



## Research findings in "Chemo-brain"

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# Research findings in “Chemo-brain”

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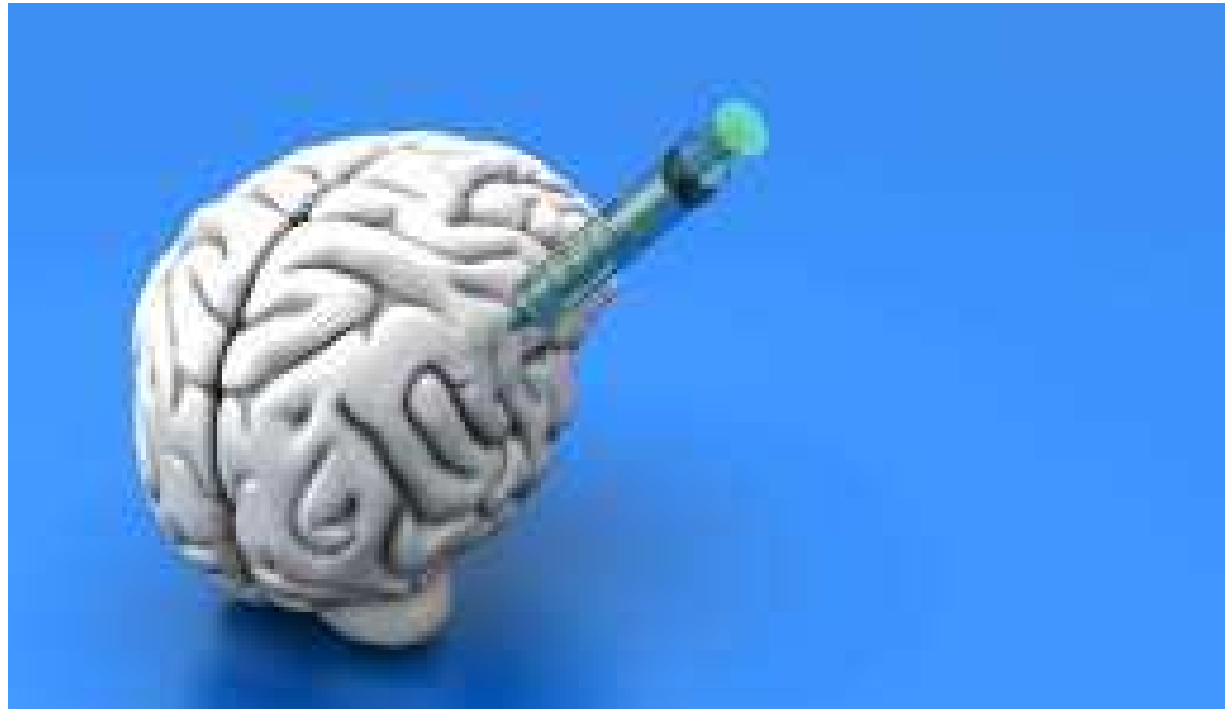


@LindnerOana

# Outline

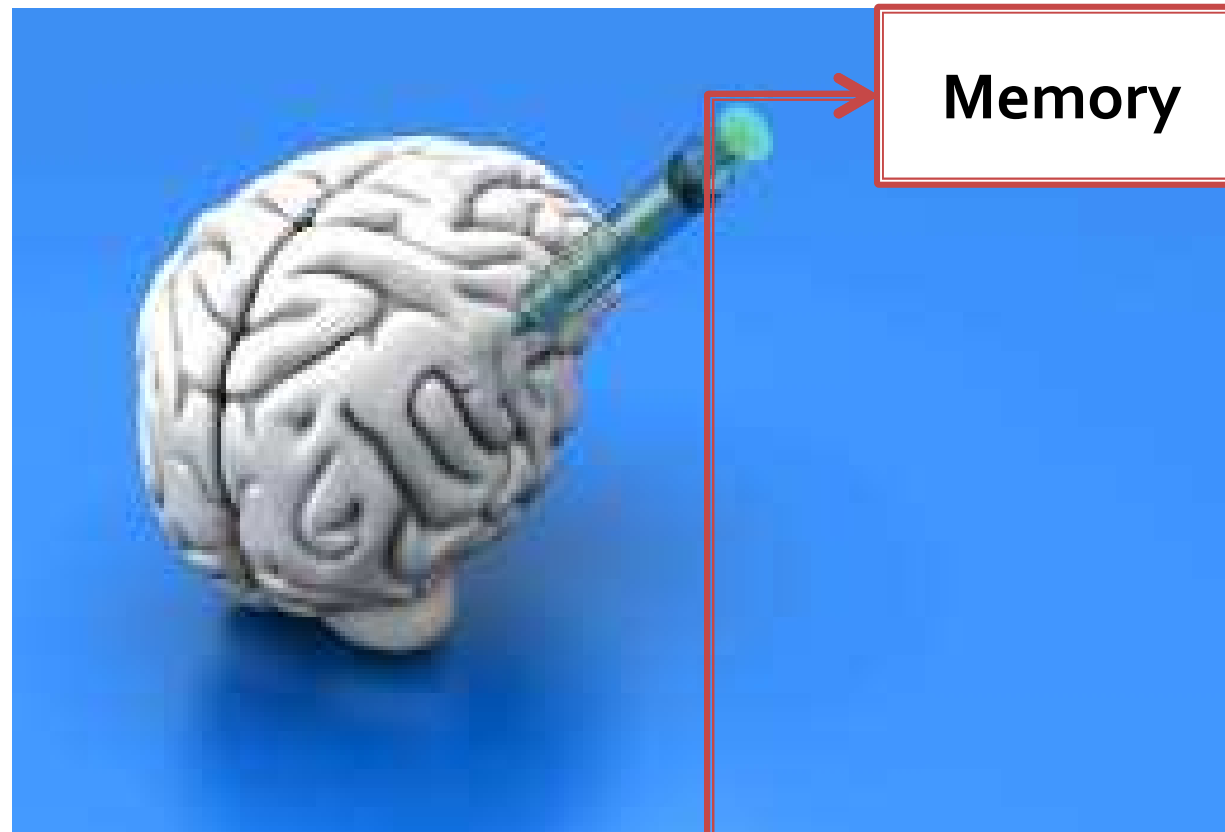
- Background
- Our preliminary results:
  - Cognitive functioning in Post-treatment patients
  - Cognitive functioning in Pre-treatment patients
  - Psycho-social functioning
- Future directions

# Chemo-brain



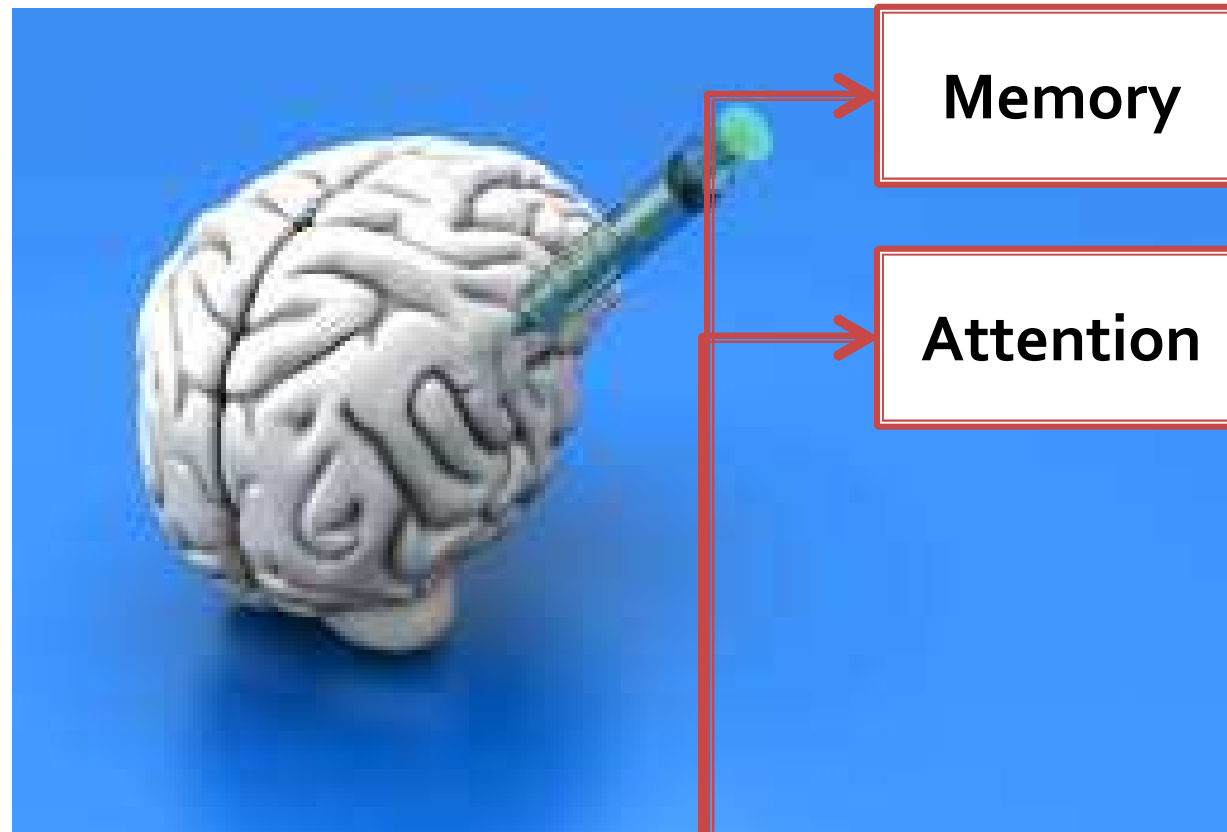
**Effect of chemotherapy on cognitive functioning**

# Chemo-brain



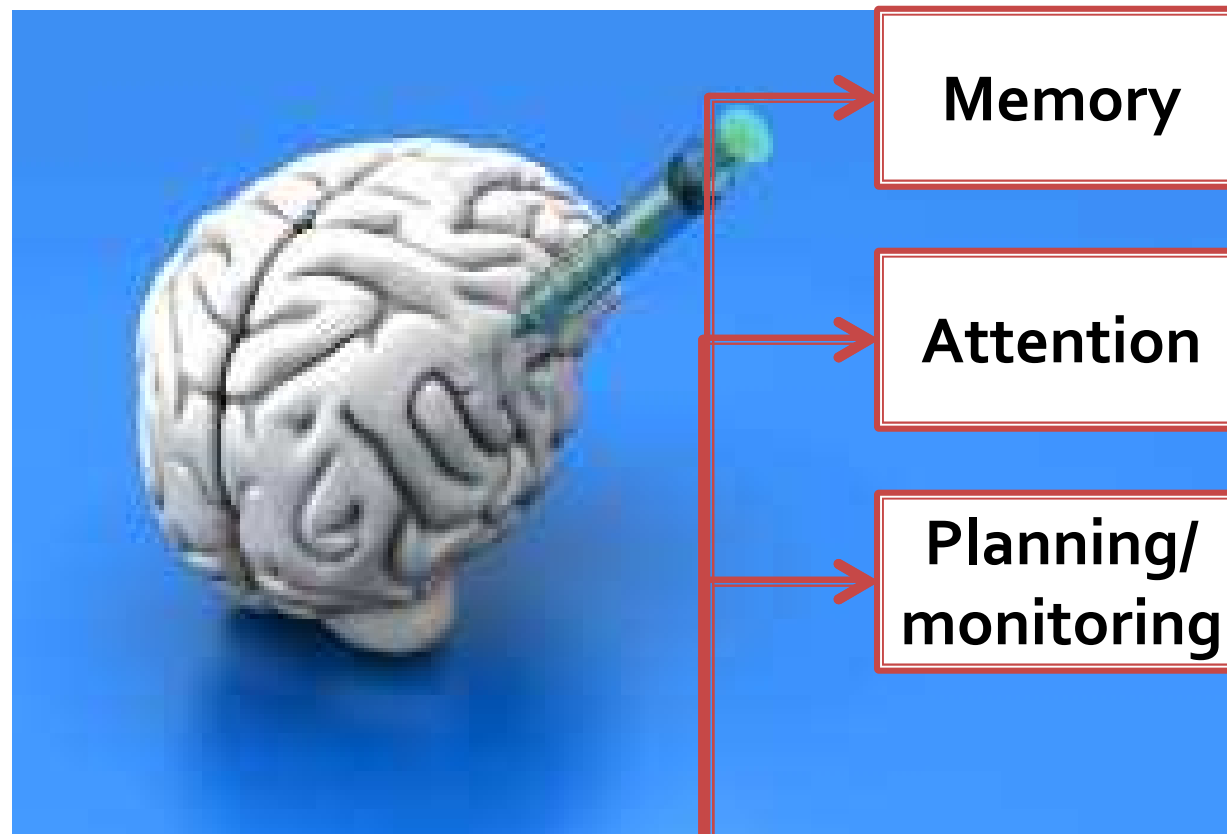
Effect of chemotherapy on **cognitive functioning**

# Chemo-brain



Effect of chemotherapy on **cognitive functioning**

# Chemo-brain



Effect of chemotherapy on **cognitive functioning**

# Chemo-brain

No central nervous  
system treatments





# Chemo-brain

No central nervous  
system treatments

No brain tumours



# Chemo-brain

No central nervous  
system treatments

No brain tumours

No cranial  
irradiation



# Chemo-brain

Everyone?



# Chemo-brain

Everyone?



Risk factors?

# Chemo-brain

Everyone?

