In [ ]:
```r
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# 导入TwoSampleMR包
library(TwoSampleMR)
```

In [ ]:
```r
exposure_dat=extract_instruments("ieu-a-2")  # 从ieu-a-2中提取数据
outcome_data=extract_outcome_data(snps=exposure_dat$SNP,outcomes="ieu-a-7")  # 从ieu-a-7中提取数据
```

```
API: public: http://gwas-api.mrcieu.ac.uk/

Extracting data for 79 SNP(s) from 1 GWAS(s)
```

In [ ]:
```r
dat=harmonise_data(exposure_dat,outcome_data)
# harmonise_data()函数用于合并数据集
```

```
Harmonising Body mass index || id:ieu-a-2 (ieu-a-2) and Coronary heart disease || id:ieu-a-7 (ieu-a-7)
```

In [ ]:
```r
res=mr(dat)
# 两样本MR分析
```

In [ ]:
```r
res
# 查看结果
```

A data.frame: 5 × 9

id.exposure	id.outcome	outcome	exposure	method	nsnp	b	se	pval
<chr>	<chr>	<chr>	<chr>	<chr>	<int>	<dbl>	<dbl>	<dbl>
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	MR Egger	79	0.5024935	0.14396056	8.012590e-04
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	Weighted median	79	0.3870065	0.07434532	1.934480e-07
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	Inverse variance weighted	79	0.4459091	0.05898302	4.032020e-14
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	Simple mode	79	0.3401554	0.15710535	3.343382e-02
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	Weighted mode	79	0.3888249	0.10812281	5.643101e-04

In [ ]:
```
mr_pleiotropy_test(dat)
# 用于检验多重性
```

A data.frame: 1 × 7

id.exposure	id.outcome	outcome	exposure	egger_intercept	se	pval
<chr>	<chr>	<chr>	<chr>	<dbl>	<dbl>	<dbl>
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	-0.001719304	0.003985962	0.6674266

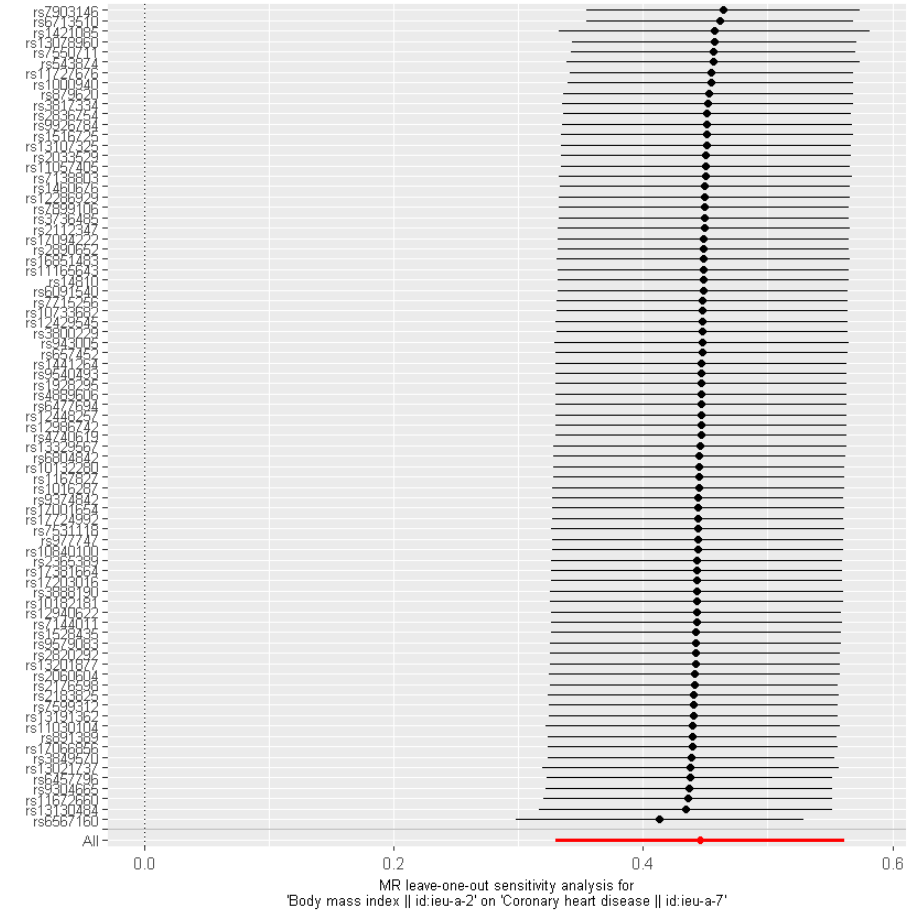
In [ ]:
```
# 用于检验异质性
mr_heterogeneity(dat)
```

A data.frame: 2 × 8

id.exposure	id.outcome	outcome	exposure	method	Q	Q_df	Q_pval
<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>	<dbl>	<dbl>
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	MR Egger	143.3046	77	6.841585e-06
ieu-a-2	ieu-a-7	Coronary heart disease || id:ieu-a-7	Body mass index || id:ieu-a-2	Inverse variance weighted	143.6508	78	8.728420e-06

