Package 'essential8'

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Title Reproducible Cardiovascular Health Metric Scoring

Version 0.1.0

Description Provides a reproducible R implementation of the American Heart Association Life's Essential 8 cardiovascular health scoring framework for complete adult records from people aged 20 years or older. Calculates the eight component scores and their unweighted composite score using the 2022 adult definition described by Lloyd-Jones et al. (2022) <doi:10.1161/CIR.0000000000001078>.

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URL https://thatoneguy006.github.io/essential8/, https://github.com/thatoneguy006/essential8

BugReports https://github.com/thatoneguy006/essential8/issues

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score_le8 *Score Life's Essential 8 cardiovascular health*

Description

Computes the eight adult Life's Essential 8 (LE8) component scores and their unweighted mean using the American Heart Association's 2022 Presidential Advisory. This initial implementation requires complete data for every required input and applies only to adults aged 20 years or older.

Usage

```
score_le8(data, diet_method = "mepa", mepa_columns = NULL)
```

Arguments

`data`	A data frame with one row per adult and the required columns described below.
`diet_method`	A single diet-scoring method applied to every row in `data`: `"mepa"` (the default) or `"percentile"`. Values are matched case-insensitively. Score data that use different methods in separate calls.
`mepa_columns`	`NULL`, or a named character vector mapping canonical MEPA fields to columns in `data`. The names are canonical fields and the values are actual column names. Unmapped fields use their canonical names.

Value

A data frame containing the original columns plus `mepa_total` (missing for population-percentile rows), `physical_activity_moderate_equivalent_minutes`, the eight component score columns prefixed with `le8_`, `le8_composite_score`, and `le8_category`. The composite score is the exact, unrounded mean. Categories are `"low"` for scores below 50, `"moderate"` for scores from 50 to less than 80, and `"high"` for scores of at least 80.

Required columns

- `age`: Age in years; must be at least 20.
- For `diet_method = "mepa"`, the 16 Table C screener-item columns named below and `sex` (or `female` when `sex` is absent). The item names are matched exactly after case normalization. Supply daily servings in `olive_oil`, `green_leafy_vegetables`, `other_vegetables`, and `whole_grains`; supply weekly servings or frequency in `berries`, `other_fruit`, `meat`, `fish`, `chicken`, `cheese`, `butter_cream`, `beans`, `sweets_and_pastries`, `nuts`, and `alcohol`; supply the number of times per week that fast-food meals are consumed in `fast_food`. Sex may be encoded as `"m"`/`"f"`, `"male"`/`"female"`, or `0`/`1`, where `0` is male and `1` is female. Character encodings are matched case-insensitively, and character `"0"`/`"1"` values are also accepted.
- `diet_value`: Required only when `diet_method = "percentile"`. Supply a DASH or HEI-2015 percentile from 1 to 100, calculated against the relevant reference distribution. The function does not rank supplied rows against one another. If this column is present for MEPA data, all its values must be missing.

- `moderate_activity_minutes` and `vigorous_activity_minutes`: Weekly minutes. Each vigorous minute counts as two moderate-equivalent minutes.
- `smoking_status`: One of `"never"`, `"former"`, or `"current"`.
- `years_since_quit`: Years since quitting combustible tobacco. This is used only when `smoking_status` is `"former"`.
- `current_inhaled_nds`: Whether an inhaled nicotine-delivery system is currently used.
- `secondhand_smoke_home`: Whether the adult lives with an active indoor smoker.
- `sleep_hours`: Average hours of sleep per night.
- `bmi`: Body mass index in kg/m^2. Values below 18.5 are not scored because the AHA advisory defers to clinician judgment for underweight adults.
- `bmi_profile`: Either `"general"` or `"asian_pacific"`. The function never infers a profile from race or ethnicity.
- `non_hdl_cholesterol`: Non-HDL cholesterol in mg/dL.
- `lipid_lowering_treatment`: Whether the lipid value is drug treated.
- `diabetes`: Whether diabetes has been diagnosed.
- `glucose_measure`: Either `"fasting_glucose"` or `"hba1c"`.
- `glucose_value`: Fasting glucose in mg/dL or HbA1c in percent, as named by `glucose_measure`. Diagnosed diabetes requires HbA1c. A record with no diabetes diagnosis but a value in the diagnostic diabetes range is rejected because the AHA scoring table does not assign that combination.
- `systolic_bp` and `diastolic_bp`: Blood pressure in mm Hg.
- `antihypertensive_treatment`: Whether the blood pressure is treated.

