

# Package ‘coveffectsplot’

September 18, 2023

**Title** Produce Forest Plots to Visualize Covariate Effects

**Version** 1.0.4

**Description** Produce forest plots to visualize covariate effects using either the command line or an interactive 'Shiny' application.

**URL** <https://smouksassi.github.io/coveffectsplot/>,  
<https://github.com/smouksassi/coveffectsplot>

**BugReports** <https://github.com/smouksassi/coveffectsplot/issues>

**Depends** R (>= 4.0.0), data.table (>= 1.9.8)

**Imports** colourpicker, egg, grid, ggplot2 (>= 3.3.2), shiny, stats,  
utils

**Suggests** markdown, dplyr, tidyr, shinyjs, shinymeta, table1, clipr,  
formatR, MASS, knitr, rmarkdown, mrgsolve, GGally, ggridges,  
ggrepel, ggstance, patchwork, plotly, scales, shinyAce, Rcpp,  
gamlss.dist, ggdist, ggh4x, ggpmisc, quantreg

**License** MIT + file LICENSE

**SystemRequirements** pandoc with https support

**LazyData** true

**VignetteBuilder** knitr

**RoxygenNote** 7.2.3

**Encoding** UTF-8

**NeedsCompilation** no

**Author** Samer Mouksassi [aut, cre] (<<https://orcid.org/0000-0002-7152-6654>>),  
Benjamin Rich [aut],  
Dean Attali [ctb]

**Maintainer** Samer Mouksassi <samerkouksassi@gmail.com>

**Repository** CRAN

**Date/Publication** 2023-09-18 12:40:16 UTC

## R topics documented:

covdatasim . . . . .	2
draw_key . . . . .	3
expand_modelframe . . . . .	3
forest_plot . . . . .	4
get_sample_data . . . . .	14
prezista . . . . .	14
run_interactiveforestplot . . . . .	15
wtage . . . . .	15
<b>Index</b>	<b>17</b>

---

covdatasim	<i>Correlated Covariates data</i>
------------	-----------------------------------

---

### Description

A example dataset used to illustrate multivariate joint covariate effects.

### Usage

```
covdatasim
```

### Format

A dataset with 2000 rows and 5 variables

**ID** Subject ID

**AGE** Age in years

**WT** Weight in kg

**Sex** 0=male; 1=female

**ALB** Albumin in g/dL

### Source

simulated based on a real dataset

---

draw_key	<i>Horizontal key drawing functions from ggstance in case it is deprecated</i>
----------	--

---

**Description**

Horizontal key drawing functions from ggstance in case it is deprecated

**Usage**

```
draw_key_hpath(data, params, size)
```

```
draw_key_pointrangeh(data, params, size)
```

**Arguments**

data	A single row data frame containing the scaled aesthetics to display in this key
params	A list of additional parameters supplied to the geom.
size	Width and height of key in mm.

**Value**

A grid grob.

---

expand_modelframe	<i>Expand covariate values choices and reference values varying one at a time</i>
-------------------	---

---

**Description**

Expand covariate values choices and reference values varying one at a time

**Usage**

```
expand_modelframe(rv, covcol = "covname", ...)
```

**Arguments**

rv	a data.frame with columns names of covariate(s) and values equal reference
covcol	column name for the covariate being varied
...	Arguments to be passed to methods

**Value**

A data.frame with combination of covariates

**Examples**

```
reference.values <- data.frame(WT = 85, ALB = 45, SEX = 0)
covcomb <- expand_modelframe(
  WT = c(56, 72, 98, 128), # P05, P25, P75, P95 # ref is P50
  ALB = c(40, 50),         # P05, P95 # ref is P50
  SEX = c(1),              # Reference is for SEX=0 (female)
  rv = reference.values)
covcomb
```

