Package ‘intmed’

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**Type** Package

**Title** Mediation Analysis using Intervventional Effects

**Version** 0.1.2

**Description** Implementing the interventional effects for mediation analysis for up to 3 mediators. The methods used are based on VanderWeele, Vansteelandt and Robins (2014) <doi:10.1097/ede.000000000000034>, Vansteelandt and Daniel (2017) <doi:10.1097/ede.0000000000000596> and Chan and Leung (2020; unpublished manuscript, available on request from the author of this package). Linear regression, logistic regression and Poisson regression are used for continuous, binary and count mediator/outcome variables respectively.

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**Encoding** UTF-8

**LazyData** true

**Imports** stringr, MASS, mice, dplyr, tibble, foreach, doParallel

**RoxygenNote** 7.1.1

**Depends** R (>= 3.5.0)

**Suggests** testthat, knitr, rmarkdown

**VignetteBuilder** knitr

**NeedsCompilation** no

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**Repository** CRAN

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**intmed: A package for mediation analysis using the interventional effect approach**

### Description

This package estimates mediation effect using the interventional effect approach and Monte Carlo simulation.

### mediate

Performing mediation analysis based on the interventional effect

#### Usage

```r
mediate(
  y, 
  med, 
  treat, 
  c = NULL, 
  ymodel, 
  mmodel, 
  treat_lv = 1, 
  control_lv = 0, 
  incint = NULL, 
  inc_mmint = FALSE, 
  data, 
  sim = 1000, 
  conf.level = 0.95, 
  complete_analysis = FALSE, 
  digits = 2, 
  HTML_report = TRUE, 
  summary_report = TRUE, 
  cores = NULL, 
  imputed_data = FALSE
)
```

#### Arguments

- **y** The outcome variable.
- **med** A vector of the mediators.
mediate generates a report in HTML format based on results from the mediation analysis. This report is saved in the working directory. The followings will returned by `mediate`

**individual**

If there is no missing data or complete data analysis is performed, `individual` is a list containing the models for the outcome and mediators, and also the draws for the direct and indirect effect and other relevant estimates from each of the simulation. If multiple imputation is used for the analysis, `individual` is a vector of lists containing these information from the mediation analysis conducted on each imputed dataset. Each list contains the following items.

- `indirect1`, `indirect2`, `indirect3`

  Elements of the `individual` list. Vectors of draws for the indirect effect through mediators 1, 2 and 3.
mediate

direct Element of the individual list. Vector of draws for the direct effect of exposure.
dependence Element of the individual list. This is only available when there are two mediators. Vector of draws for the effect mediated through the dependence of the mediators.
interaction Element of the individual list. This is only available when there are two mediators. Vector of draws for the effect mediated through the interaction of the mediators.
total Element of the individual list. Vector of draws for total causal effect of the exposure.
prop1, prop2, prop3 Elements of the individual list. Vector of draws for the proportion of effects mediated through mediator 1, 2 and 3.

ymodel Element of the individual list. An object of the class lm or glm, a R object containing the fit and estimate of the outcome model.
ymodel_te Element of the individual list. Similar to ymodel, but did not have the mediators as predictors in the model.
m1_model, m2_model, m3_model Elements of the individual list. Objects of the class lm or glm containing the fit and estimates of the mediator models.
m2_model_cond Element of the individual list. Only available when there are more than one mediator. Object of the class lm or glm similar to m2_model, but included mediator 1 as a predictor.
m3_model_cond_m1, m3_model_cond_m2, m3_model_cond_m1m2 Element of the individual list. Only available where there are more than two mediators. Object of the class lm or glm similar to m3_model, but with mediator 1, mediator 2 and both as predictors respectively.
combined If multiple imputation is used for the analysis, combined is a list containing estimates for the direct/indirect effect and relevant estimates from all simulations across all imputed datasets. If there is no missing data, it contains lists of draws for the direct and indirect effect and relevant estimates from each of the simulation.
direct Element of the combined list. A vector of estimates of direct effect from all simulations in all imputed datasets. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.
indirect Element of the combined list. A list containing vectors of draws of indirect effect through mediator 1, 2 and 3 from all simulations in all imputed datasets. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.
total Element of the combined list. A vector of draws of total effect of exposure from all simulations in all imputed datasets. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.
prop Element of the combined list. A list containing vectors of draws of proportion of effects mediated through mediator 1, 2 and 3 from all simulations in all imputed datasets. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.
interaction  Element of the combined list. Only available when there are two mediators. A vector of draws of effect mediated through the interaction between mediators from all simulations in all imputed datasets. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.