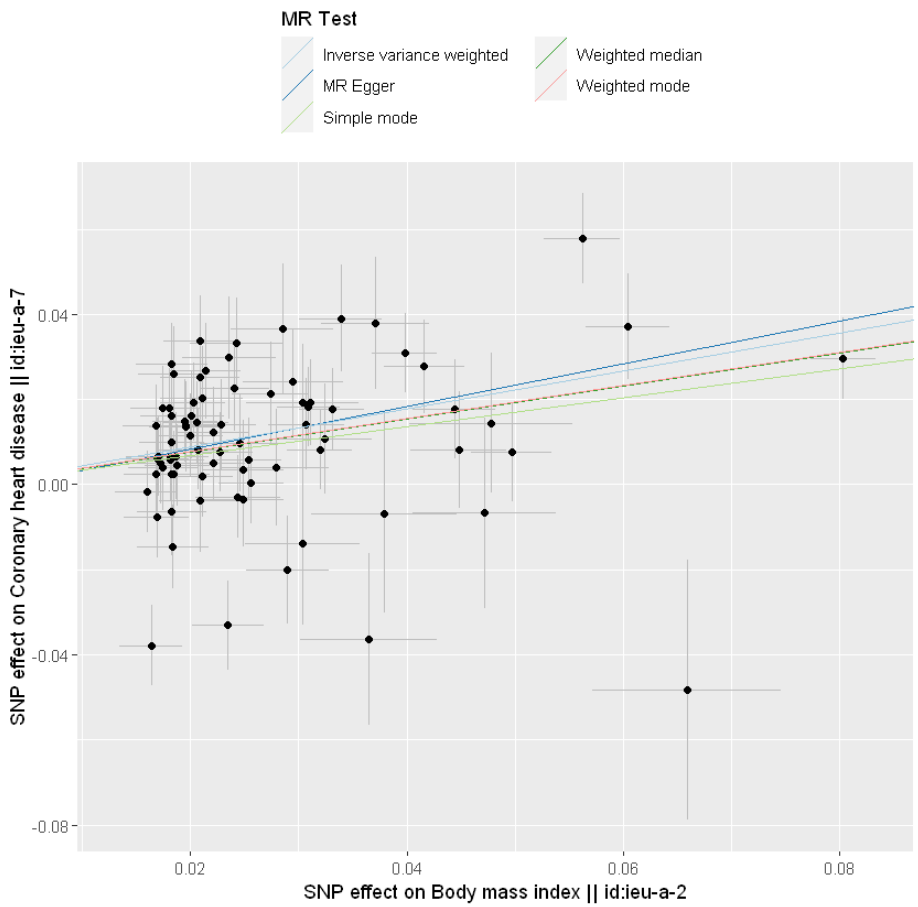
In [ ]:
```
# 用于检验留一法
res_loo=mr_leaveoneout(dat)
# 用于绘制留一法图
mr_leaveoneout_plot(res_loo)
```

```
Warning message:
"Removed 1 rows containing missing values (`geom_errorbarh()`)."
Warning message:
"Removed 1 rows containing missing values (`geom_point()`)."
$`ieu-a-2.ieu-a-7`

attr(,"split_type")
[1] "data.frame"
attr(,"split_labels")
  id.exposure id.outcome
1     ieu-a-2    ieu-a-7
```



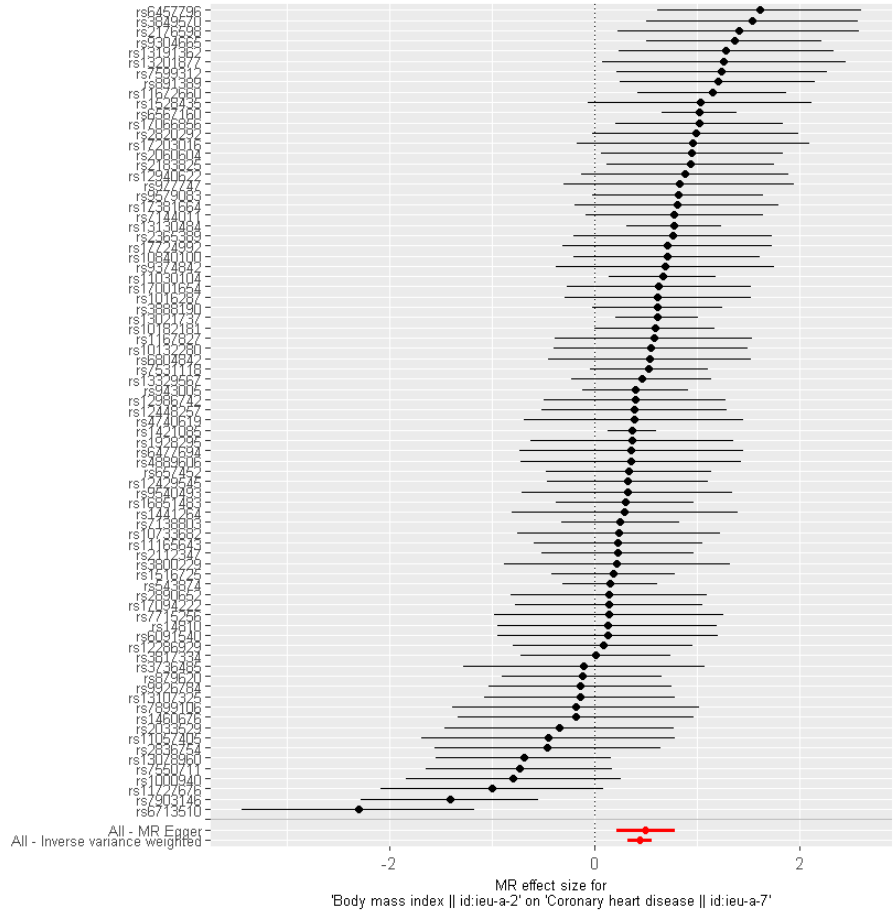
In [ ]:
```
# 用于绘制散点图
mr_scatter_plot(res,dat)
```

```
$`ieu-a-2.ieu-a-7`

attr(,"split_type")
[1] "data.frame"
attr(,"split_labels")
  id.exposure id.outcome
1     ieu-a-2    ieu-a-7
```