---

forest\_plot

*Forest plot*


---

**Description**

Produce forest plots to visualize covariate effects

**Usage**

```
forest_plot(
  data,
  facet_formula = "covname~paramname",
  xlabel = "",
  ylabel = "",
  x_facet_text_size = 13,
  y_facet_text_size = 13,
  x_facet_text_angle = 0,
  y_facet_text_angle = 0,
  x_facet_text_vjust = 0.5,
  y_facet_text_vjust = 0.5,
  x_facet_text_hjust = 0.5,
  y_facet_text_hjust = 0.5,
  x_facet_text_col = "black",
  y_facet_text_col = "black",
  xy_facet_text_bold = TRUE,
  x_label_text_size = 16,
  y_label_text_size = 16,
  legend_title_size = 12,
  break_ylabel = FALSE,
  y_label_text_width = 25,
  table_text_size = 7,
  base_size = 22,
  theme_benrich = FALSE,
  table_title = "",
  table_title_size = 15,
  ref_legend_text = "",
  area_legend_text = "",
  interval_legend_text = "",
```

```
interval_legend_title = "",
shape_legend_title = "",
legend_order = c("pointinterval", "ref", "area", "shape"),
combine_area_ref_legend = TRUE,
combine_interval_shape_legend = FALSE,
legend_position = "top",
show_ref_area = TRUE,
ref_area = c(0.8, 1.25),
ref_area_col = "#BEBEBE50",
show_ref_value = TRUE,
ref_value = 1,
ref_value_col = "black",
ref_value_size = 1,
ref_value_linetype = "dashed",
ref_value_by_panel = FALSE,
ref_value_by_panel_data = NULL,
interval_col = "blue",
interval_size = 1,
interval_fatten = 4,
interval_linewidth = 1,
interval_shape = "circle small",
bsv_col = "red",
bsv_shape = "circle small",
bsv_text_id = c("BSV", "bsv", "IIV", "Bsv"),
interval_bsv_text = "",
strip_col = "#E5E5E5",
paramname_shape = FALSE,
paramname_color = FALSE,
legend_shape_reverse = FALSE,
legend_color_reverse = FALSE,
facet_switch = c("both", "y", "x", "none"),
facet_scales = c("fixed", "free_y", "free_x", "free"),
facet_space = c("fixed", "free_x", "free_y", "free"),
facet_labeller = "label_value",
label_wrap_width = 55,
facet_labeller_multiline = FALSE,
strip_placement = c("inside", "outside"),
strip_outline = TRUE,
facet_spacing = 5.5,
major_x_ticks = NULL,
major_x_labels = NULL,
minor_x_ticks = NULL,
x_range = NULL,
logxscale = FALSE,
show_yaxis_gridlines = TRUE,
show_xaxis_gridlines = TRUE,
show_table_facet_strip = "none",
table_facet_switch = c("both", "y", "x", "none"),
```

```

show_table_yaxis_tick_label = FALSE,
reserve_table_xaxis_label_space = TRUE,
table_panel_border = TRUE,
table_position = c("right", "below", "none"),
plot_table_ratio = 4,
vertical_dodge_height = 0.8,
legend_space_x_mult = 1,
legend_ncol_interval = 1,
legend_ncol_shape = 1,
plot_margin = c(5.5, 5.5, 5.5, 5.5),
table_margin = c(5.5, 5.5, 5.5, 5.5),
legend_margin = c(0, 0.1, -0.1, 0),
parse_xlabel = FALSE,
parse_ylabel = FALSE,
plot_title = "\n",
return_list = FALSE
)

```

### Arguments

<code>data</code>	Data to use.
<code>facet_formula</code>	Facet formula.
<code>xlabel</code>	X axis title.
<code>ylabel</code>	Y axis title.
<code>x_facet_text_size</code>	Facet text size X.
<code>y_facet_text_size</code>	Facet text size Y.
<code>x_facet_text_angle</code>	Facet text angle X.
<code>y_facet_text_angle</code>	Facet text angle Y.
<code>x_facet_text_vjust</code>	Facet text vertical justification.
<code>y_facet_text_vjust</code>	Facet text vertical justification.
<code>x_facet_text_hjust</code>	Facet text horizontal justification.
<code>y_facet_text_hjust</code>	Facet text horizontal justification.
<code>x_facet_text_col</code>	Facet text color default to black.
<code>y_facet_text_col</code>	Facet text color default to black.
<code>xy_facet_text_bold</code>	Bold Facet text. Logical TRUE FALSE.

x\_label\_text\_size X axis labels size.

y\_label\_text\_size Y axis labels size.

legend\_title\_size Legend title size if present.

break\_ylabel Split Y axis labels into multiple lines. Logical FALSE TRUE.

y\_label\_text\_width Number of characters to break Y axis labels.

