Package ‘MetaDose’

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Type Package

Title Dose-Response Meta-Regression for Meta-Analysis

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URL `https://github.com/asmpro7/MetaDose/`

Description Conducting linear and nonlinear dose-response meta-regression using study-level summary data. It supports both continuous and binary outcomes and allows modeling of dose-effect relationships using linear trends or nonlinear restricted cubic splines.
The package is designed to facilitate transparent, flexible, and reproducible dose-response meta-analyses, with built-in visualization of fitted dose-response curves.

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Contents

`MetaDose-package` *MetaDose: Dose-Response Meta-Regression for Meta-Analysis*

Description

The ‘MetaDose‘ package provides tools for conducting linear and nonlinear dose-response meta-regression using study-level summary data. It supports both continuous and binary outcomes and allows modeling of dose-effect relationships using linear trends or nonlinear restricted cubic splines.

The package is designed to facilitate transparent, flexible, and reproducible dose-response meta-analyses, with built-in visualization of fitted dose-response curves.

Author(s)

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See Also

Useful functions:

- `mdcont` for dose-response meta-regression with continuous outcomes.
- `mdbin` for dose-response meta-regression with binary outcomes.

`dose` *Print and Plot Methods for Dose-Response Meta-Regression Objects*

Description

S3 methods for objects of class ‘dose‘ returned by ‘mdcont()‘ and ‘mdbin()‘ functions.

- `print.dose` displays summaries of the fitted linear and/or nonlinear dose-response meta-regression models.
- `plot.dose` visualizes the fitted dose-response curves produced by the meta-regression models.

Usage

```
## S3 method for class 'dose'
print(x, model = c("both", "linear", "nonlinear"), ...)

## S3 method for class 'dose'
plot(x, model = c("both", "linear", "nonlinear"), ...)
```

Arguments

`x`	An object of class `"dose"` returned by `mdcont` or `mdbin`.
`model`	Character string specifying which model results to display. Options are `"both"`, `"linear"`, or `"nonlinear"`.
`...`	Additional arguments (currently unused).

Value

Both methods are called for their side effects.

- `print.dose` prints model summaries to the console.
- `plot.dose` draws dose-response plots in the active graphics device.

The original object `x` is returned invisibly.

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See Also

`mdcont`, `mdbin`

`mdbin` *Linear and Nonlinear Dose-Response Meta-Regression for Binary Outcomes*

Description

Performs linear and/or nonlinear dose-response meta-regression for binary outcomes using study-level event data. The function supports relative risk (‘RR‘) and odds ratio (‘OR‘) effect measures and models the association between dose levels and treatment effects.

Usage

```
mdbin(
  measure = c("RR", "OR"),
  event.e,
  n.e,
  event.c,
  n.c,
  dose,
  data,
  linear = TRUE,
  nonlinear = TRUE,
  x_axis = "Dose",
  y_axis = "Measured Effect",
  knots = c(0.1, 0.5, 0.9)
)
```

Arguments

`measure`	Character string specifying the effect size measure. Options are `"RR"` for relative risk or `"OR"` for odds ratio.
`event.e`	Numeric vector of numbers of events in the experimental group.
`n.e`	Numeric vector of sample sizes in the experimental group.
`event.c`	Numeric vector of numbers of events in the control group.
`n.c`	Numeric vector of sample sizes in the control group.
`dose`	Numeric vector of dose levels corresponding to each study.
`data`	A data frame containing the meta-analysis data.
`linear`	Logical; if `TRUE`, a linear dose-response model is fitted.
`nonlinear`	Logical; if `TRUE`, a nonlinear dose-response model using restricted cubic splines is fitted.
`x_axis`	Character string specifying the x-axis label for plots.
`y_axis`	Character string specifying the y-axis label for plots.
`knots`	Numeric vector of quantiles used to place knots for the nonlinear restricted cubic spline model.