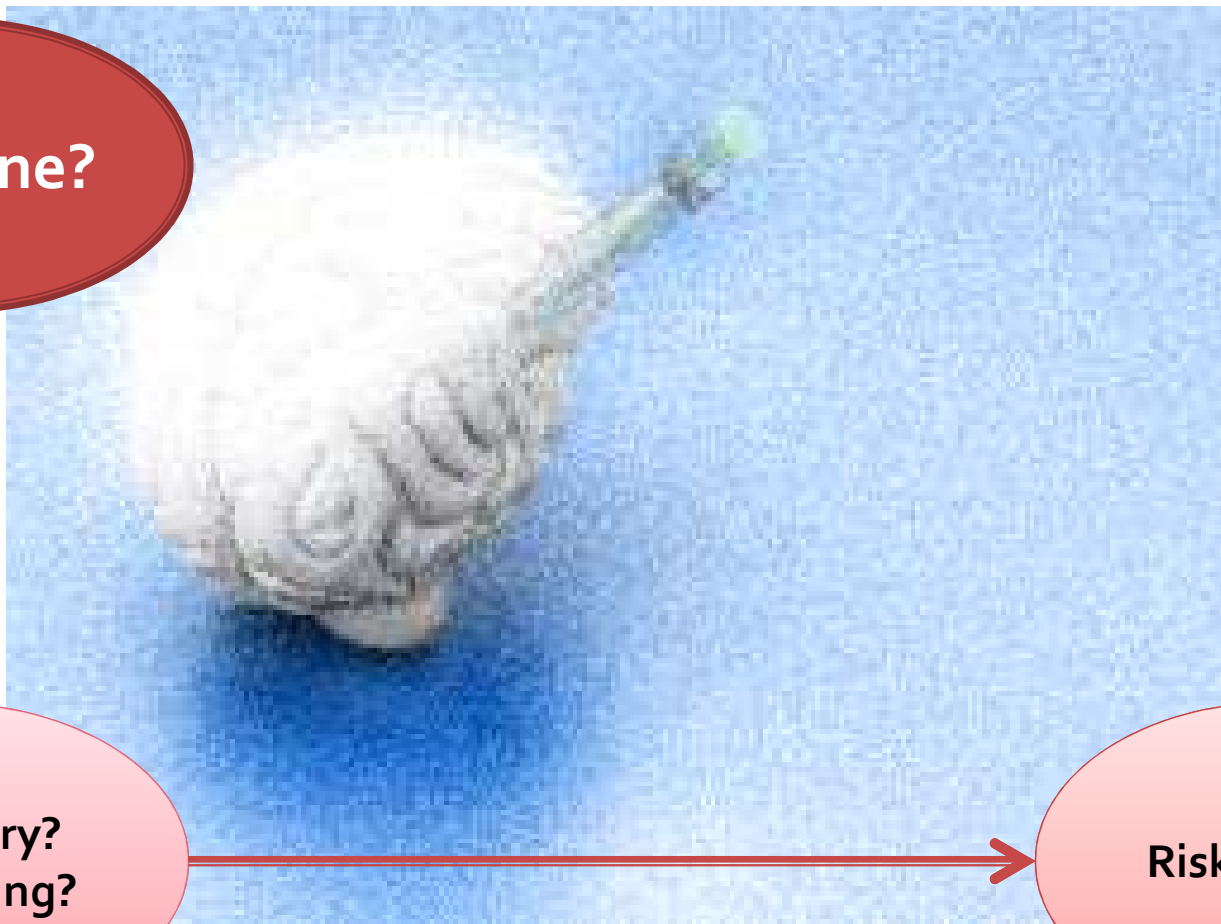


Temporary?  
Long lasting?

Risk factors?

# Chemo-brain

Everyone?



Temporary?  
Long lasting?

Risk factors?

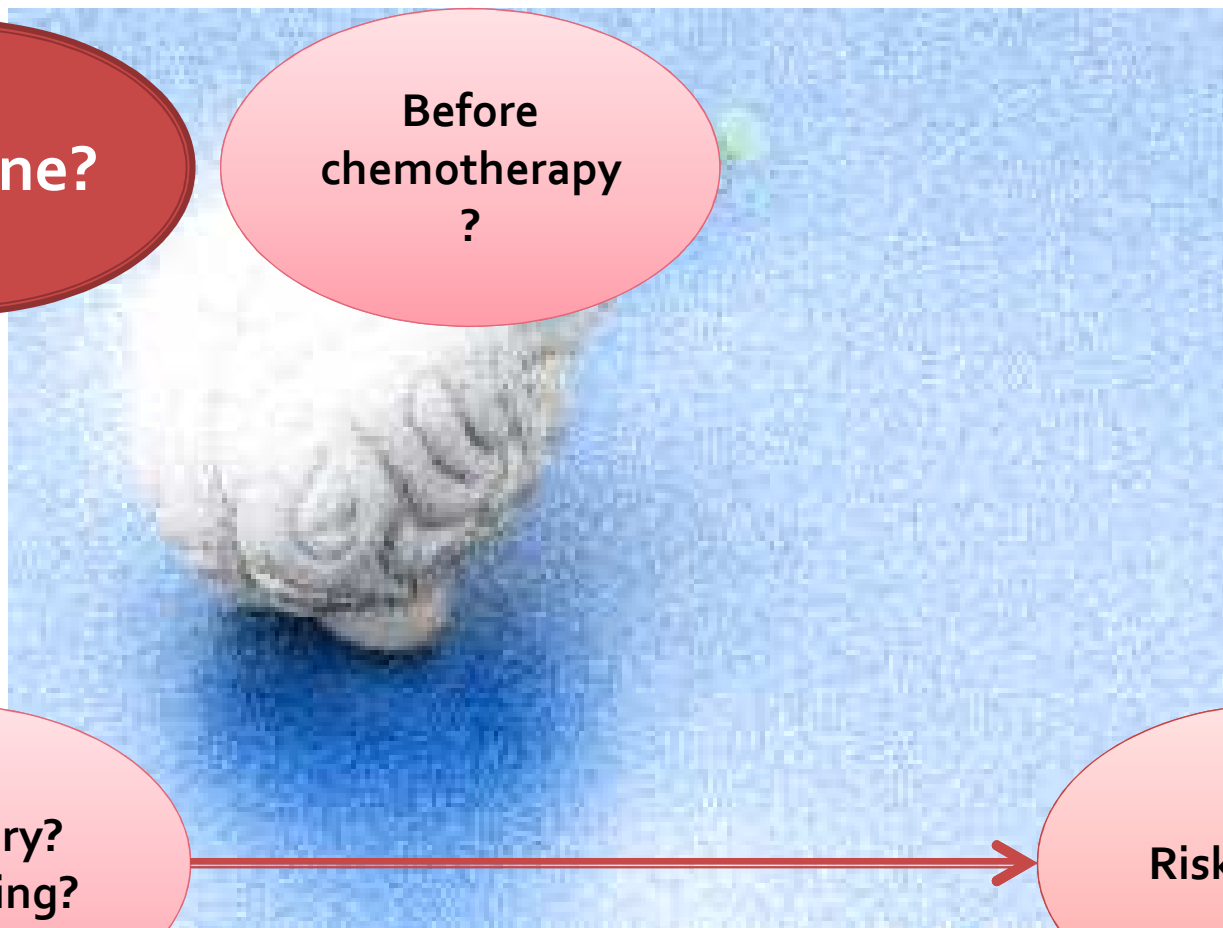
# Chemo-brain

Everyone?

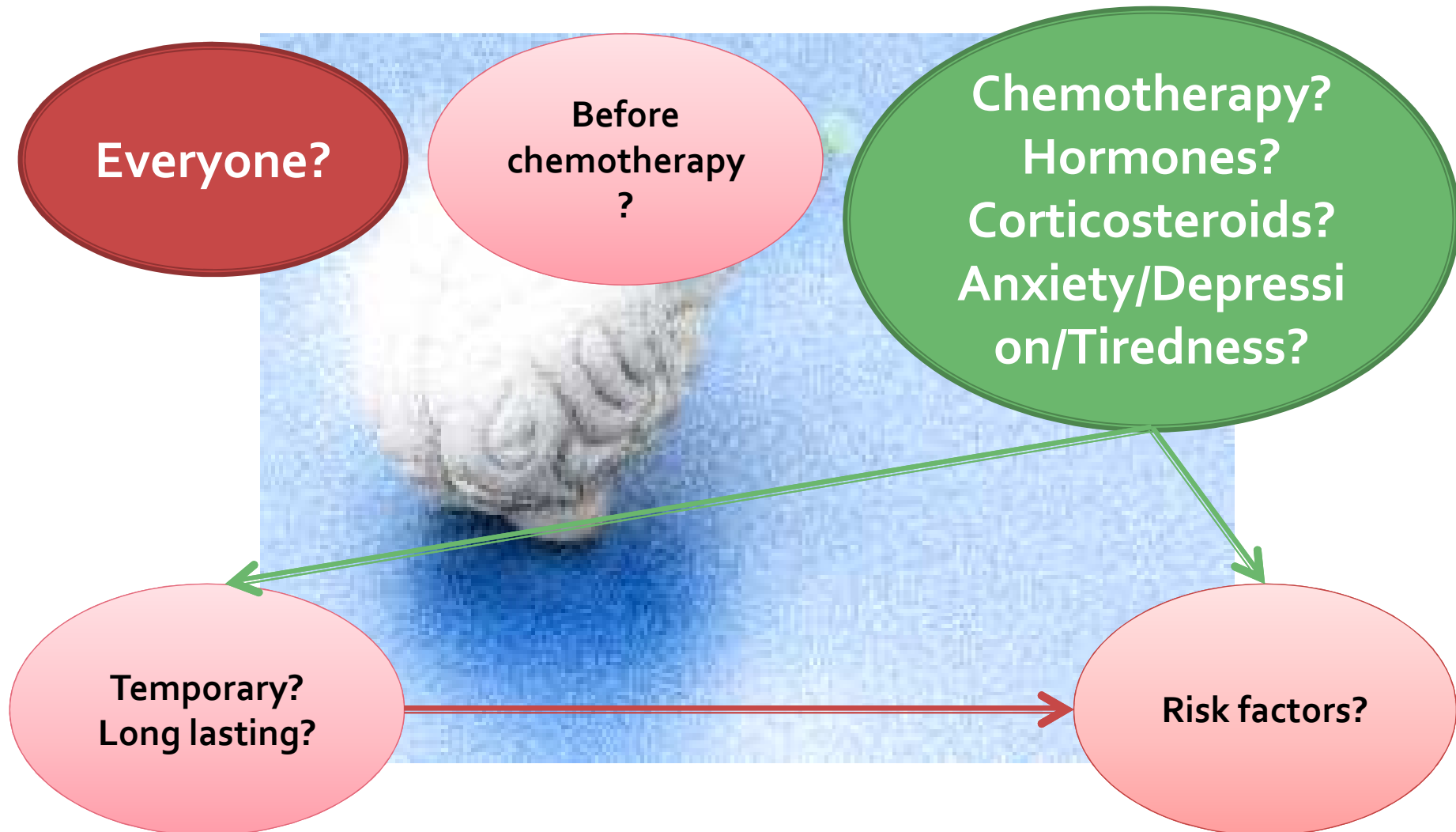
Before  
chemotherapy  
?

Temporary?  
Long lasting?

Risk factors?