table\_text\_size Table text size.

base\_size theme\_bw base\_size for the plot and table.

theme\_benrich apply Benjamin Rich's theming.

table\_title What text to use for table title (theme\_benrich has a default).

table\_title\_size table title size.

ref\_legend\_text Reference legend text.

area\_legend\_text Area legend text.

interval\_legend\_text Pointinterval legend text.

interval\_legend\_title Pointinterval legend title defaults to empty.

shape\_legend\_title Shape legend title defaults to empty.

legend\_order Legend order. A four-element vector with the following items ordered in your desired order: "pointinterval", "ref", "area", "shape". if an item is absent the legend will be omitted.

combine\_area\_ref\_legend Combine reference and area legends if they share the same text?

combine\_interval\_shape\_legend Combine interval and shape legends?

legend\_position where to put the legend: "top", "bottom", "right", "none"

show\_ref\_area Show reference window?

ref\_area Reference area. Two-element numeric vector multiplying the ref\_value.

ref\_area\_col Reference area background color.

show\_ref\_value Show reference line?

ref\_value X intercept of reference line.

ref\_value\_col Reference line color.

ref\_value\_size Reference line size.

`ref_value_linetype` Reference line linetype.  
`ref_value_by_panel` The ref\_value vary by panel TRUE or FALSE.  
`ref_value_by_panel_data` if ref\_value\_by\_panel is TRUE, data.frame to use for Reference (lines).  
`interval_col` Point range color. One or Multiple values.  
`interval_size` Point range size. Default to 1  
`interval_fatten` Point range fatten. Default to 4  
`interval_linewidth` Point range line width. Default to 1  
`interval_shape` Shape used for the Point Range. Default to "circle small".  
`bsv_col` BSV pointinterval color. One value.  
`bsv_shape` Shape used for the BSV Point Range. Default to "circle small".  
`bsv_text_id` Text string(s) to identify BSV. Default to c("BSV", "bsv", "IIV", "Bsv")  
`interval_bsv_text` BSV legend text.  
`strip_col` Strip background color.  
`paramname_shape` Map symbol to parameter(s) name? TRUE or FALSE.  
`paramname_color` Map color to parameter(s) name? TRUE or FALSE.  
`legend_shape_reverse` TRUE or FALSE.  
`legend_color_reverse` TRUE or FALSE.  
`facet_switch` Facet switch to near axis. Possible values: "both", "y", "x", "none".  
`facet_scales` Facet scales. Possible values: "free\_y", "fixed", "free\_x", "free".  
`facet_space` Facet spaces. Possible values: "fixed", "free\_x", "free\_y", "free".  
`facet_labeller` Facet Labeller. Default "label\_value" any other valid 'facet\_grid' labeller can be specified.  
`label_wrap_width` How many characters before breaking the line. Numeric value. any other valid 'facet\_grid' labeller can be specified.  
`facet_labeller_multiline` break facet strips into multiple lines. Logical TRUE FALSE.  
`strip_placement` Strip placement. Possible values: "inside", "outside".  
`strip_outline` Draw rectangle around the Strip. Logical TRUE FALSE.  
`facet_spacing` Control the space between facets in points.  
`major_x_ticks` X axis major ticks. Numeric vector.

major_x_labels	X axis labels. Character vector should be same length as major_x_ticks.
minor_x_ticks	X axis minor ticks. Numeric vector.
x_range	Range of X values. Two-element numeric vector.
logxscale	X axis log scale. Logical TRUE FALSE.
show_yaxis_gridlines	Draw the y axis gridlines. Logical TRUE FALSE.
show_xaxis_gridlines	Draw the x axis gridlines. Logical TRUE FALSE.
show_table_facet_strip	Possible values: "none", "both", "y", "x".
table_facet_switch	Table facet switch to near axis. Possible values: "both", "y", "x", "none".
show_table_yaxis_tick_label	Show table y axis ticks and labels?
reserve_table_xaxis_label_space	keep space for the x axis label to keep alignment.
table_panel_border	Draw the panel border for the table. Logical TRUE FALSE.
table_position	Table position. Possible values: "right", "below", "none".
plot_table_ratio	Plot-to-table ratio. Suggested value between 1-5.
vertical_dodge_height	Amount of vertical dodging to apply on segments and table text.
legend_space_x_mult	Multiplier to adjust the spacing between legend items.
legend_ncol_interval	Control the number of columns for the pointinterval legend.
legend_ncol_shape	Control the number of columns for the shape legend.
plot_margin	Control the white space around the main plot. Vector of four numeric values for the top, right, bottom and left sides.
table_margin	Control the white space around the table. Vector of four numeric values for the top, right, bottom and left sides.
legend_margin	Control the white space around the plot legend. Vector of four numeric values for the top, right, bottom and left sides.
parse_xlabel	treat xlabel as an expression. Logical FALSE TRUE.
parse_ylabel	treat ylabel as an expression. Logical FALSE TRUE.
plot_title	main plot title default to a line break.
return_list	What to return if True a list of the main and table plots is returned instead of the gtable/plot.

