee, B. J., Major, R. W., Metzger, M., Miura, K., Naimark, D. M. J., Nelson, R. G., Sawhney, S., Stempniewicz, N., Tang, M., Townsend, R. R., Traynor, J. P., Valdivielso, J. M., Wetzels, J., Polkinghorne, K. R., and Heerspink, H. J. L. (2020). Conversion of urine protein-creatinine ratio or urine dipstick protein to urine albumin-creatinine ratio for use in chronic kidney disease screening and prognosis. *Annals of Internal Medicine*, 173(6), 426-435. doi:10.7326/M200529

Examples

```
df <- data.frame(
  sex = c("female", "male"),
  diabetes = c(1, 0),
  hypertension = c(0, 1),
  upcr = c(100, 400)  # mg/g (or same ratio units)
)
upcr_uacr(df, "sex", "diabetes", "hypertension", "upcr")
```

Index