# Chemo-brain





# Paediatric patients



**Mean age = 10**

# Paediatric patients



Acute  
lymphoblastic  
leukaemia

**Mean age = 10**

# Paediatric patients



Acute  
lymphoblastic  
leukaemia

Wilms'  
tumour

Mean age = 10

# Paediatric patients



Acute  
lymphoblastic  
leukaemia  
29-59% impaired

Wilms'  
tumour

Mean age = 10

# Adult patients



**Mean age = 55**

# Adult patients



**Breast cancer**

**Mean age = 55**

# Adult patients



**Breast cancer**

**Testicular  
cancer**

**Mean age = 55**

# Adult patients



Breast cancer

Testicular  
cancer

Other: lung,  
colorectal,  
lymphoma

Mean age = 55



# Adult patients



**Breast cancer**

**Testicular  
cancer**

**Other: lung,  
colorectal,  
lymphoma**

**Up to 80% complain of  
poor cognitive  
performance**

**Mean age = 55**

# Our group



16-50 year old patients

# Our group

Lymphoma



16-50 year old patients

# Our group

Lymphoma

Sarcoma



16-50 year old patients

# Our group

Lymphoma

Sarcoma

Germ cell  
tumour

16-50 year old patients



# Our group

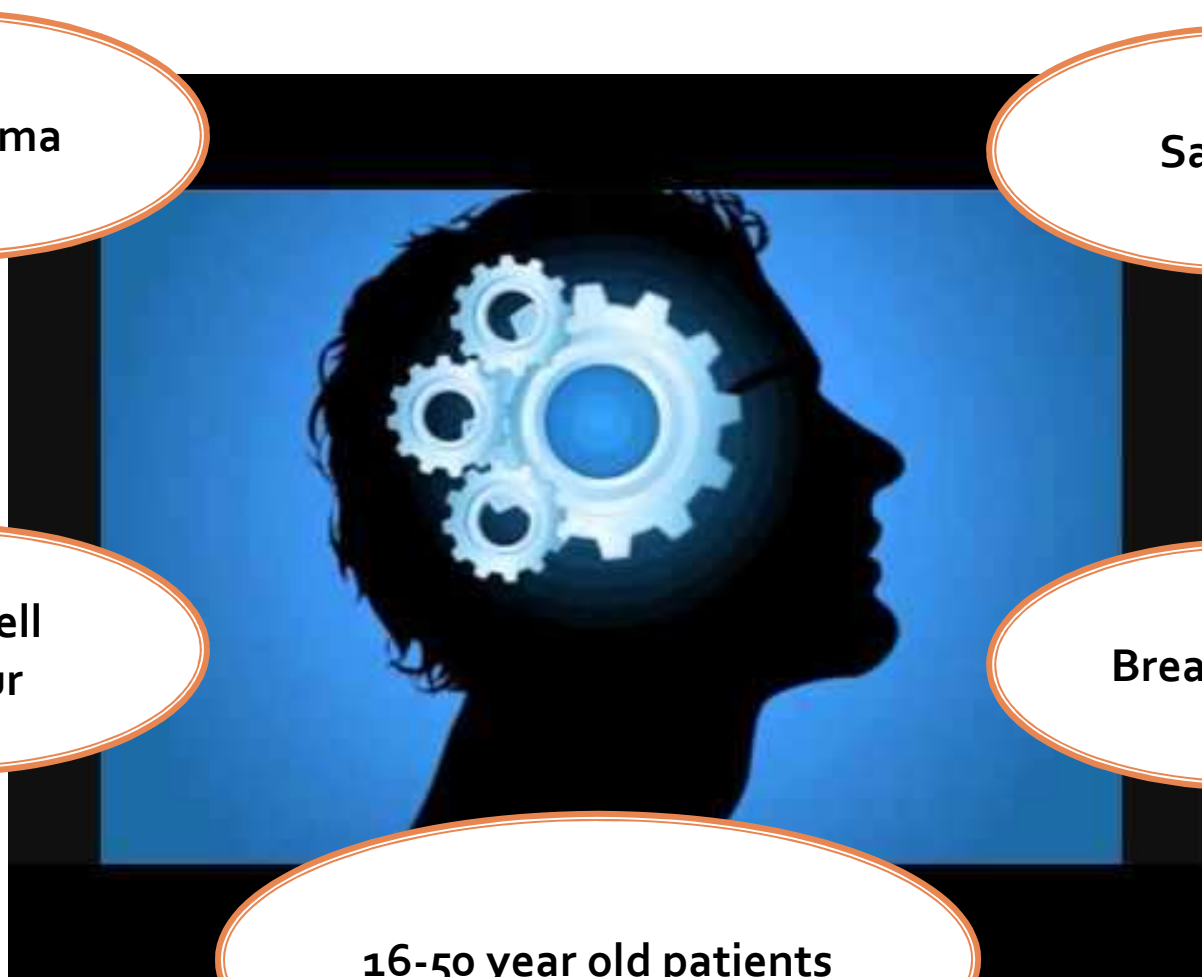
**Lymphoma**

**Sarcoma**

**Germ cell  
tumour**

**Breast cancer**

**16-50 year old patients**



# Our group

Before  
treatment  
N=30

Control  
N=96

After  
treatment  
N=75



# Our group



Before  
treatment  
N=30

Control  
N=96

After  
treatment  
N=75

Effects?  
Which ones?  
Other factors?



# Instruments

- 12 neuropsychological tests: attention, memory, planning/self-monitoring.
- Psycho-social questionnaires: cognitive complaints, symptoms, anxiety, depression, tiredness, quality of life.

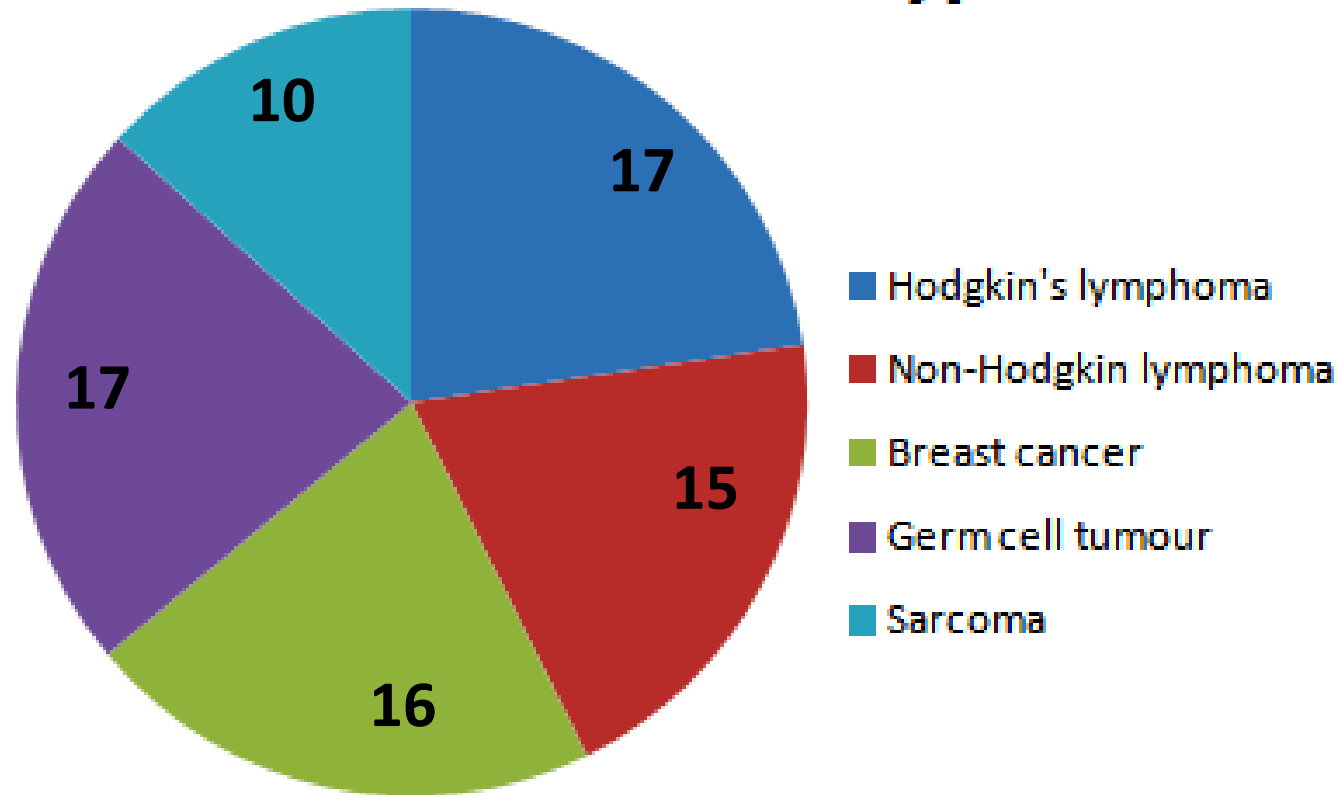
# Post-treatment patients

- 75 patients versus 75 healthy matched controls
- 6 months to 5 years post-treatment (mean=2.5 years)

	Variable	Survivors	Controls
✓	Age (m/sd)	35.55 (9.49)	29.62 (9.84)
✓	Sex (m/sd)	0.48 (0.50)	0.53 (0.50)
✓	Years of education (m/sd)	14.20 (2.22)	15.15 (2.14)