## Examples

```

library(dplyr)
library(ggplot2)

# Example 1

plotdata <- get_sample_data("forest-plot-table.csv")
plotdata <- plotdata %>%
  mutate(midlabel = format(round(mid,2), nsmall = 2),
         lowerlabel = format(round(lower,2), nsmall = 2),
         upperlabel = format(round(upper,2), nsmall = 2),
         LABEL = paste0(midlabel, " [", lowerlabel, "-", upperlabel, "]"))
param <- "BZD AUC"
plotdata <- filter(plotdata,paramname==param)
plotdata$covname <- reorder(plotdata$covname,plotdata$upper,FUN =max)
plotdata$label <- reorder(plotdata$label,plotdata$scen)
covs <- c("WEIGHT","AGE")
plotdata <- filter(plotdata,covname%in%covs)
forest_plot(plotdata,
            ref_legend_text = "Reference (vertical line)",
            area_legend_text = "Reference (vertical line)",
            xlabel = paste("Fold Change in", param, "Relative to Reference"),
            logxscale = TRUE, major_x_ticks =c(0.1,1,1.5),
            show_ref_area = FALSE,
            paramname_color =TRUE,
            interval_col =c("steelblue","red","steelblue","red"),
            facet_formula = "covname~.",
            facet_scales = "free_y",
            facet_space = "free_y",
            show_table_facet_strip = "none",
            table_position = "right",
            plot_title = "",
            plot_table_ratio = 4)

# Example 2

plotdata <- get_sample_data("forest-plot-table.csv")
plotdata <- plotdata %>%
  mutate(midlabel = format(round(mid,2), nsmall = 2),
         lowerlabel = format(round(lower,2), nsmall = 2),
         upperlabel = format(round(upper,2), nsmall = 2),
         LABEL = paste0(midlabel, " [", lowerlabel, "-", upperlabel, "]"))
param <- c("BZD AUC","BZD Cmax")
plotdata <- filter(plotdata,paramname%in%param)
plotdata <- filter(plotdata,covname%in%"WEIGHT")
plotdata$covname <- reorder(plotdata$covname,plotdata$upper,FUN =max)
plotdata$label <- reorder(plotdata$label,plotdata$scen)
forest_plot(plotdata,
            ref_legend_text = "Reference (vertical line)",
            area_legend_text = "Reference (vertical line)",
            xlabel = paste("Fold Change of Parameter", "Relative to Reference"),
            show_ref_area = FALSE,