Optional clinical-judgment columns

- `apply_lean_muscular_bmi_override`: A caller-adjudicated flag asserting that a lean, higher-muscle-mass adult in the general BMI profile has a BMI from 25 to less than 30 and should receive 100 BMI points. If absent, the standard BMI band is used.
- `apply_sleep_apnea_penalty`: If `TRUE`, subtract 20 points for untreated or undertreated sleep apnea. If absent, no discretionary penalty is applied.
- `apply_prediabetes_metformin_penalty`: A caller-adjudicated flag asserting that the adult has a history of prediabetes, is taking metformin to prevent diabetes, is currently normoglycemic, and the clinician chose to apply the AHA's discretionary 20-point decrement. If absent, no discretionary penalty is applied.

Source-constrained behavior

The function derives the 0-to-16 MEPA total from the 16 raw screener responses. For population scoring, callers must supply a DASH or HEI-2015 percentile calculated against the relevant reference population; the rows in `data` are not their own reference distribution.

The AHA table applies 20-point treatment decrements to blood-lipid and blood-pressure scores. These components are floored at zero, consistent with the AHA's 0-to-100 metric definition and the non-negative possible scores shown in its applied NHANES implementation. Optional sleep-apnea and prediabetes/metformin decrements are applied only through explicit flags. Inputs are not

rounded. The documented MEPA daily/weekly equivalences are applied where the source question and criterion use different timeframes. Combinations without a source-defined score, including simultaneous current combustible smoking and current inhaled-NDS use, produce a structured error.

References

Lloyd-Jones DM, Allen NB, Anderson CAM, et al. (2022). Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health. *Circulation*, 146(5), e18-e43. doi:10.1161/CIR.0000000000001078

Lloyd-Jones DM, Ning H, Labarthe D, et al. (2022). Status of Cardiovascular Health in US Adults and Children Using the American Heart Association's New Life's Essential 8 Metrics. *Circulation*, 146(11), 822-835. doi:10.1161/CIRCULATIONAHA.122.060911

Examples

```
patient <- data.frame(
  id = "patient_1",
  age = 55,
  sex = "female",
  # Daily servings
  olive_oil = 2,
  green_leafy_vegetables = 1,
  other_vegetables = 2,
  whole_grains = 2,
  # Weekly servings
  berries = 3,
  other_fruit = 5,
  meat = 2,
  fish = 3,
  chicken = 2,
  cheese = 1,
  butter_cream = 1,
  beans = 3,
  sweets_and_pastries = 1,
  nuts = 4,
  alcohol = 4,
  # Fast-food meals per week
  fast_food = 0,
  moderate_activity_minutes = 90,
  vigorous_activity_minutes = 0,
  smoking_status = "former",
  years_since_quit = 6,
  current_inhaled_nds = FALSE,
  secondhand_smoke_home = FALSE,
  sleep_hours = 7.5,
  bmi = 27.5,
  bmi_profile = "general",
  non_hdl_cholesterol = 145,
  lipid_lowering_treatment = FALSE,
  diabetes = FALSE,
  glucose_measure = "fasting_glucose",
  glucose_value = 95,
```

```
  systolic_bp = 128,
  diastolic_bp = 78,
  antihypertensive_treatment = FALSE
)

scores <- score_le8(patient, diet_method = "mepa")
scores[
  c(
    "id",
    "mepa_total",
    "le8_diet_score",
    "le8_composite_score",
    "le8_category"
  )
]
```

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