dependence  Element of the combined list. Only available when there are two mediators. A vector of draws of effect mediated through the dependence between mediators from all simulations in all imputed dataset. If multiple imputation is not performed, it is a list of estimates of direct effect from all simulations.

mids  Only available if multiple imputation is used. This is the mids object from mice, the multiple imputation package by Stef van Buuren.

y_pooled_res  Only available if multiple imputation is used. This contains the pooled model estimates from the outcome model.

m_pooled_res  Only available if multiple imputation is used. This contains the pooled model estimates from the mediator model(s).

model_summary  This is a formatted table for the results from the mediator and outcome models.

res_html  This is the HTML code for the result report.

summary_text  This is the formatted text of the result summary.

Examples

# One mediator, no HTML report.
# Set HTML_report = TRUE if a HTML report is needed.
med_res <- mediate(y = "y", med = c("m"), treat = "x", ymodel = "regression",
mmodel = c("regression"), treat_lv = 1, control_lv = 0, incint = FALSE, inc_mmint = FALSE,
conf.level = 0.9, data = sim_data, sim = 20, complete_analysis = TRUE,
HTML_report = FALSE, digits = 3, cores = 2)

# One mediator with exposure-mediator interaction
# Results presented in a HTML report (This is the default).
med_res <- mediate(y = "y", med = c("m"), treat = "x", ymodel = "regression",
mmodel = c("regression"), treat_lv = 1, control_lv = 0, incint = TRUE, inc_mmint = FALSE,
conf.level = 0.9, data = sim_data, sim = 1000, complete_analysis = TRUE, digits = 3, cores = 2)

# Two mediators, complete data analysis and no HTML report.
med_res <- mediate(y = "sub_misuse", med = c("dev_peer","sub_exp"), treat = "fam_int",
c = c("conflict","gender"), ymodel = "logistic regression", mmodel = c("logistic regression",
"logistic regression"), treat_lv = 1, control_lv = 0, conf.level = 0.9,
data = substance, sim = 20, complete_analysis = TRUE,
HTML_report = FALSE, digits = 3, cores = 2)

# Two mediators with multiple imputation (missing data are imputed by default)
# Results presented in a HTML report.
med_res <- mediate(y = "sub_misuse", med = c("dev_peer","sub_exp"), treat = "fam_int",
c = c("conflict","gender"), ymodel = "logistic regression", mmodel = c("logistic regression",
"logistic regression"), treat_lv = 1, control_lv = 0, conf.level = 0.9,
substance
data = substance, sim = 1000, digits = 3, cores = 2)

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**sim_data**  
_A simulated dataset for demonstrating mediation analysis with a single mediator_

**Description**  
A simulated dataset with three variables.

**Usage**  
`sim_data`

**Format**  
A data frame with 1000 rows:
- **x** Exposure variable
- **m** Mediator
- **y** Outcome

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**substance**  
_Fictitious family intervention data_

**Description**  
A fictitious dataset about family intervention and youth substance misuse.

**Usage**  
`substance`

**Format**  
A data frame with 553 rows:
- **gender** Gender of the participants, Male/Female.
- **conflict** Level of family conflict. Higher value represents higher level of conflict.
- **dev_peer** Engagement with deviant peer groups. 1: Yes; 0: No
- **sub_exp** Experimentation with substance. 1: Yes; 0: No
- **fam_int** Participation in family intervention during adolescence. 1: Yes; 0: No
- **sub_misuse** Substance misuse in young adulthood. 1: Yes; 0: No
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