```

```

    facet_formula = "covname~paramname",
    facet_scales = "free_y",
    facet_space = "free_y",
    x_facet_text_size = 10,
    y_facet_text_size = 10,
    y_label_text_size = 10,
    y_label_text_width = 15,
    x_label_text_size = 10,
    facet_switch = "both",
    show_table_facet_strip = "both",
    show_table_yaxis_tick_label = TRUE,
    table_position = "below",
    plot_title = "",
    plot_table_ratio = 1)
## Not run:

# Example 3a

plotdata <- get_sample_data("forest-plot-table.csv")
plotdata <- plotdata %>%
  mutate(midlabel = format(round(mid,2), nsmall = 2),
         lowerlabel = format(round(lower,2), nsmall = 2),
         upperlabel = format(round(upper,2), nsmall = 2),
         LABEL = paste0(midlabel, " [", lowerlabel, "-", upperlabel, "]"))
plotdata$covname <- reorder(plotdata$covname,plotdata$upper,FUN =max)
plotdata$label <- reorder(plotdata$label,plotdata$scen)

plotdata$compound <- c(rep("1-OH",30),rep("BZD",30))
plotdata$paramname <- c(rep("AUC",15),rep("CMAX",15),rep("AUC",15),rep("CMAX",15))

forest_plot(plotdata,
  ref_area = c(0.8, 1.2),
  x_facet_text_size = 13,
  y_facet_text_size = 13,
  ref_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
  area_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
  xlabel = "Fold Change Relative to Parameter",
  facet_formula = covname~compound,
  facet_switch = "both",
  facet_scales = "free",
  facet_space = "fixed",
  paramname_shape = TRUE,
  legend_shape_reverse = TRUE,
  interval_shape = c("square","triangle"),
  paramname_color = FALSE,
  combine_interval_shape_legend = FALSE,
  table_position = "right", plot_title = "",
  ref_area_col = rgb( col2rgb("gray50")[1], col2rgb("gray50")[2],col2rgb("gray50")[3],
                    max = 255, alpha = 0.1*255 ) ,
  interval_col = c("steelblue"),
  strip_col = "lightblue",
  plot_table_ratio = 1.5)

```

```

# Example 3b

plotdata$paramname <- c(rep("1-OH",30),rep("BZD",30))
plotdata$paramname2 <- c(rep("AUC",15),rep("CMAX",15),rep("AUC",15),rep("CMAX",15))
forest_plot(plotdata,
  show_ref_area = TRUE,
  x_facet_text_size = 13,
  y_facet_text_size = 13,
  ref_legend_text = "Reference (vertical line)",
  area_legend_text = "Reference (vertical line)",
  xlabel = "Fold Change Relative to Parameter",
  facet_formula = covname~paramname2,
  facet_switch = "both",
  facet_scales = "free",
  facet_space = "free",
  legend_order = c("shape","pointinterval","ref"),
  paramname_shape = TRUE,
  interval_shape = c("diamond","diamond filled",
                    "diamond","diamond filled"),
  paramname_color = TRUE,
  combine_interval_shape_legend = TRUE,
  legend_shape_reverse = TRUE,
  legend_color_reverse = TRUE,
  interval_legend_title="Median (points)\n95% CI (horizontal lines)",
  table_position = "right", plot_title = "",
  ref_area_col = "gray85" ,
  interval_col = c("#ee3124", "#fdbb2f"),
  strip_col = "#475c6b",
  y_facet_text_col = "white",x_facet_text_col = "white",
  major_x_labels = c("1/2", "0.8","1", "1.25", "2"),
  logxscale = TRUE, major_x_ticks =c(0.5,0.8,1,1.25,2),
  table_text_size = 5,
  plot_table_ratio = 1.5,
  ref_value_by_panel = TRUE,
  ref_value_by_panel_data = as.data.frame(
  plotdata %>%
  distinct(paramname2,covname) %>%
  dplyr::mutate(xintercept=ifelse(paramname2=="CMAX",1,1.2))))

# Example 3

plotdata <- get_sample_data("forestplotdatacpidata.csv")
forest_plot(plotdata,
  ref_area = c(0.8, 1.2),
  x_facet_text_size = 12,
  y_facet_text_size = 12,
  y_label_text_size = 10,
  x_label_text_size = 10,
  table_text_size = 6,
  plot_table_ratio = 1.5,
  ref_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
  area_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
  xlabel = "Fold Change Relative to RHZE",