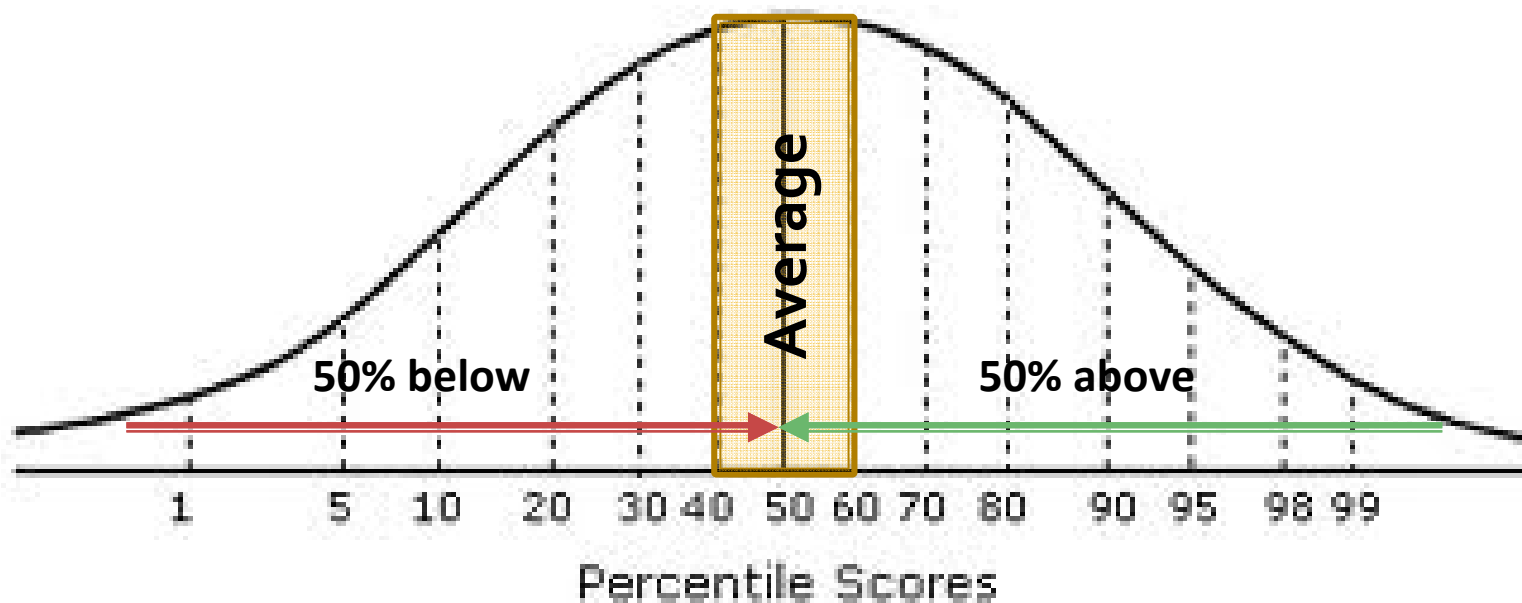
# Post-treatment patients

## Survivors - cancer type



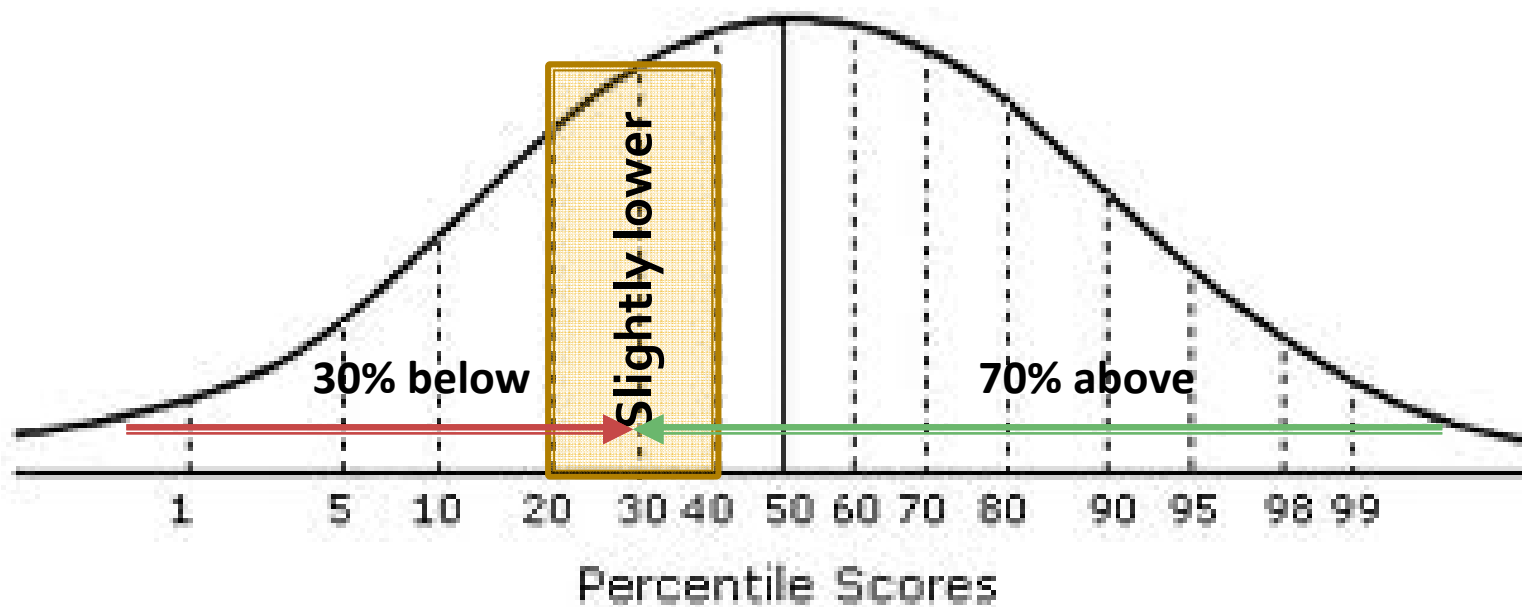
# Results

## Post-treatment patients



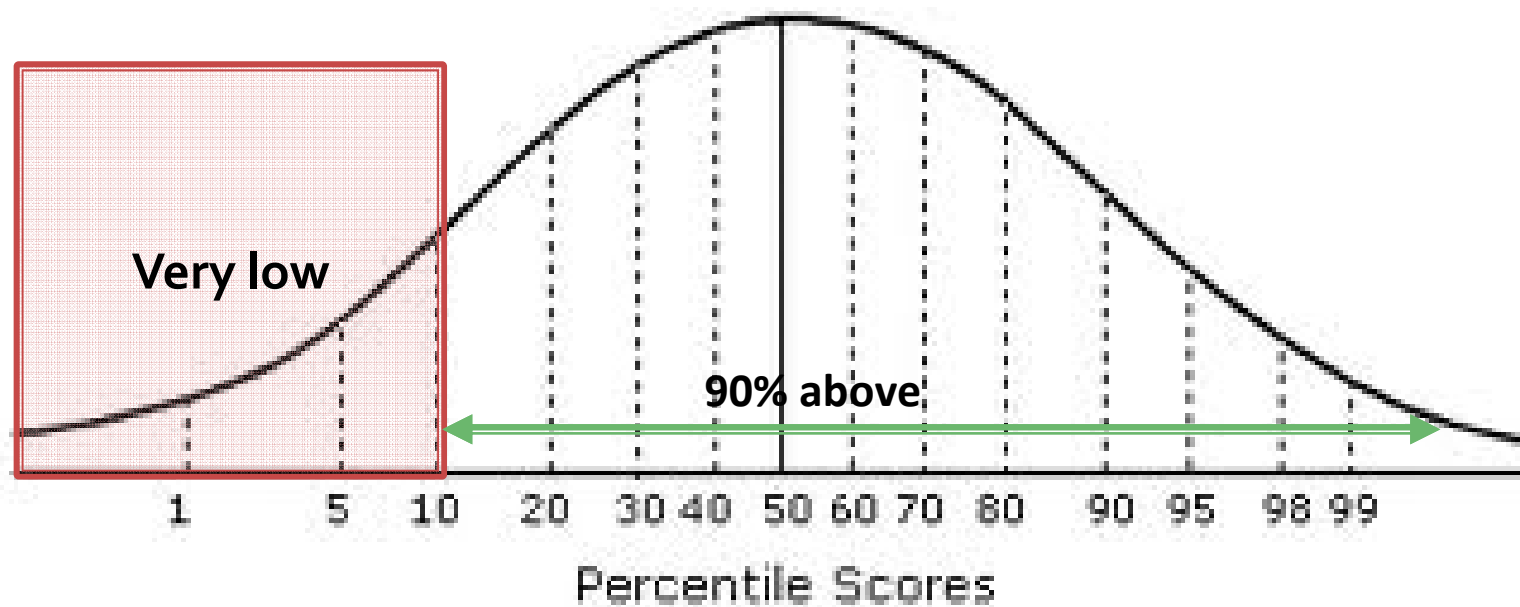
# Results

## Post-treatment patients



# Results

## Post-treatment patients



# Verbal memory

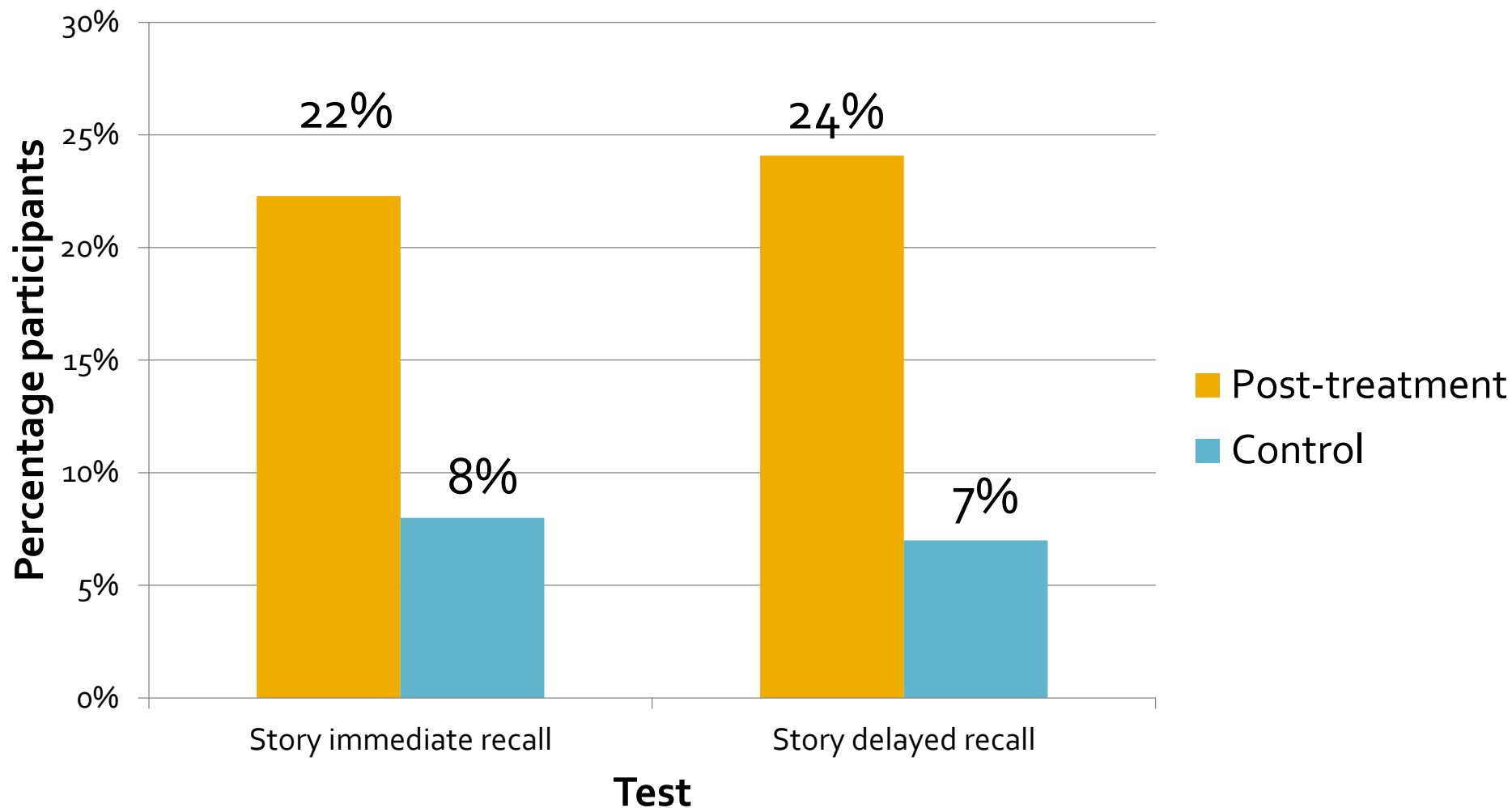
## Post-treatment patients

- Remembering a story:

“On Wednesday afternoon/ Mr. Jones was waiting for his train/ in the local station/. The train was delayed/ and he had to wait for an additional 20 minutes. “

# Verbal memory

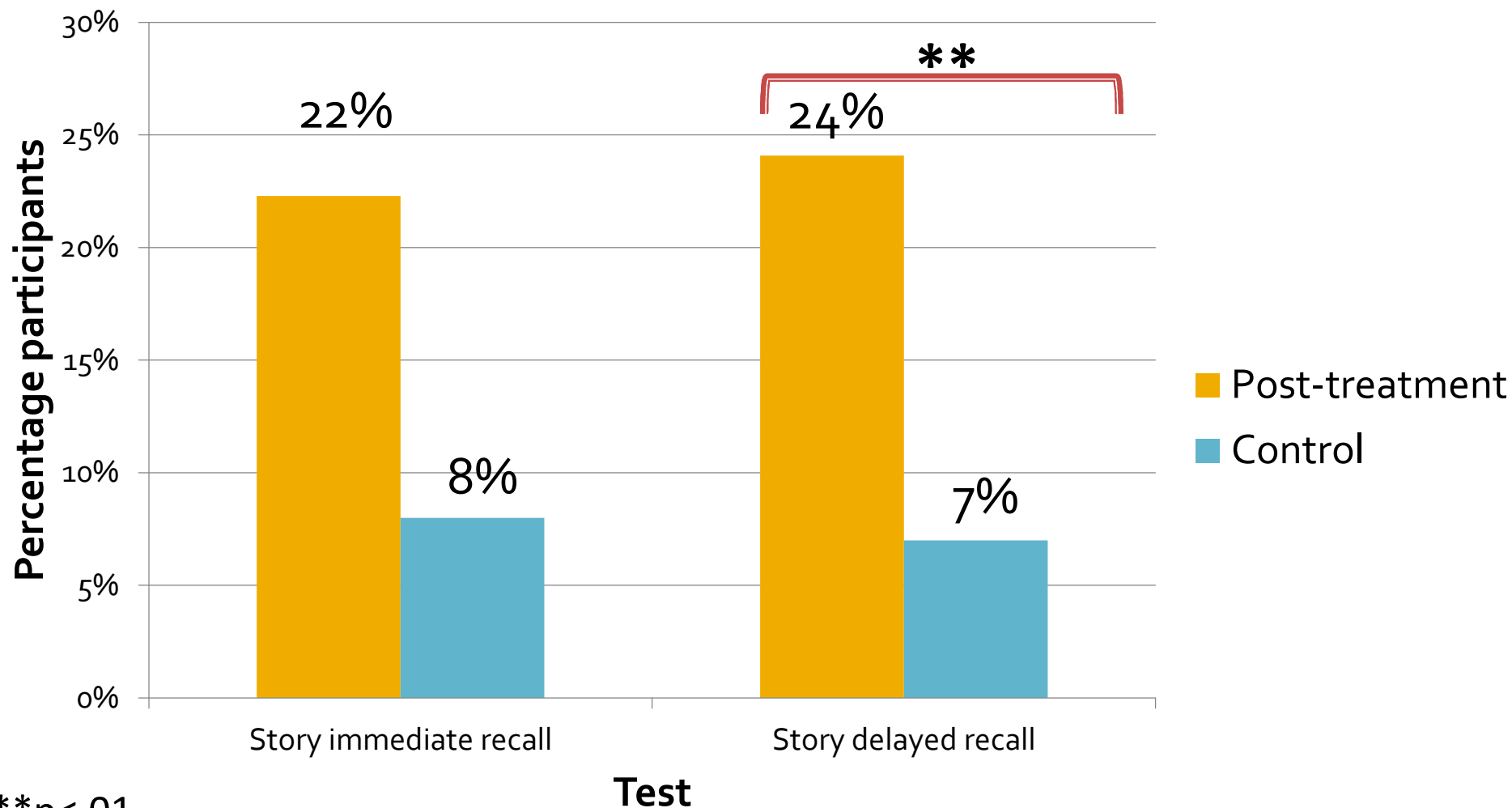
## Post-treatment patients





# Verbal memory

## Post-treatment patients



# Verbal memory

## Post-treatment patients

- Recognising two lists of words

### List A

Dog  
Plate  
Pencil  
Skate

Read and  
recall  
5 times

# Verbal memory

## Post-treatment patients

- Recognising two lists of words

### List A

Dog  
Plate  
Pencil  
Skate

**Read and  
recall  
5 times**

### List B

Pigeon  
Book  
Sand  
Mug

**Read and  
recall  
once**

# Verbal memory

## Post-treatment patients

- Recognising two lists of words


<b>List A</b>	<b>List B</b>	<b>List A</b>
Dog Plate Pencil Skate	Pigeon Book Sand Mug	?
<b>Read and recall 5 times</b>	<b>Read and recall once</b>	<b>Recall</b>

# Verbal memory

## Post-treatment patients

- Recognising two lists of words

<p><b>List A</b></p> <p>Dog Plate Pencil Skate</p> <p><b>Read and recall 5 times</b></p>	<p><b>List B</b></p> <p>Pigeon Book Sand Mug</p> <p><b>Read and recall once</b></p>	<p><b>List A</b></p> <p>?</p> <p><b>Recall</b></p>	<table border="1"><tr><td>Dog</td><td>Horse</td></tr><tr><td>Paper</td><td>Sand</td></tr><tr><td>Phone</td><td>Skate</td></tr><tr><td>Pigeon</td><td>Train</td></tr><tr><td>Rabbit</td><td>Plate</td></tr><tr><td>Mug</td><td>Apple</td></tr><tr><td>Pencil</td><td>Guitar</td></tr><tr><td>Kettle</td><td>Book</td></tr></table> <p><b>Which word? From which list?</b></p>	Dog	Horse	Paper	Sand	Phone	Skate	Pigeon	Train	Rabbit	Plate	Mug	Apple	Pencil	Guitar	Kettle	Book
Dog	Horse																		
Paper	Sand																		
Phone	Skate																		
Pigeon	Train																		
Rabbit	Plate																		
Mug	Apple																		
Pencil	Guitar																		
Kettle	Book																		