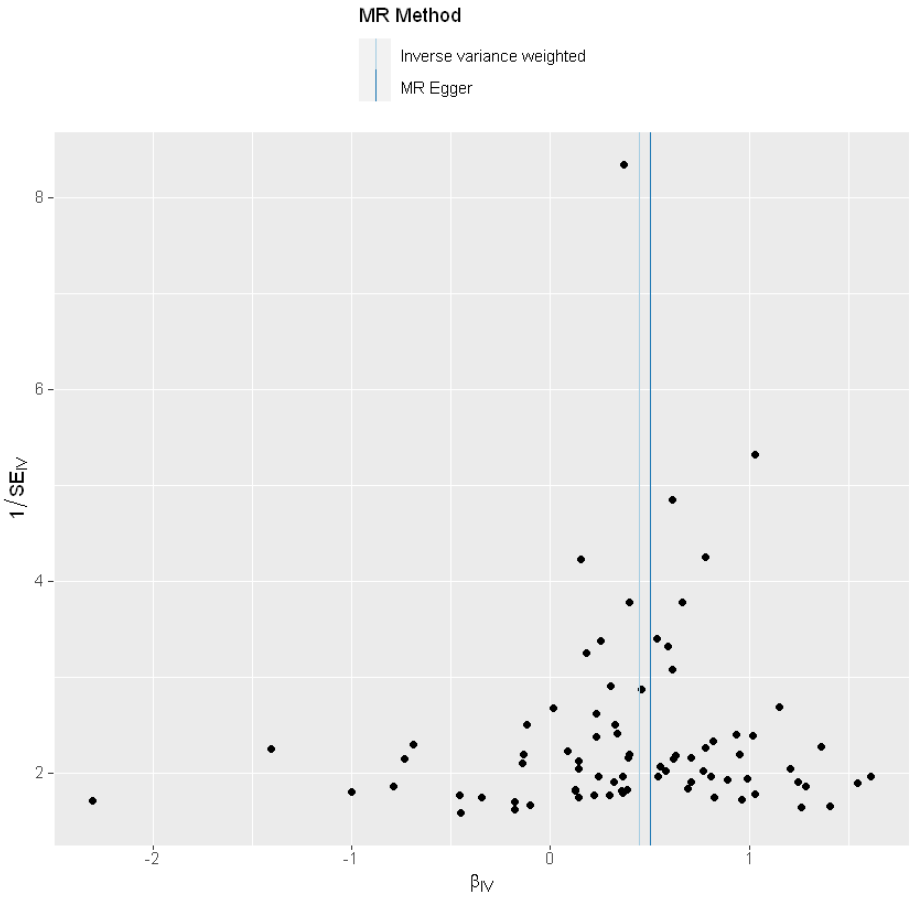
In [ ]:
```
# 用于检验单个SNP
res_single=mr_singlesnp(dat)
# 用于绘制森林图
mr_forest_plot(res_single)
```

```
Warning message:
"Removed 1 rows containing missing values (`geom_errorbarh()`)."
Warning message:
"Removed 1 rows containing missing values (`geom_point()`)."
$`ieu-a-2.ieu-a-7`

attr(,"split_type")
[1] "data.frame"
attr(,"split_labels")
  id.exposure id.outcome
1     ieu-a-2    ieu-a-7
```



In [ ]:
```
# 用于绘制漏斗图
mr_funnel_plot(res_single)
```

```
$`ieu-a-2.ieu-a-7`

attr(,"split_type")
[1] "data.frame"
attr(,"split_labels")
  id.exposure id.outcome
1     ieu-a-2    ieu-a-7
```



In [ ]:
```
# 用于绘制漏斗图
mr_funnel_plot(res_single)
```

```
$`ieu-a-2.ieu-a-7`

attr(,"split_type")
[1] "data.frame"
attr(,"split_labels")
  id.exposure id.outcome
1     ieu-a-2    ieu-a-7
```