```

```

    facet_formula = "covname~paramname",
    table_position = "below",
    show_table_facet_stripe = "both",
    show_table_yaxis_tick_label = TRUE)

# Example 4
plotdata <- get_sample_data("dataforest.csv")
plotdata <- plotdata %>%
  dplyr::mutate(midlabel = format(round(mid,2), nsmall = 2),
               lowerlabel = format(round(lower,2), nsmall = 2),
               upperlabel = format(round(upper,2), nsmall = 2),
               LABEL = paste0(midlabel, " [", lowerlabel, "-", upperlabel, "]"))
plotdata <- plotdata %>%
  filter(covname%in%c("Weight"))
plotdata$label <- as.factor(as.character(plotdata$label))
plotdata$label <- factor(plotdata$label, c("36.2 kg", "66 kg", "110 kg"))
forest_plot(plotdata,
            ref_area = c(0.8, 1.2),
            x_facet_text_size = 13,
            y_facet_text_size = 13,
            ref_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
            area_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
            xlabel = "Fold Change Relative to Parameter",
            facet_formula = "covname~paramname",
            facet_switch = "both",
            facet_scales = "free",
            facet_space = "fixed",
            table_position = "below",
            plot_table_ratio = 1,
            show_table_facet_stripe = "both",
            show_table_yaxis_tick_label = TRUE)

# Example 5
forest_plot(plotdata,
            ref_area = c(0.8, 1.2),
            x_facet_text_size = 13,
            y_facet_text_size = 13,
            ref_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
            area_legend_text = "Reference (vertical line)\n+/- 20% limits (colored area)",
            xlabel = "Fold Change Relative to Parameter",
            facet_formula = "covname~.",
            facet_switch = "both",
            facet_scales = "free",
            facet_space = "fixed",
            paramname_shape = TRUE,
            table_position = "none",
            ref_area_col = rgb( col2rgb("gray50")[1], col2rgb("gray50")[2], col2rgb("gray50")[3],
                               max = 255, alpha = 0.1*255 ) ,
            interval_col = "steelblue",
            stripe_col = "lightblue",
            plot_table_ratio = 1)

```

```
## End(Not run)
```

---

```
get_sample_data      Get sample dataset
```

---

### Description

Get a sample dataset that is included with the package to plot a forest plot.

### Usage

```
get_sample_data(dataset = "dfall.csv")
```

### Arguments

```
dataset      A sample dataset file.
```

---

```
prezista      Prezista Drug Label Data
```

---

### Description

A dataset containing an excerpt from the official Prezista FDA Drug Label to help in the app exploration.

### Usage

```
prezista
```

### Format

A dataset with 33 rows and 6 variables

**covname** Covariate Name, a character variable with two values Protease Inhibitors and Other Antiretrovirals

**label** Covariate value label, a character variable with several possible values

**paramname** Parameter on which the effects are shown, a character variable with three possible values Cmax, AUC and Cmin

**mid** Middle value for the effects, the median from the uncertainty distribution

**lower** Lower value for the effects usually the 5% from the uncertainty distribution

**upper** Upper value for the effects usually the 95% from the uncertainty distribution

### Source

Table 16 from [https://www.accessdata.fda.gov/drugsatfda\\_docs/label/2017/021976s045\\_202895s0201b1.pdf](https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/021976s045_202895s0201b1.pdf)

---

`run_interactiveforestplot`*Run the interactiveforestplot application*

---

**Description**

Run the interactiveforestplot application.

**Usage**

```
run_interactiveforestplot(data = NULL)
```

**Arguments**

`data` optional data to load when the app is launched

**Examples**

```
if (interactive()) {  
  run_interactiveforestplot()  
}
```

---

`wtage`*Weight Age CDC growth charts data*

---

**Description**

Weight-for-age, 2 to 20 years, LMS parameters and selected smoothed weight percentiles in kilograms, by sex and age.

**Usage**

```
wtage
```

**Format**

A dataset with 436 rows and 14 variables

**Sex** 1=male; 2=female

**Agemos** Age in months

**L** skewness distribution parameter

**M** location distribution parameter

**S** scale distribution parameter

**P3** Smoothed third percentile

- P5** Smoothed fifth percentile
- P10** Smoothed tenth percentile
- P25** Smoothed twenty fifth percentile
- P50** Smoothed fiftieth percentile
- P75** Smoothed seventy fifth percentile
- P90** Smoothed ninetieth percentile
- P95** Smoothed ninety fifth percentile
- P97** Smoothed ninety seventh percentile

**Source**

CDC website <https://www.cdc.gov/growthcharts/data/zscore/wtage.csv>

# Index

## \* datasets

covdatasim, [2](#)

prezista, [14](#)

wtage, [15](#)

covdatasim, [2](#)

draw\_key, [3](#)

draw\_key\_hpath (draw\_key), [3](#)

draw\_key\_pointrangeh (draw\_key), [3](#)

expand\_modelframe, [3](#)

forest\_plot, [4](#)

get\_sample\_data, [14](#)

prezista, [14](#)

run\_interactiveforestplot, [15](#)

wtage, [15](#)