# Verbal memory

## Post-treatment patients

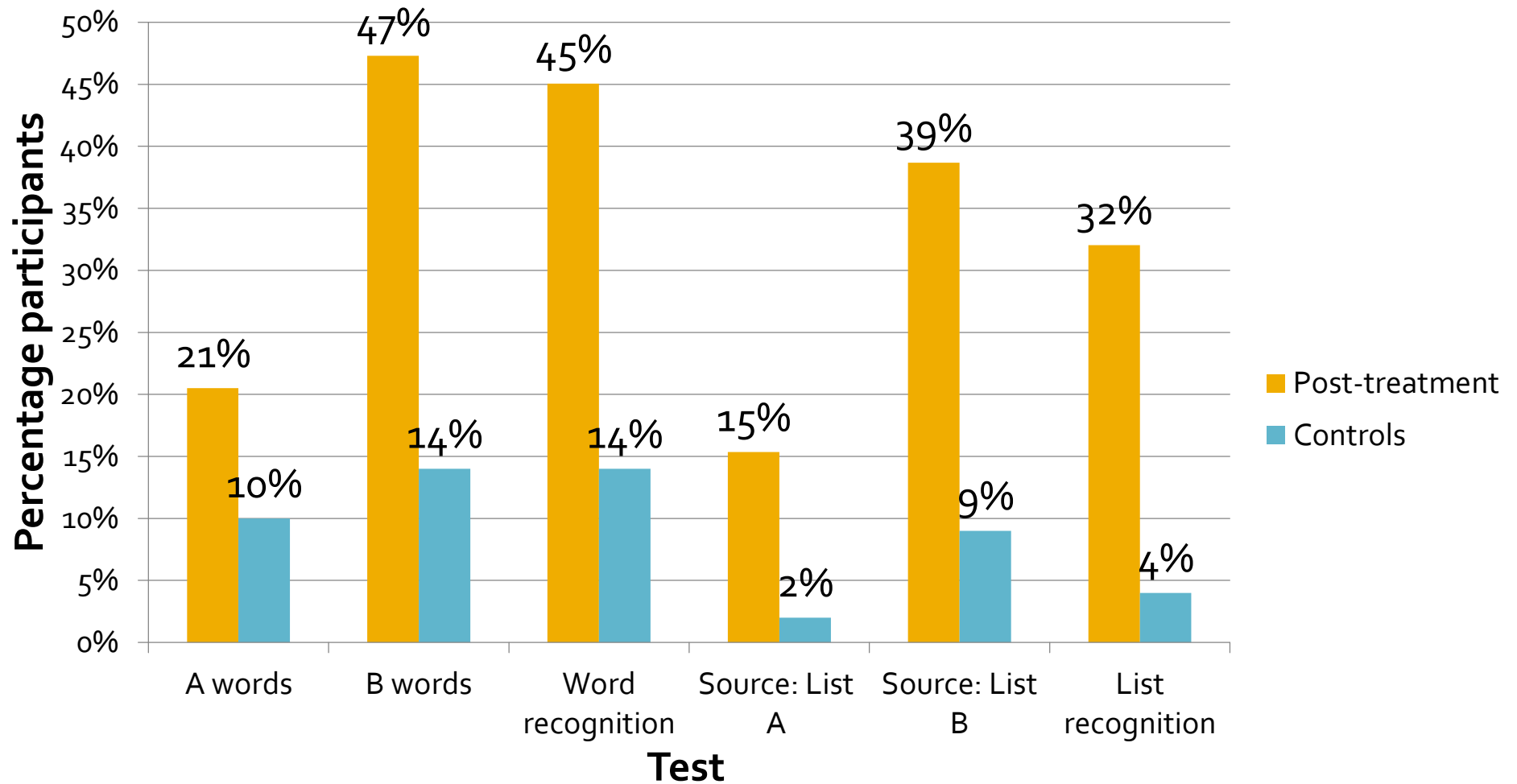
- Recognising two lists of words

<p><b>List A</b></p> <p>Dog Plate Pencil Skate</p> <p><b>Read and recall 5 times</b></p>	<p><b>List B</b></p> <p>Pigeon Book Sand Mug</p> <p><b>Read and recall once</b></p>	<p><b>List A</b></p> <p>?</p> <p><b>Recall</b></p>	<table border="1"><tr><td>Dog</td><td>Horse</td></tr><tr><td>Paper</td><td>Sand</td></tr><tr><td>Phone</td><td>Skate</td></tr><tr><td>Pigeon</td><td>Train</td></tr><tr><td>Rabbit</td><td>Plate</td></tr><tr><td>Mug</td><td>Apple</td></tr><tr><td>Pencil</td><td>Guitar</td></tr><tr><td>Kettle</td><td>Book</td></tr></table> <p><b>Which word? From which list?</b></p>	Dog	Horse	Paper	Sand	Phone	Skate	Pigeon	Train	Rabbit	Plate	Mug	Apple	Pencil	Guitar	Kettle	Book
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Rabbit	Plate																		
Mug	Apple																		
Pencil	Guitar																		
Kettle	Book																		



