

# Package ‘cmpproviders’

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**Version** 0.30

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**Title** Compare Providers

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**Depends** R (>= 4.0.4), ggplot2, ggrepel, grid, lattice

**Suggests** COUNT,  
medpar,  
dplyr,  
knitr,  
rmarkdown

## Description

A program that compares provider rate data using funnel plots or control charts. The implementations are based on Bonert et al. (2017) <[https://doi.org/10.4103/jpi.jpi\\_50\\_17](https://doi.org/10.4103/jpi.jpi_50_17)> and on Bonert et al. (2023) <<https://doi.org/10.1038/s41598-022-26962-w>>

**License** GPL (>= 3)

**URL** <https://github.com/mbonert/cmpproviders>

**BugReports** michael@librepathology.org

**RoxygenNote** 7.1.1

**VignetteBuilder** knitr

## R topics documented:

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controlchart2cmpproviders

*Creates a control chart with an arbitrary number of control lines*


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## Description

Control charts to compare (healthcare) providers or institutions

## Usage

```
controlchart2cmpproviders(
  x_var,
  y_var,
  labels = NULL,
  limits = c(95, 99.9),
  control_chart_centre_line = NULL,
  addlabels = "NONE",
  labels_to_display = NULL,
  x_label = NULL,
  y_label = NULL,
  plot_title = NULL,
  show_legend = TRUE,
  y_percent = FALSE,
  sort_by_y_norm = TRUE,
  showoutlier_arr = FALSE
)
```

## Arguments

x_var	x values on funnel plot, e.g. number of specimens
y_var	y values on funnel plot, e.g. diagnostic rate (0-1)
labels	labels that describe the (x,y) data points, e.g. name of institution or provider identification; default: the data points are numbered (if undefined)
limits	limits (confidence intervals); default: 95%, 99.9%
control_chart_centre_line	defines the control chart centre line; default: median of y_var
addlabels	whether to display labels on the funnel plot; accepted values are: <ul style="list-style-type: none"> <li>• "none" : do not add labels (default)</li> <li>• "all" : add labels to all points</li> <li>• "outliers" : label only outliers outside of the inner funnels</li> <li>• "outliers2" : label only outliers outside of second innermost funnel</li> <li>• "only_oaf" : label only outliers outside of all funnels</li> <li>• "list" : display the list of labels given by argument labels_to_display</li> </ul>
labels_to_display	selected labels to display (see argument <i>addlabels</i> )

x_label	x axis label
y_label	y axis label
plot_title	title of the (funnel) plot
show_legend	TRUE shows legend at bottom of plot
y_percent	y axis in percent (multiplies y_var_normed by 100)
sort_by_y_norm	sort by the normed y value
showoutlier_arr	show the outlier array

## Details

A function to compare provider rate data. The implementation is based on Bonert et al. (2023) <https://doi.org/10.1038/s41598-022-26962-w>

## Value

funnel plot object

## Examples

```
library(COUNT)
library(dplyr)
data(medpar)

print("Number of cases by provider ...")
provider_count=as.data.frame(table(medpar$provnum))
colnames(provider_count) = c('PROVIDER', 'COUNT')
provider_count

print("Purging providers with less than 20 cases ...")
requiredcases=20
medpar_trunc <- medpar[medpar$provnum %in% provider_count[provider_count$COUNT>=requiredcases,]$PROVIDER,]

print("Number of cases by provider in purged data set ...")
provider_count_trunc=as.data.frame(table(medpar_trunc$provnum))
colnames(provider_count_trunc) = c('PROVIDER', 'COUNT')
provider_count_trunc

medpar_trunc_died <- medpar_trunc[medpar_trunc$died==1,]

print("Number of died by provider in purged data set ...")
provider_count_trunc_died=as.data.frame(table(medpar_trunc_died$provnum))
colnames(provider_count_trunc_died) = c('PROVIDER', 'COUNT')
provider_count_trunc_died

print("Death rate by provider ...")
y_var = provider_count_trunc_died[,2]/ provider_count_trunc[,2]
y_var

x_var = provider_count_trunc[,2]
```

```

provider_labels = provider_count_trunc[,1]

print("Creating control charts ...")
cc1=controlchart2cmpproviders(x_var, y_var, limits=c(95,99.9,99.9999), addlabels = 1,
  x_label = "Provider", y_label = "Normalized Death Rate by Provider",
  plot_title = "Normalized Death Rate by Provider")
cc2=controlchart2cmpproviders(x_var, y_var, limits=c(95,99.9,99.9999), labels=provider_labels,
  addlabels = "OUTLIERS", x_label = "Provider", y_label = "Normalized Provider Death Rate",
  plot_title = "Normalized Death Rate by Provider with Outliers Labelled", do_not_sort_by_y_norm=1)
cc3=controlchart2cmpproviders(x_var, y_var, limits=c(95,99.9,99.9999), labels=provider_labels,
  addlabels = "OUTLIERS", x_label = "Provider", y_label = "Normalized Provider Death Rate",
  plot_title = "Normalized Death Rate by Provider with Outliers Labelled")

```

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funnel2cmpproviders      *Creates a funnel plot with an arbitrary number of funnels*