Details

The function computes logarithmic effect sizes and corresponding sampling variances from binary outcome data. Linear and/or nonlinear dose-response meta-regression models are then fitted, with nonlinear relationships modeled using restricted cubic splines. Dose-response plots are generated to visualize the fitted associations.

Value

An S3 object of class ‘dose‘, which is a list containing:

`linear_model`	The fitted linear dose-response meta-regression model.
`linear_plot`	A plot of the linear dose-response relationship.
`nonlinear_model`	The fitted nonlinear dose-response meta-regression model.
`nonlinear_plot`	A plot of the nonlinear dose-response relationship.

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See Also

`mdcont` for dose-response meta-regression with continuous outcomes.

`mdcont` *Linear and Nonlinear Dose-Response Meta-Regression for Continuous Outcomes*

Description

Performs linear and/or nonlinear dose-response meta-regression for continuous outcomes using study-level summary data. The function supports mean difference (‘MD‘) and standardized mean difference (‘SMD‘) effect measures and fits models across different dose levels using meta-regression techniques.

Usage

```
mdcont(
  measure = c("MD", "SMD"),
  mean.e,
  sd.e,
  n.e,
  mean.c,
  sd.c,
  n.c,
  dose,
  data,
  linear = TRUE,
  nonlinear = TRUE,
  x_axis = "Dose",
  y_axis = "Measured Effect",
  knots = c(0.1, 0.5, 0.9)
)
```

Arguments

`measure`	Character string specifying the effect size measure. Options are `"MD"` for mean difference or `"SMD"` for standardized mean difference.
`mean.e`	Numeric vector of means in the experimental group.
`sd.e`	Numeric vector of standard deviations in the experimental group.
`n.e`	Numeric vector of sample sizes in the experimental group.
`mean.c`	Numeric vector of means in the control group.
`sd.c`	Numeric vector of standard deviations in the control group.
`n.c`	Numeric vector of sample sizes in the control group.
`dose`	Numeric vector of dose levels corresponding to each study.
`data`	A data frame containing the meta-analysis data.
`linear`	Logical; if `TRUE`, a linear dose-response model is fitted.

`nonlinear`	Logical; if `TRUE`, a nonlinear dose-response model using restricted cubic splines is fitted.
`x_axis`	Character string specifying the x-axis label for plots.
`y_axis`	Character string specifying the y-axis label for plots.
`knots`	Numeric vector of quantiles used to place knots for the nonlinear restricted cubic spline model.

Details

The function first computes effect sizes and their variances from continuous outcome data. It then fits a linear dose-response meta-regression model and/or a nonlinear model using restricted cubic splines, depending on user selection. Corresponding dose-response plots are generated for visualization.

Value

An S3 object of class ‘dose‘, which is a list containing:

`linear_model`	The fitted linear dose-response meta-regression model.
`linear_plot`	A plot of the linear dose-response relationship.
`nonlinear_model`	The fitted nonlinear dose-response meta-regression model.
`nonlinear_plot`	A plot of the nonlinear dose-response relationship.

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See Also

`mdbin` for dose-response meta-regression with binary outcomes.

Examples

```
# Create a small example dataset
study_data <- data.frame(
  mean.e = c(5.2, 6.1, 7.0, 6.5),
  sd.e   = c(1.1, 1.3, 1.2, 1.0),
  n.e    = c(40, 35, 50, 45),
  mean.c = c(4.8, 5.5, 6.2, 5.9),
  sd.c   = c(1.0, 1.2, 1.1, 1.1),
  n.c    = c(38, 33, 48, 42),
  dose   = c(10, 20, 30, 40)
)

# Fit a dose-response meta-regression model
res <- mdcont(
  measure = "MD",
  mean.e  = mean.e,
```

```
    sd.e    = sd.e,
    n.e     = n.e,
    mean.c  = mean.c,
    sd.c    = sd.c,
    n.c     = n.c,
    dose    = dose,
    data    = study_data,
    linear  = TRUE,
    nonlinear = TRUE
  )

  # Print results
  print(res)

  # Access components
  # res$linear_model
  # res$nonlinear_model
```

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