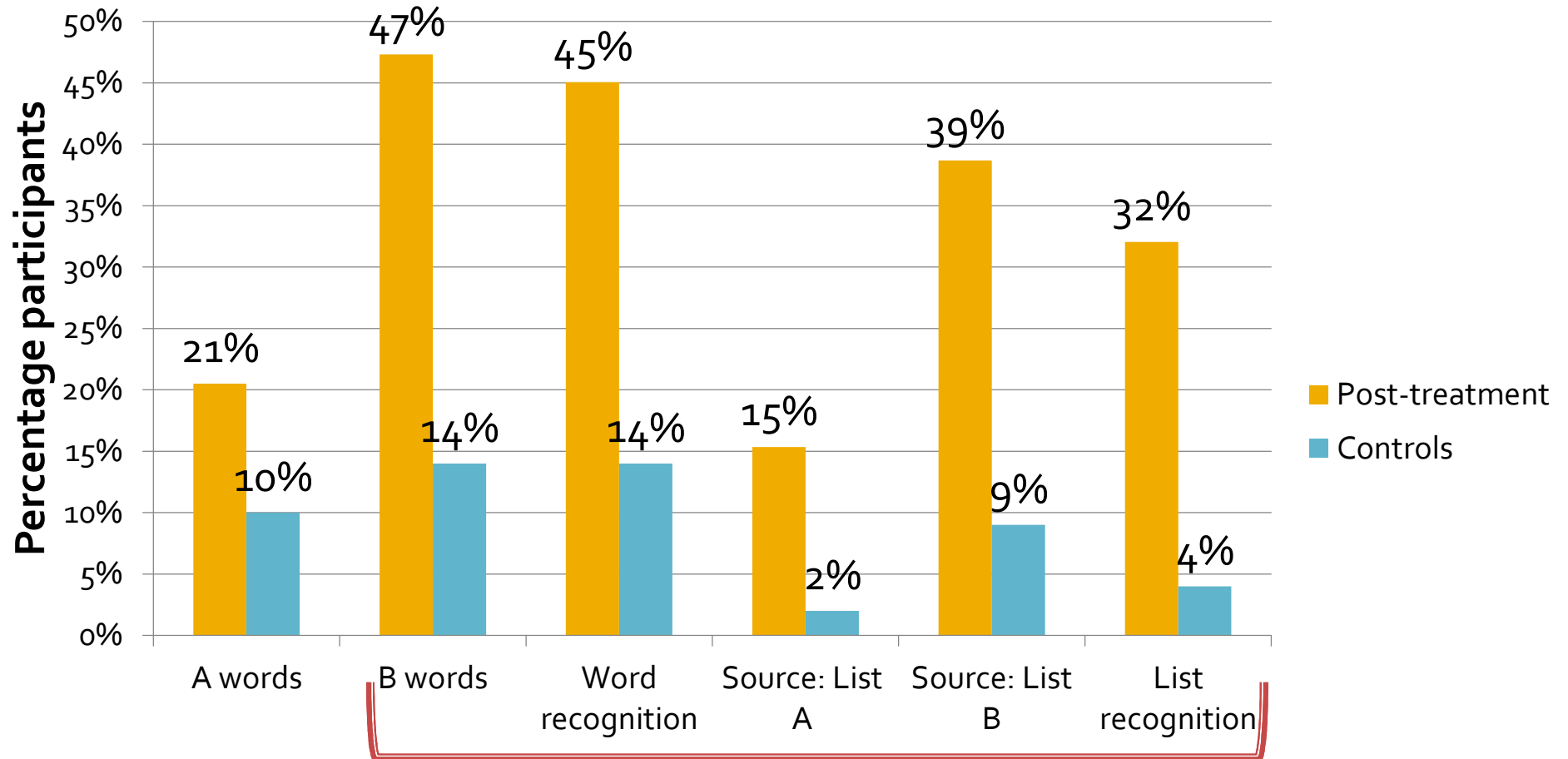
# Verbal memory

## Post-treatment patients



# Verbal memory

## Post-treatment patients



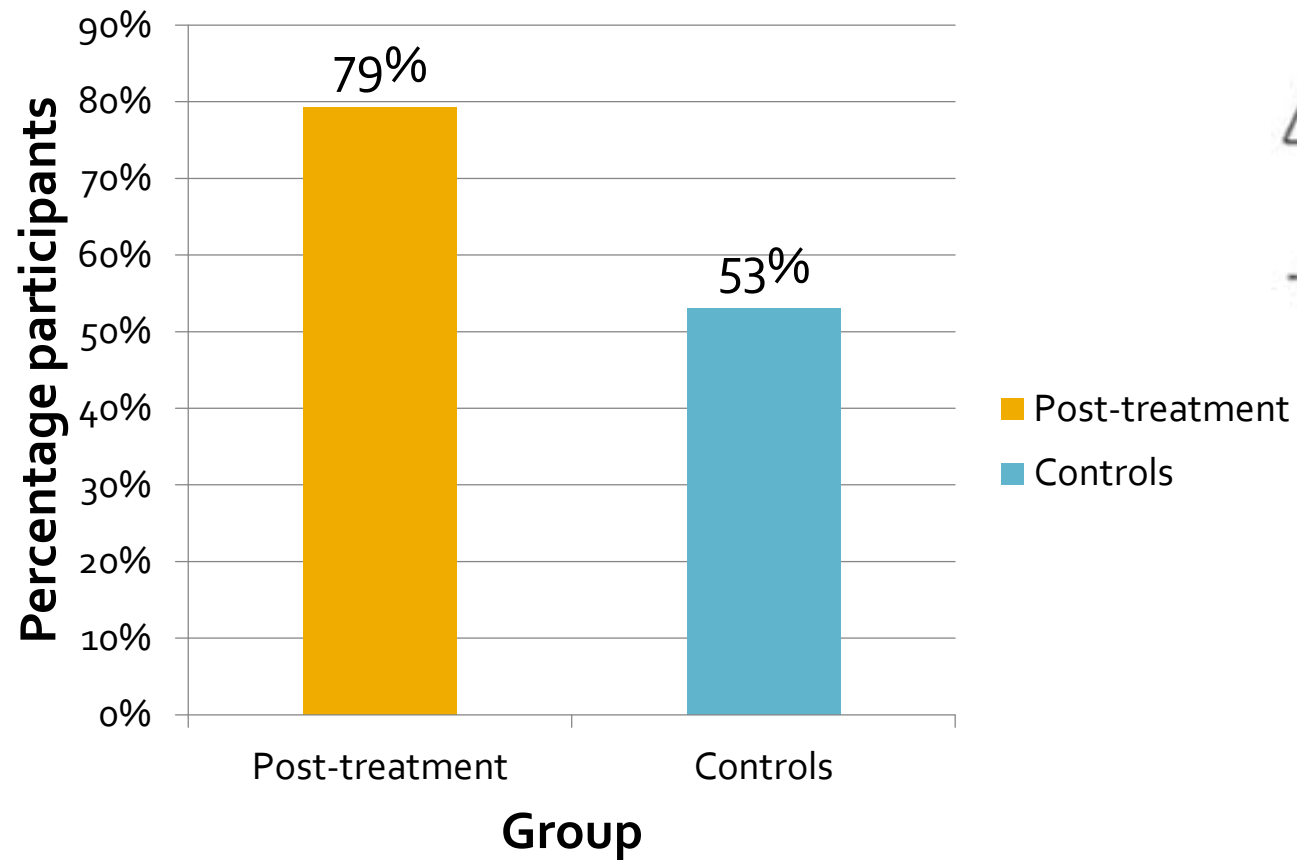
p<.01

\*\*



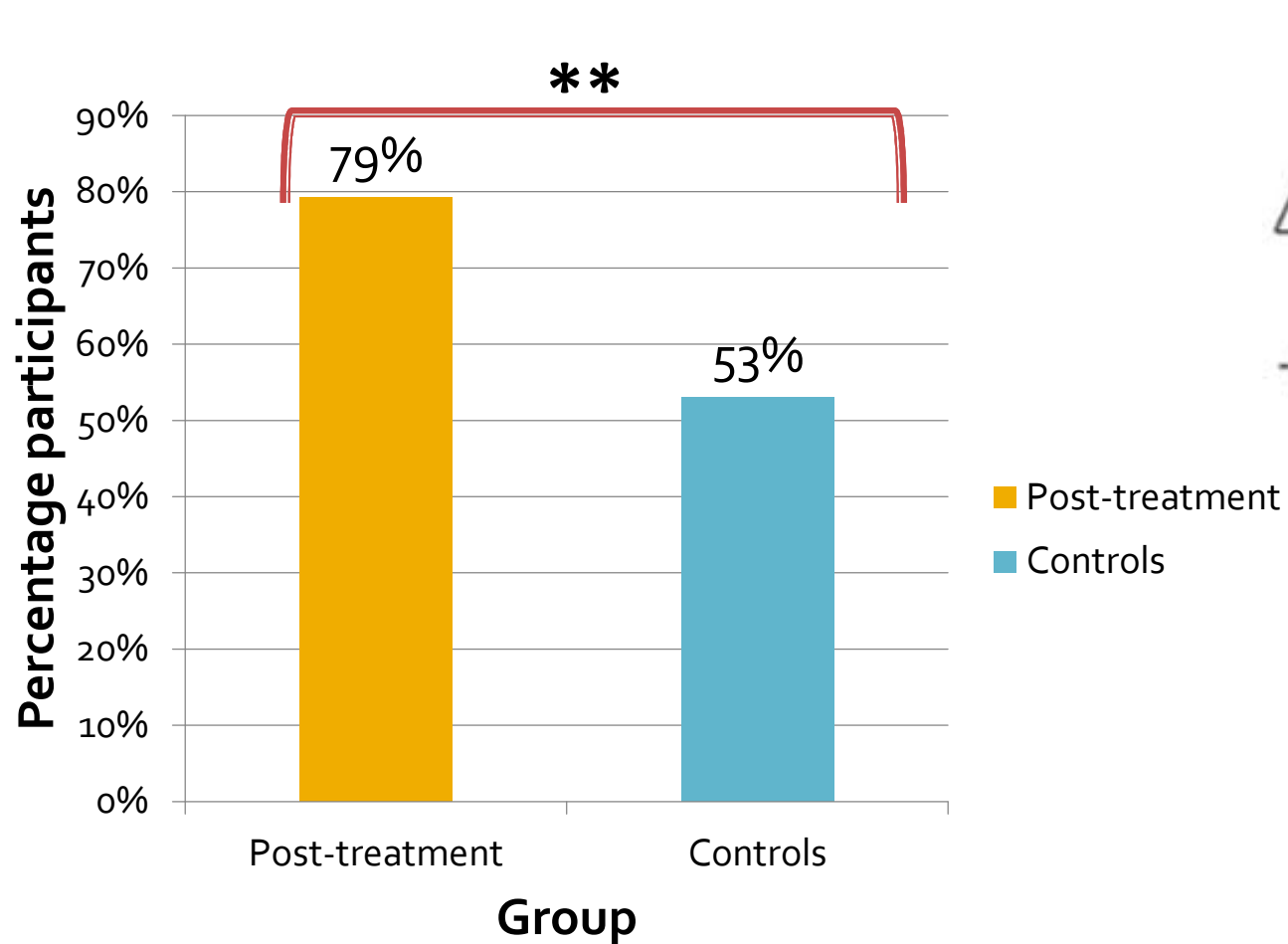
# Visuo-spatial abilities

## Post-treatment patients



# Visuo-spatial abilities

## Post-treatment patients



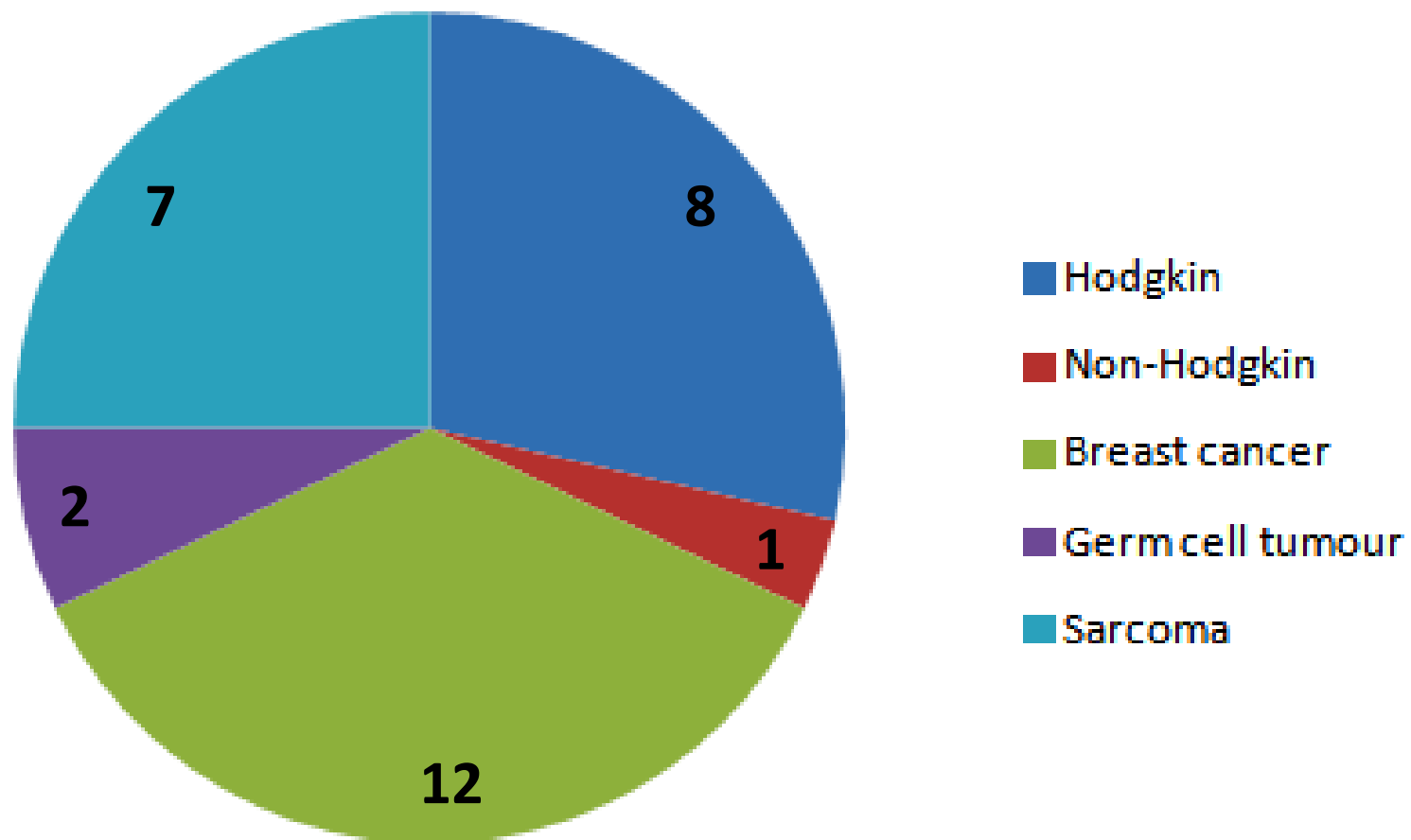
\*\*<.001

# Pre-treatment patients

- 30 pre-treatment patients versus 30 healthy matched controls

	Variable	New patients	Controls
✓	Age (m/sd)	30.92 (13.01)	30.57 (12.38)
✓	Sex (m/sd)	0.71 (0.46)	0.67 (0.47)
✓	Years of education (m/sd)	13.57 (1.81)	14.96 (2.65)