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## Description

Funnel plots to compare (healthcare) providers or institutions

## Usage

```

funnel2cmpproviders(
  x_var,
  y_var,
  labels = NULL,
  limits = c(95, 99.9),
  funnel_centre_line = NULL,
  addlabels = "NONE",
  labels_to_display = NULL,
  x_label = NULL,
  y_label = NULL,
  plot_title = NULL,
  x_lower_limit = NULL,
  x_upper_limit = NULL,
  y_lower_limit = NULL,
  y_upper_limit = NULL,
  x_fpad_upper = 0.1,
  x_fpad_lower = 0.03,
  y_fsd = 0.5,
  funnel_curve_calculation_parameter = 3,
  fc_min_dx = 0.5,
  fc_max_y_err = 0.003,
  x2plot = NULL,
  show_legend = TRUE,
  y_percent = FALSE,
  showoutlier_arr = FALSE
)

```

**Arguments**

<code>x_var</code>	x values on funnel plot, e.g. number of specimens
<code>y_var</code>	y values on funnel plot, e.g. diagnostic rate (0-1)
<code>labels</code>	labels that describe the (x,y) data points, e.g. name of institution or provider identification; default: the data points are numbered (if undefined)
<code>limits</code>	limits (confidence intervals); default: 95%, 99.9%
<code>funnel_centre_line</code>	defines the funnel centre line; default: median of <code>y_var</code>
<code>addlabels</code>	whether to display labels on the funnel plot; accepted values are: <ul style="list-style-type: none"> <li>• "none" : do not add labels (default)</li> <li>• "all" : add labels to all points</li> <li>• "outliers" : label only outliers outside of the inner funnels</li> <li>• "outliers2" : label only outliers outside of second innermost funnel</li> <li>• "only_oaf" : label only outliers outside of all funnels</li> <li>• "list" : display the list of labels given by argument <code>labels_to_display</code></li> </ul>
<code>labels_to_display</code>	selected labels to display (see argument <i>addlabels</i> )
<code>x_label</code>	x axis label
<code>y_label</code>	y axis label
<code>plot_title</code>	title of the (funnel) plot
<code>x_lower_limit</code>	lower x limit (min x value on plot)
<code>x_upper_limit</code>	upper x limit (max x value on plot)
<code>y_lower_limit</code>	lower y limit (min y value on plot)
<code>y_upper_limit</code>	upper y limit (max y value on plot)
<code>x_fpad_upper</code>	upper padding as fraction of x axis range
<code>x_fpad_lower</code>	lower padding as fraction of x axis range
<code>y_fsd</code>	padding as fraction of standard deviation of y values
<code>funnel_curve_calculation_parameter</code>	method used to calculate the funnel curves / determine the x values used to calculate the funnel curves; 1: uses <code>geom_function</code> to calculate/plot funnel curves, 2 = uses <code>geom_line</code> to plot funnel curves, 3: uses <code>geom_line</code> to plot funnel curves, calculates ideal x using <i>get_ideal_x.r</i> (default)
<code>fc_min_dx</code>	funnel curve parameter, minimum delta x
<code>fc_max_y_err</code>	funnel curve parameter, maximum y error
<code>x2plot</code>	vector defines extra x values used to calculate the funnel curves
<code>show_legend</code>	TRUE shows legend at bottom of plot
<code>y_percent</code>	y axis in percent (multiplies <code>y_var</code> by 100)
<code>showoutlier_arr</code>	show the outlier array

## Details

A function to compare provider rate data. The implementation is based on Bonert et al. (2017) [https://doi.org/10.4103/jpi.jpi\\_50\\_17](https://doi.org/10.4103/jpi.jpi_50_17)

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provider_count

print("Purging providers with less than 20 cases ...")
requiredcases=20
medpar_trunc <- medpar[medpar$provnum %in% provider_count[provider_count$COUNT>=requiredcases,]$PROVIDER,]

print("Number of cases by provider in purged data set ...")
provider_count_trunc=as.data.frame(table(medpar_trunc$provnum))
colnames(provider_count_trunc) = c('PROVIDER', 'COUNT')
provider_count_trunc

medpar_trunc_died <- medpar_trunc[medpar_trunc$died==1,]

print("Number of died by provider in purged data set ...")
provider_count_trunc_died=as.data.frame(table(medpar_trunc_died$provnum))
colnames(provider_count_trunc_died) = c('PROVIDER', 'COUNT')
provider_count_trunc_died

print("Death rate by provider ...")
y_var = provider_count_trunc_died[,2]/ provider_count_trunc[,2]
y_var

x_var = provider_count_trunc[,2]
provider_labels = provider_count_trunc[,1]

print("Creating funnel plots ...")
fp1=funnel2cmpproviders(x_var, y_var, limits=c(95,99.9,99.9999), addlabels = 1,
  x_label = "Provider \crVolume (Patients Cared for by Provider)", y_label = "Death Rate (Deaths by
  Provider/Patients Cared for by Provider)", plot_title = "Death Rate by Provider and Volume")
fp2=funnel2cmpproviders(x_var, y_var, limits=c(95,99.9,99.9999), labels=provider_labels,
  addlabels = "OUTLIERS", x_label = "Provider Volume (Patients Cared for by Provider)",
  y_label = "Provider Death Rate (Deaths by Provider/Patients Cared for by Provider)",
  plot_title = "Death Rate by Provider and Volume with Outliers Labelled")
```

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