

# RenR 480/711

Type I & Type II error

Statistical power

# Type I & II Error simulation

Please enter the following code in R:

# Type I error

```
a = rnorm(5,10,5)
```

```
b = rnorm(5,10,5)
```

```
t.test(a,b)
```

Chances are that you rejected  $H_0$  while it is true (Type I error)

# Type II error

```
a = rnorm(5,15,5)
```

```
b = rnorm(5,10,5)
```

```
t.test(a,b)
```

Chances are that you fail to reject  $H_0$  while it is false (Type II error)

# Statistical power

What does statistical power mean?

- The ability to reject  $H_0$  when it is false
  - The ability to detect an effect (in case there is an effect)

How can you increase statistical power?

- Increase the sample size
- Increase the alpha level (0.1 instead of 0.05, or 0.05 instead of 0.01)

**Caution: increasing the alpha level increases Type I error!**

- If the direction of the effect is known: Use a one tailed test
- Paired test when data allows (before, after)

# Statistical power simulation

Please enter the following code in R:

# Type II error

```
a = rnorm(5,15,5)
b = rnorm(5,10,5)
t.test(a,b)
```

```
a = rnorm(10,15,5)
b = rnorm(10,10,5)
t.test(a,b)
```

```
a = rnorm(15,15,5)
b = rnorm(15,10,5)
t.test(a,b)
```

```
a = rnorm(20,15,5)
b = rnorm(20,10,5)
t.test(a,b)
```

```
a = rnorm(25,15,5)
b = rnorm(25,10,5)
t.test(a,b)
```

```
a = rnorm(30,15,5)
b = rnorm(30,10,5)
t.test(a,b)
```

Conclusion: Type II error decreases as sample size increases!

# Type I and Type II error

Type I Error



Type II Error