# Pre-treatment patients



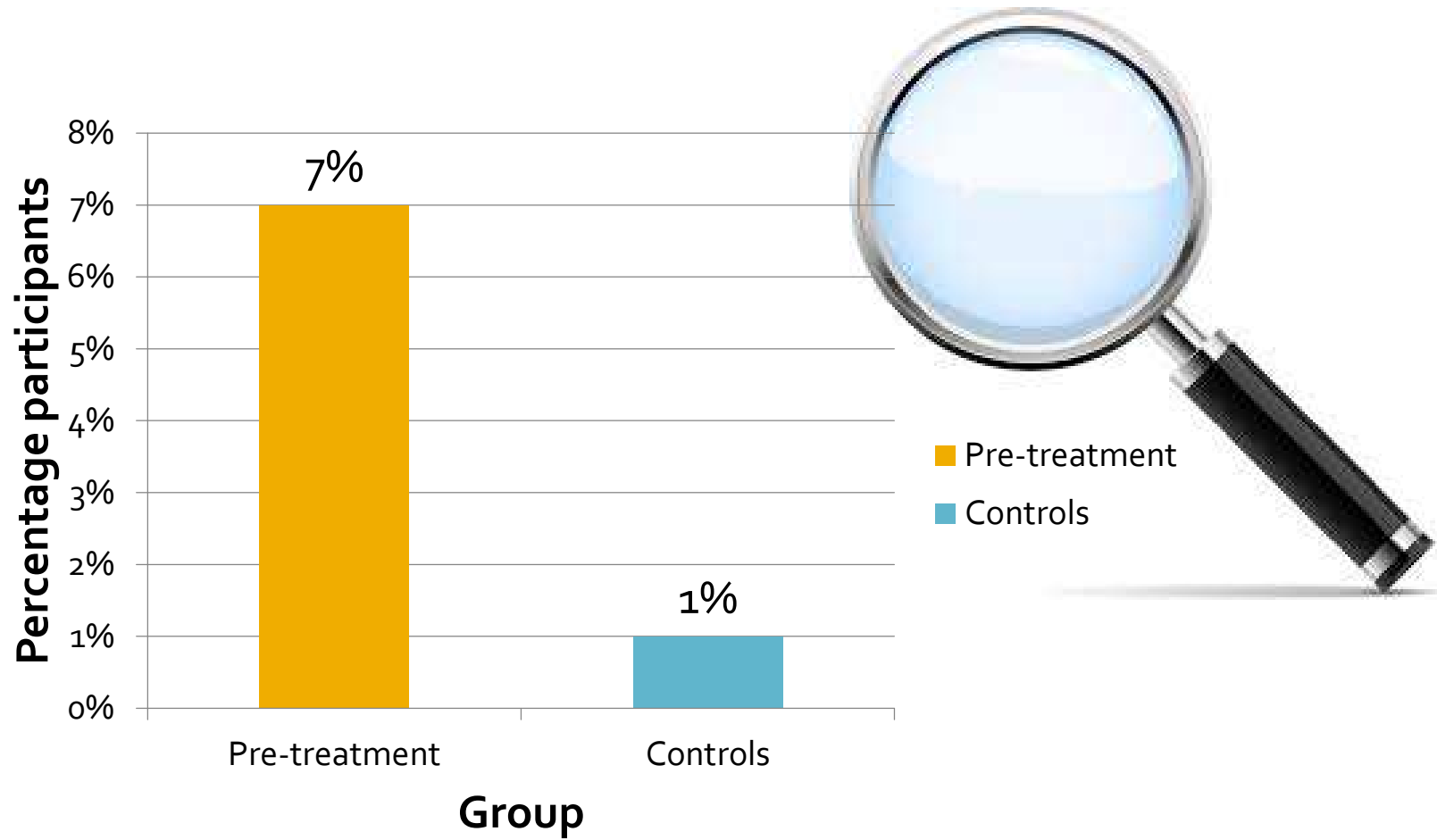
# Attention

## Pre-treatment patients



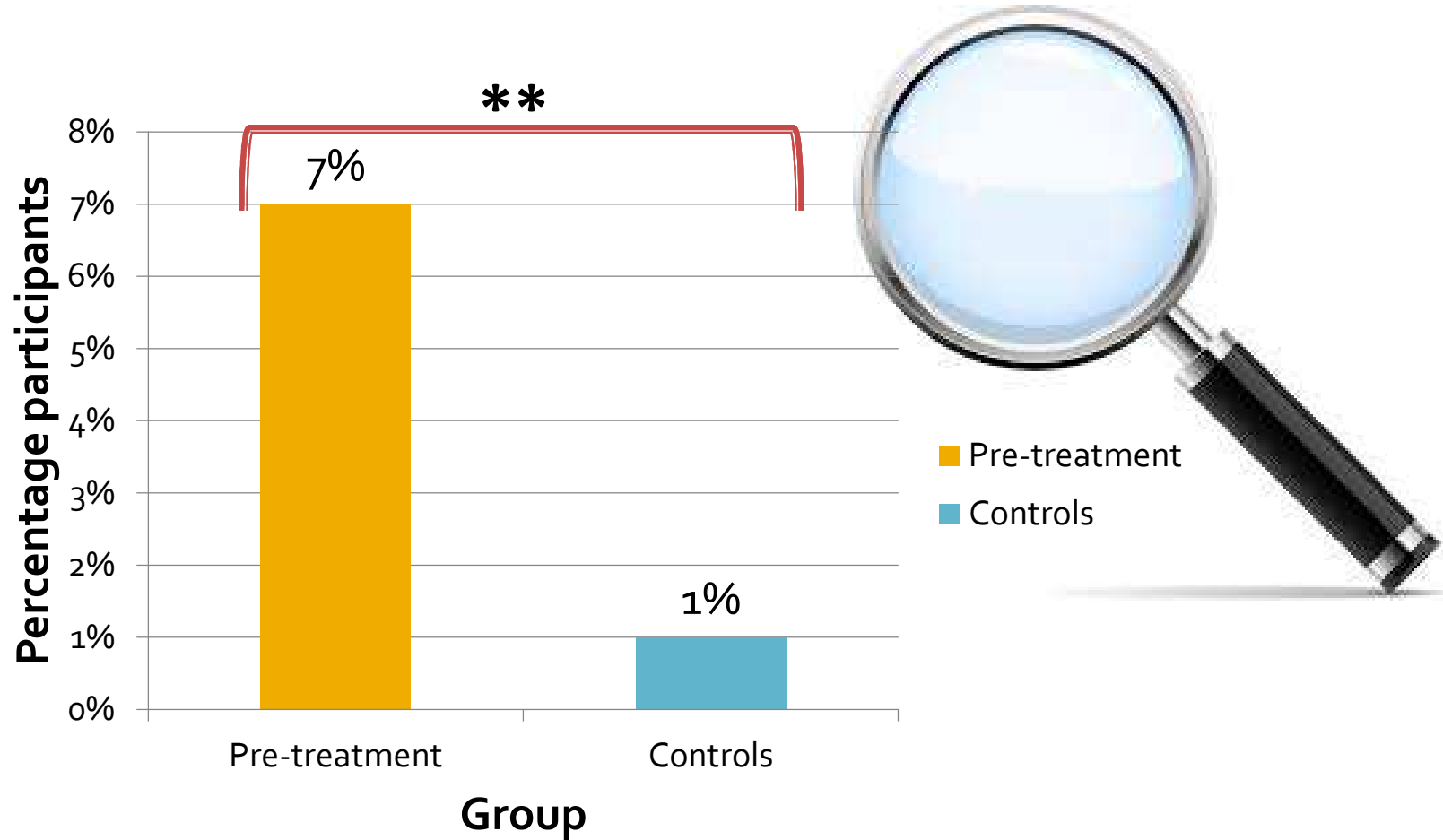
# Attention

## Pre-treatment patients



# Attention

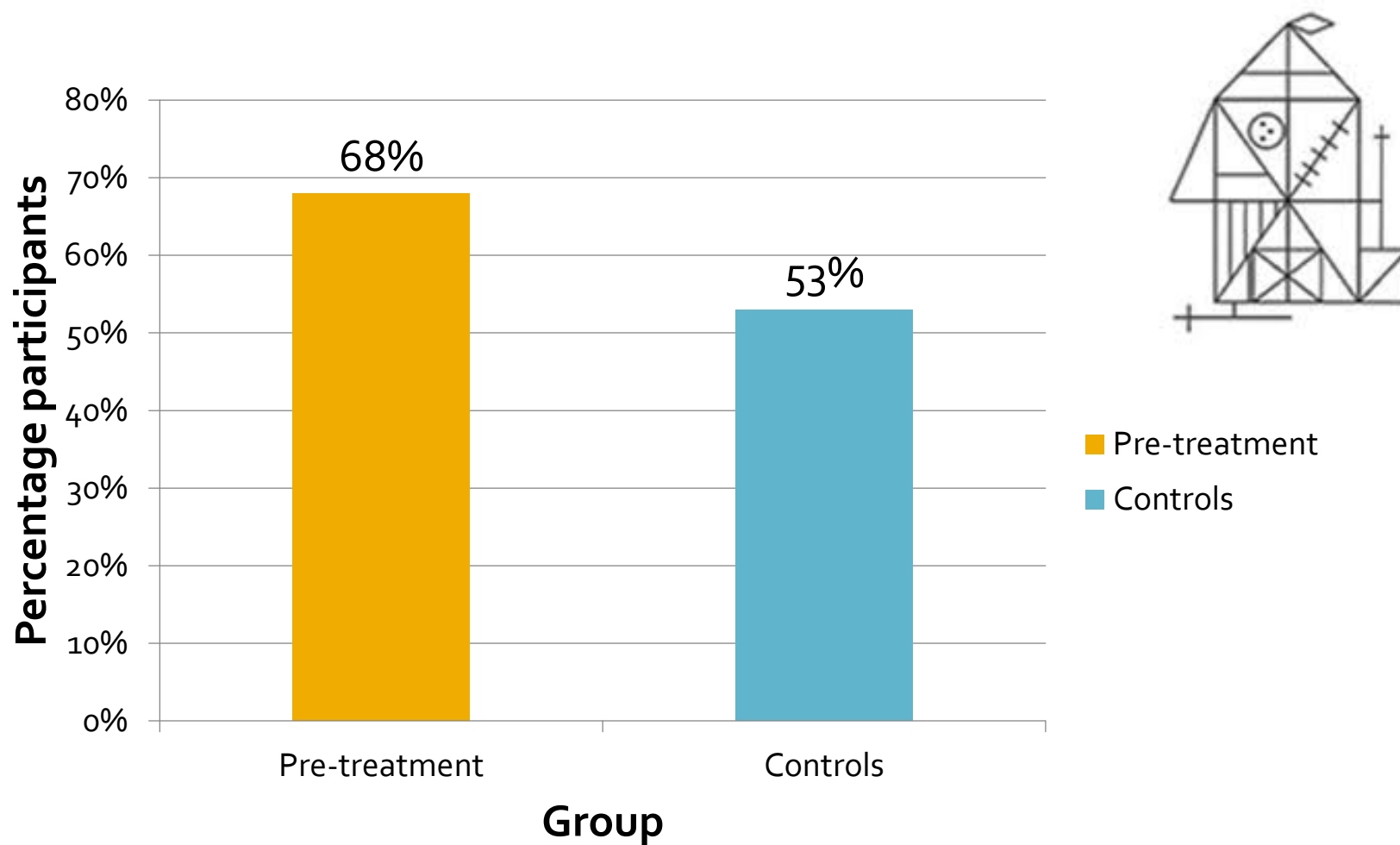
## Pre-treatment patients



\*\*p<.01

# Visuo-spatial abilities

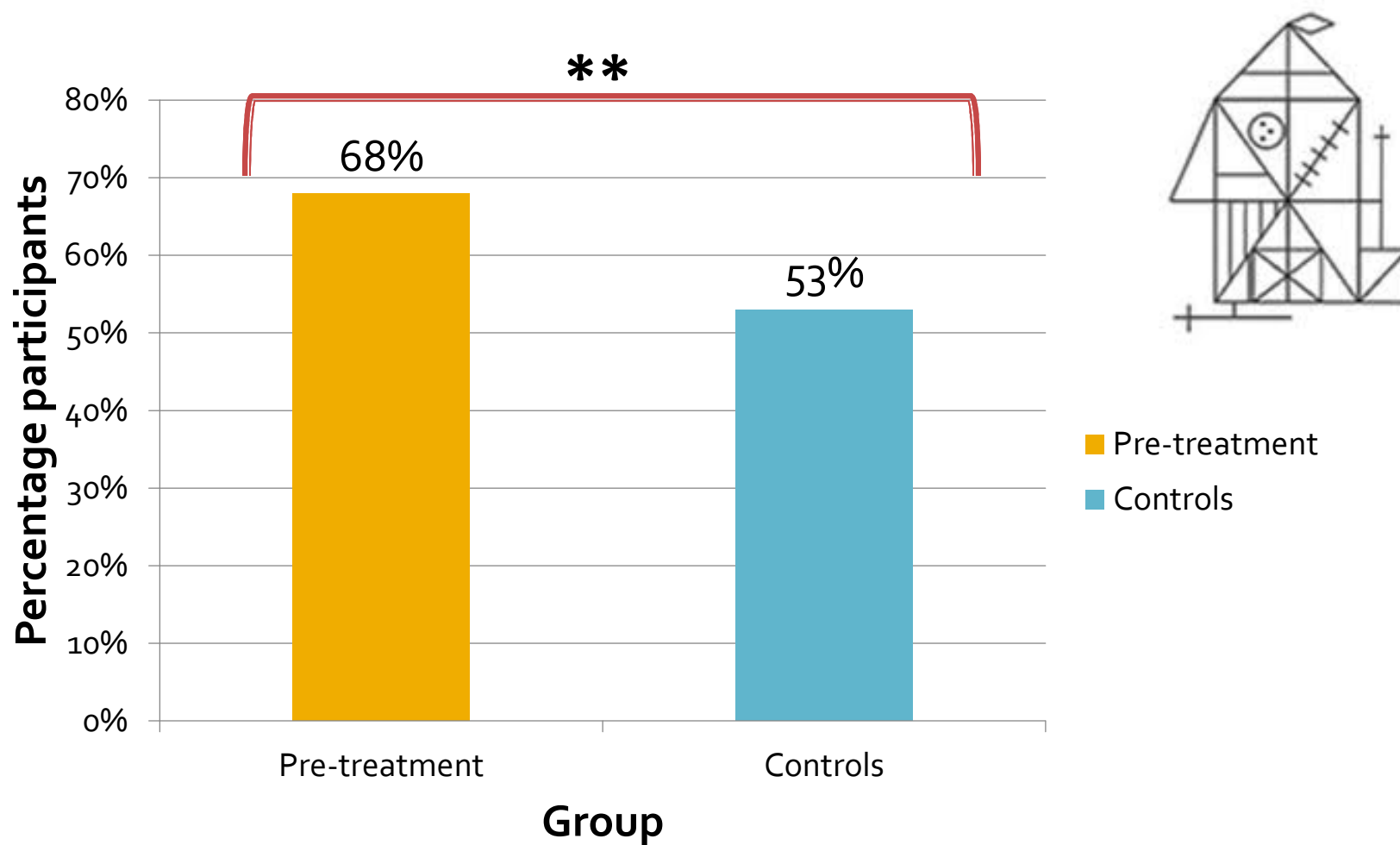
## Pre-treatment patients





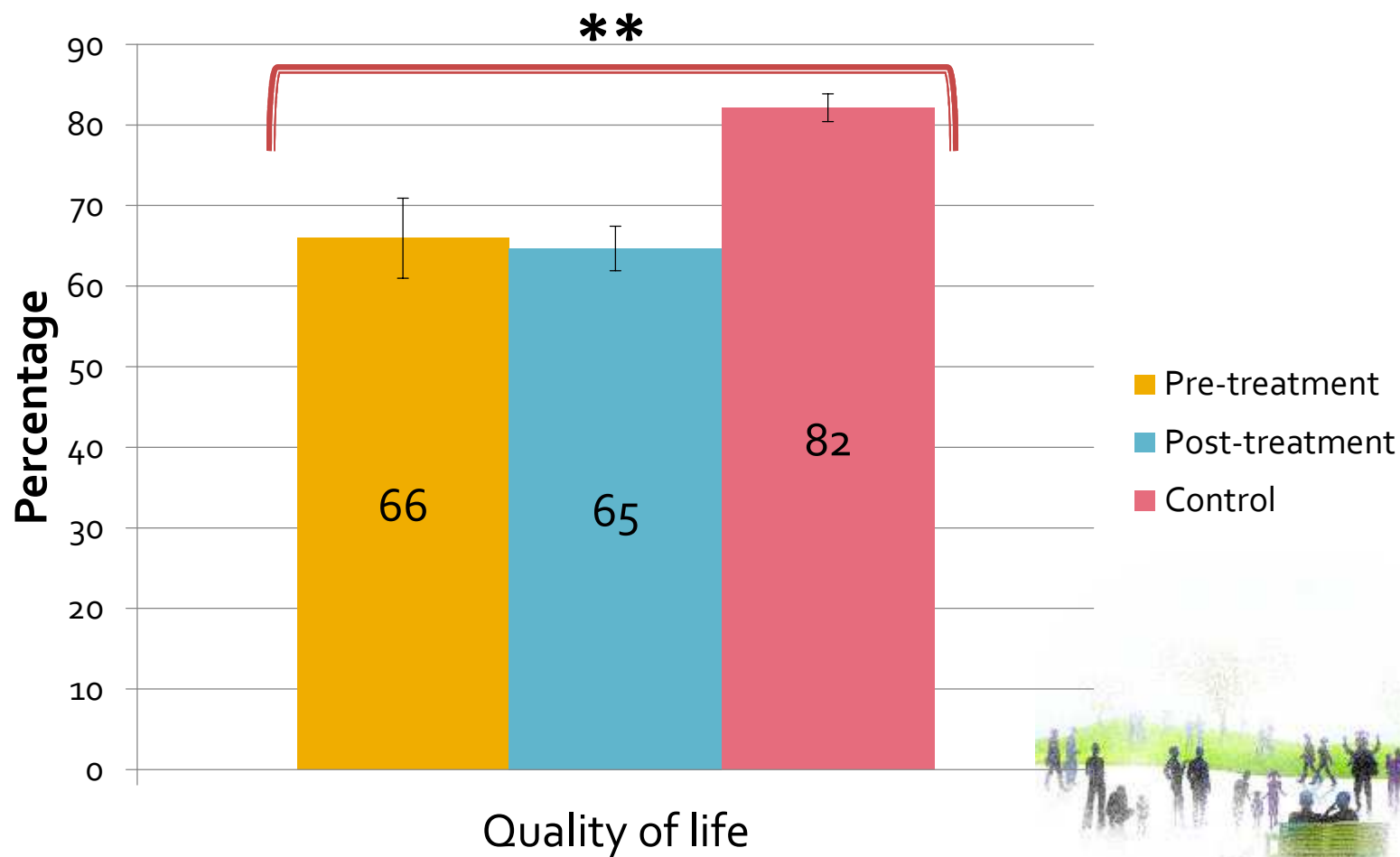
# Visuo-spatial abilities

## Post-treatment patients



\*\*p<.01

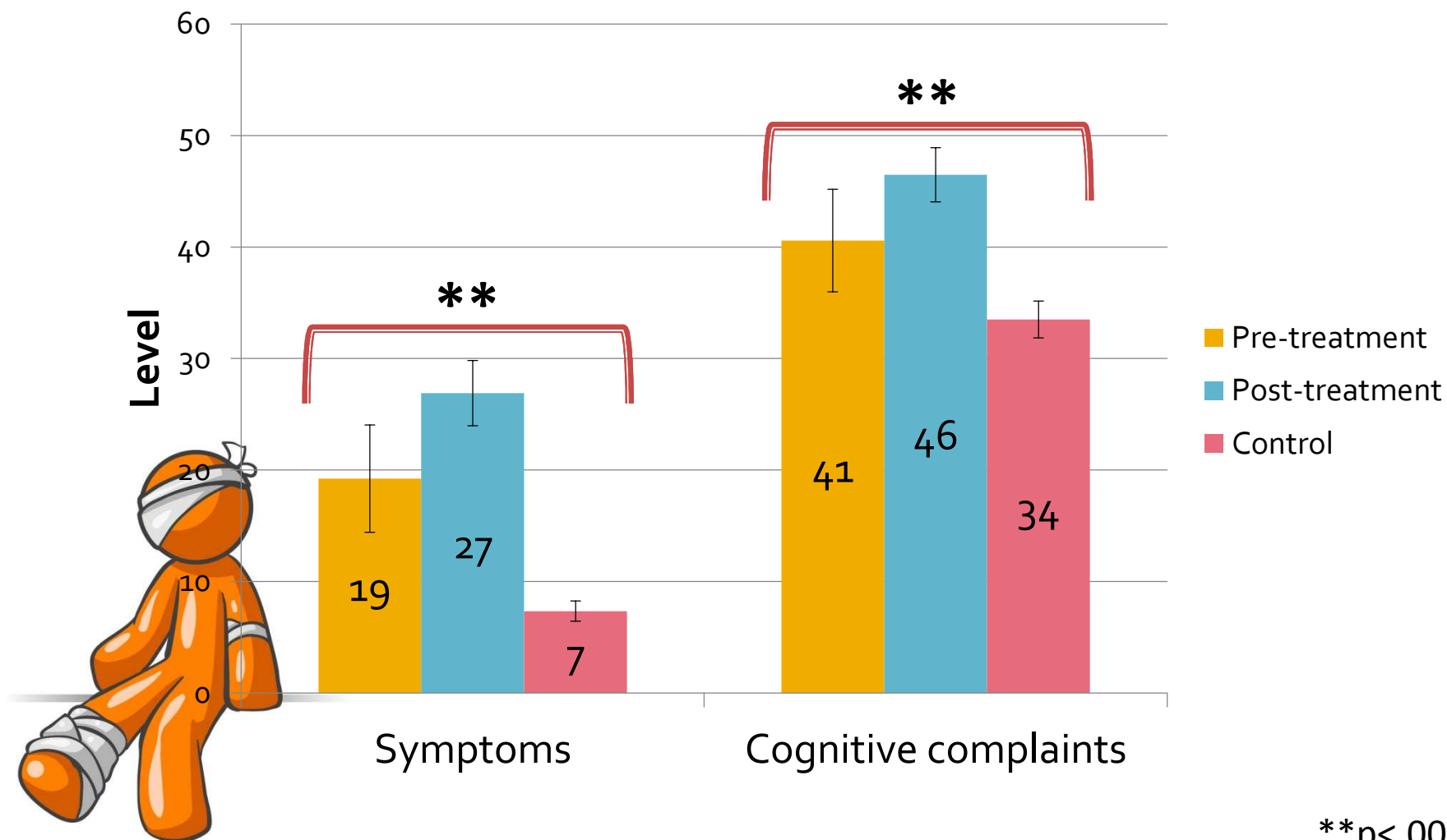
# Quality of life



\*\*p<.001

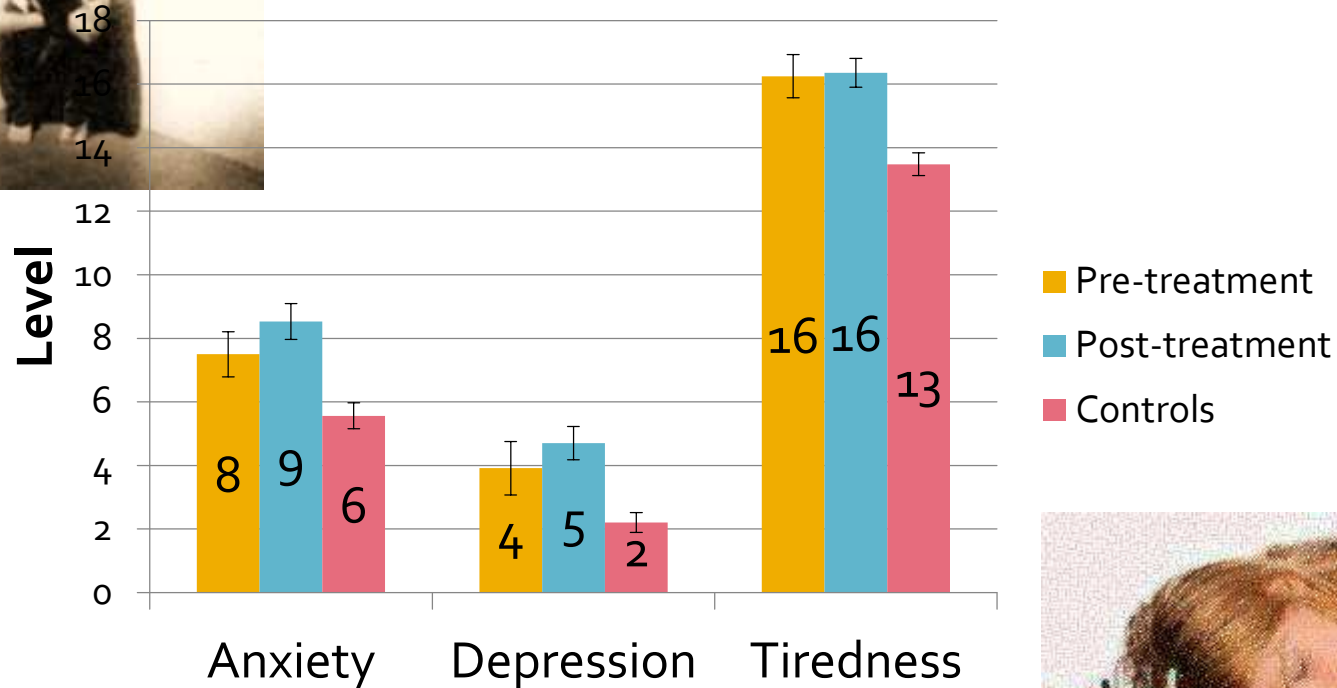
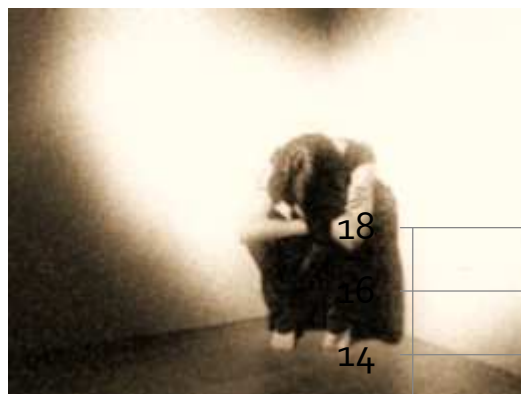


# Symptoms



\*\*p<.001

# Distress and tiredness



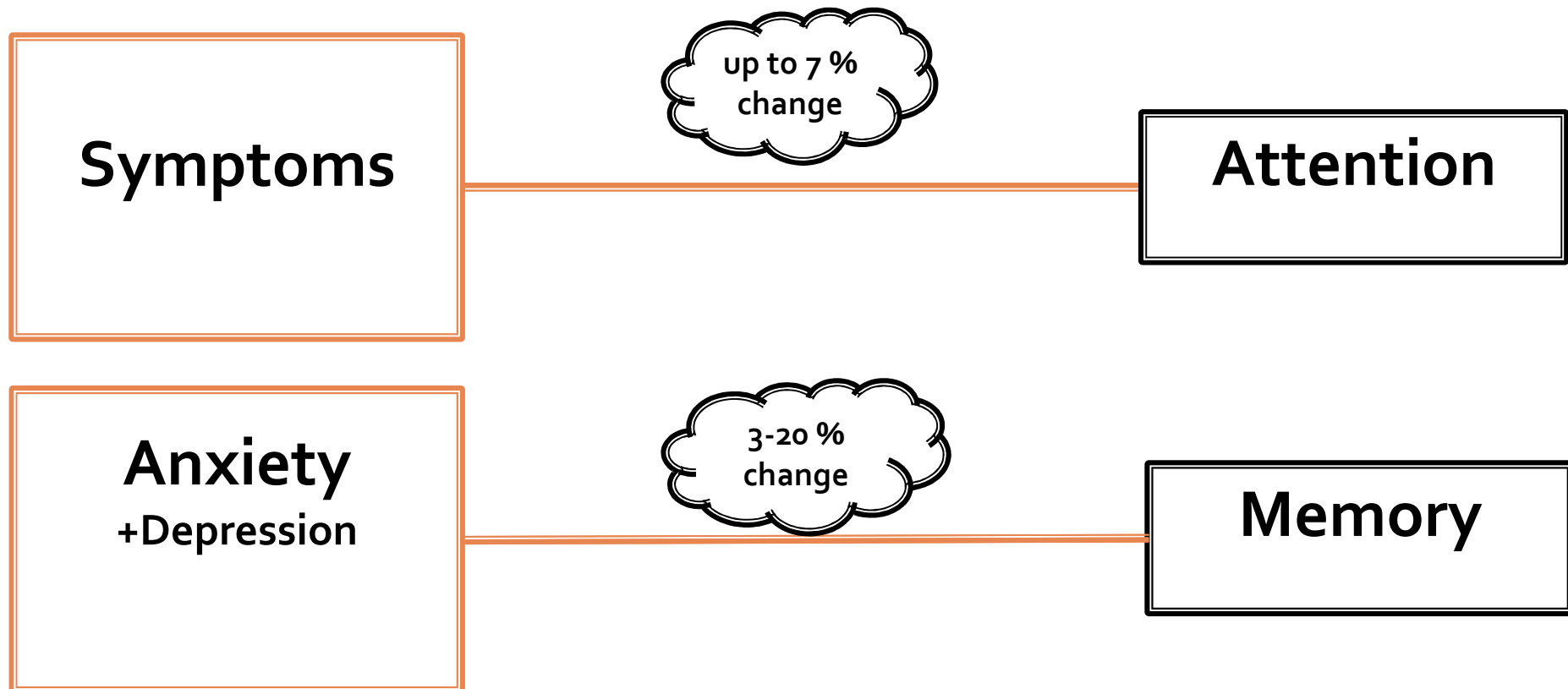
# Influence on cognition

## Pre-treatment patients



# Influence on cognition

## Post-treatment patients



# Summary

- **Post-treatment patients** - poor memory for verbal information and find it difficult to represent visuo-spatial information.
- **Pre-treatment patients** - lower attention and poor performance on visuo-spatial tests.
- All patients - **lower psycho-social functioning.**
- **They explain a part, but not all of the cognitive issues.**

# Future directions

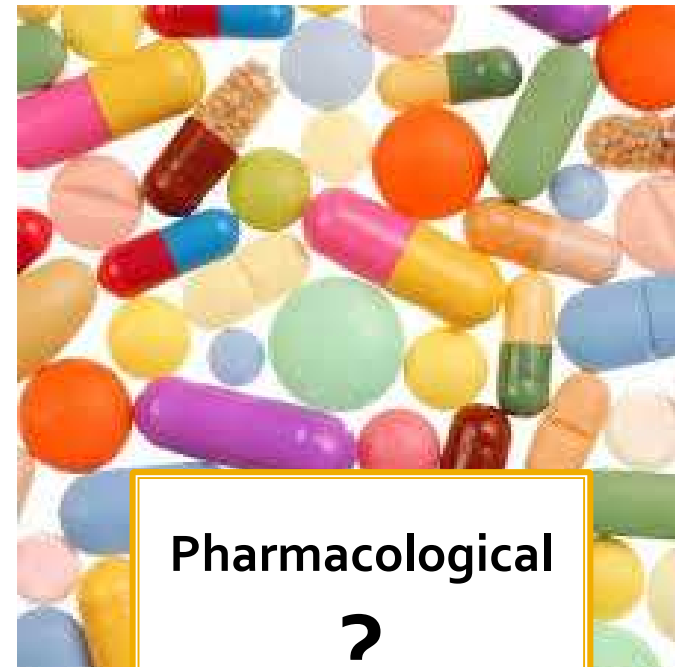
- More research on potential mechanisms





# Future directions

- More research on potential mechanisms
- To inform potential treatments



Pharmacological

?

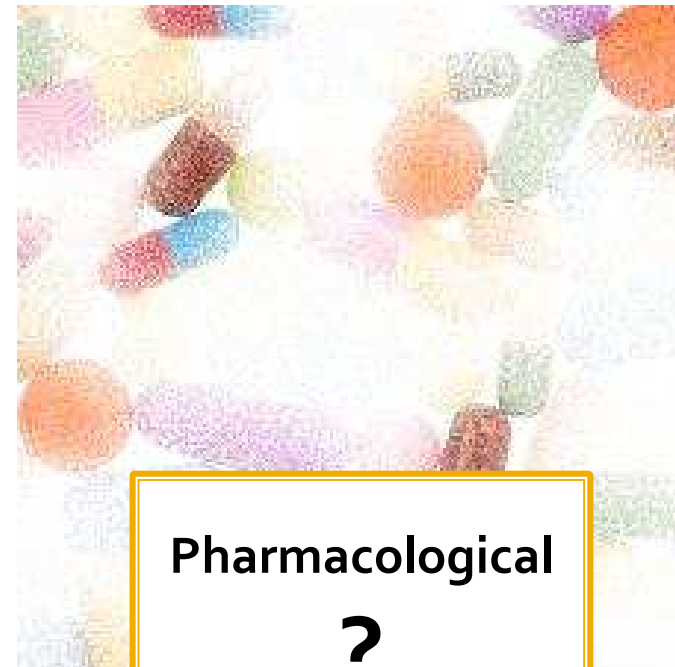
# Future directions

- More research on potential mechanisms
- To inform potential treatments



Cognitive training

?



Pharmacological

?

# Future directions

- More research on potential mechanisms
- To inform potential treatments

Physical exercise

?



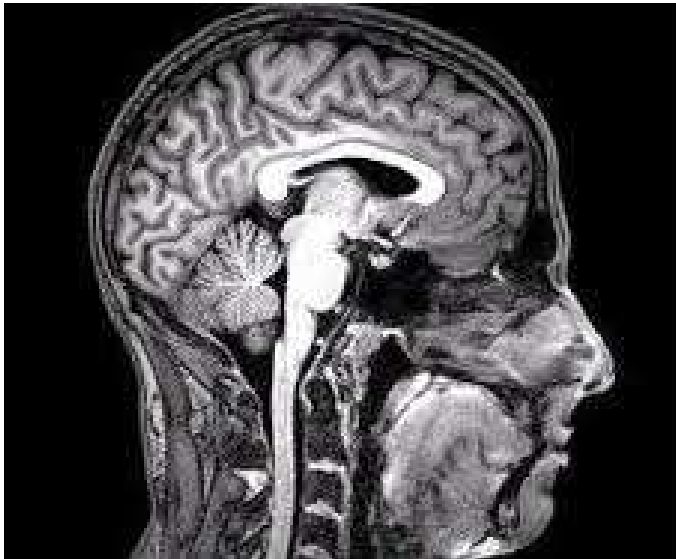
# Future directions

- Clinical trials



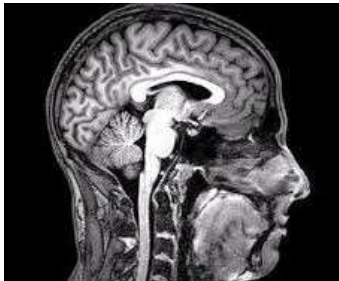
# Future directions

- Clinical trials
- Extend to imaging studies



# Future directions

- Clinical trials
- Extend to imaging studies



- And translational studies



**Thank you for your attention!**

# Acknowledgements

- All the participants who took part in our study
- The Medical Research Council for funding this project
- My supervisors : Dr. Martin McCabe, Prof. Andrew Mayes, Prof. Alison Wearden, and Dr. Deborah Talmi)
- My advisor: Prof. Linda McGowan
- The clinical teams and research nurses in the 5 NHS Trusts: Prof. John Radford, Dr. Kim Linton, Dr. Adam Gibson, Dr. Goode, Dr. Welch, Dr. Kalakonda, Dr. Leahy,
- Students who contributed to this work.

