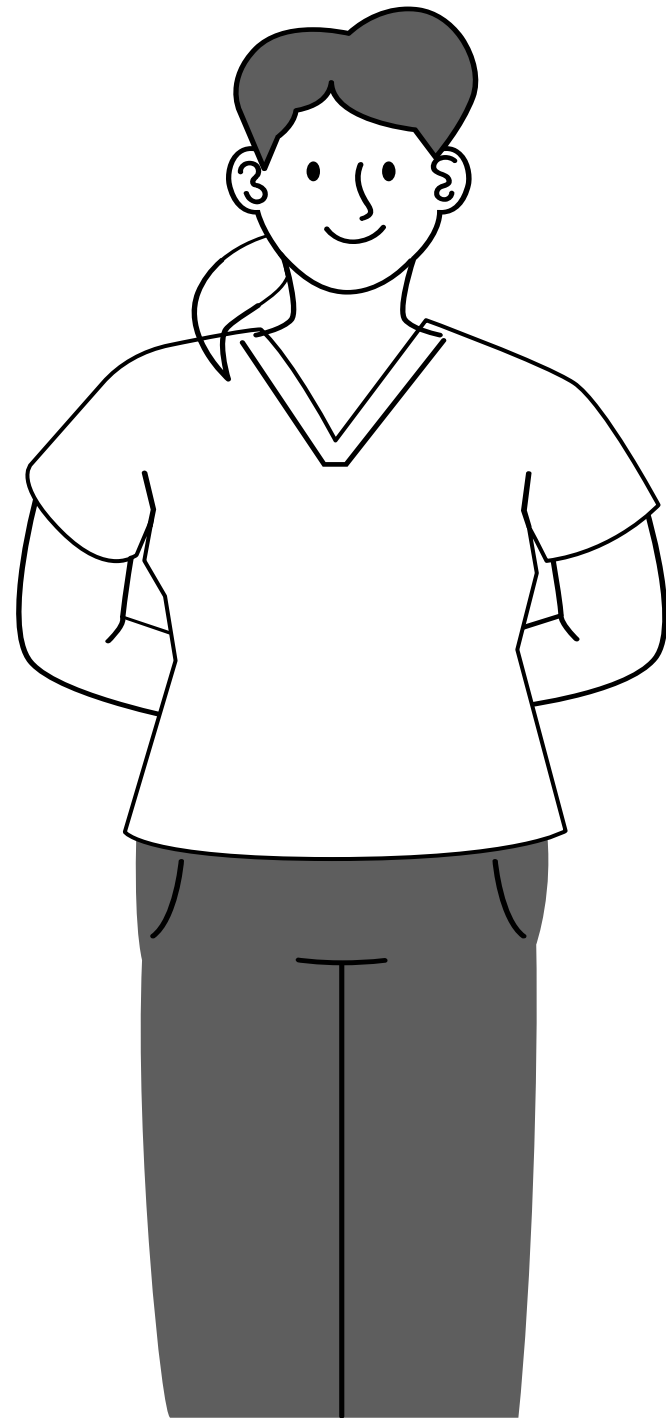


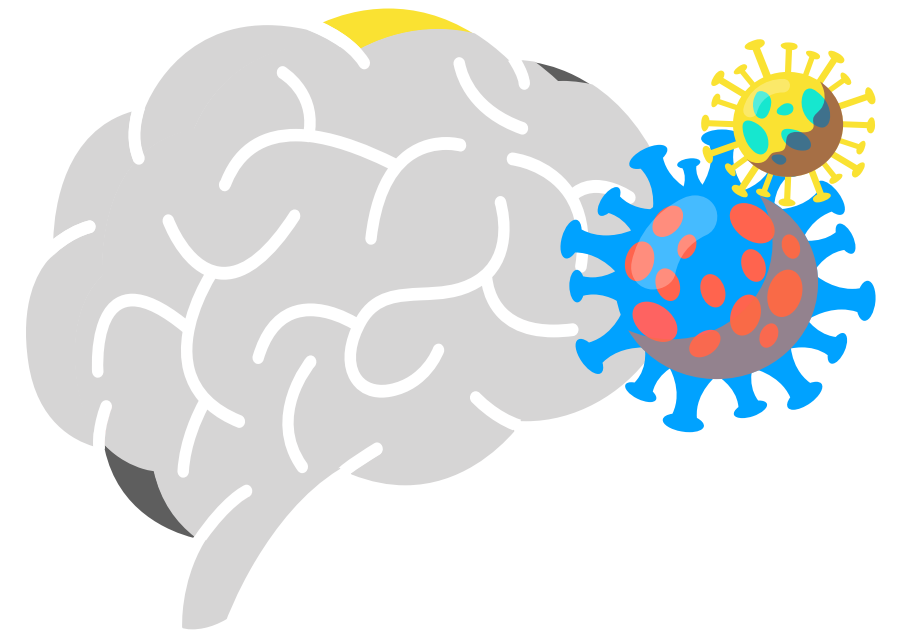
## **The Effect of LiuZiJue on Frontal Lobe Oxyhemoglobin levels in Adults with Long COVID-19 Syndrome and Healthy Adults: *A Functional Near-infrared Spectroscopy prospective study***

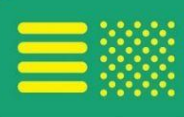
Calvin Yip Chi Kong<sup>1</sup>, Lu Linlin<sup>1</sup>, Chu Ping Sze<sup>1</sup>, Tang Yi Ting<sup>1</sup>, Armstrong Chiu Tat San<sup>2</sup>

<sup>1</sup> School of Medical and Health Sciences, Tung Wah College  
<sup>2</sup> The Hong Kong Society for the Blind, Hong Kong

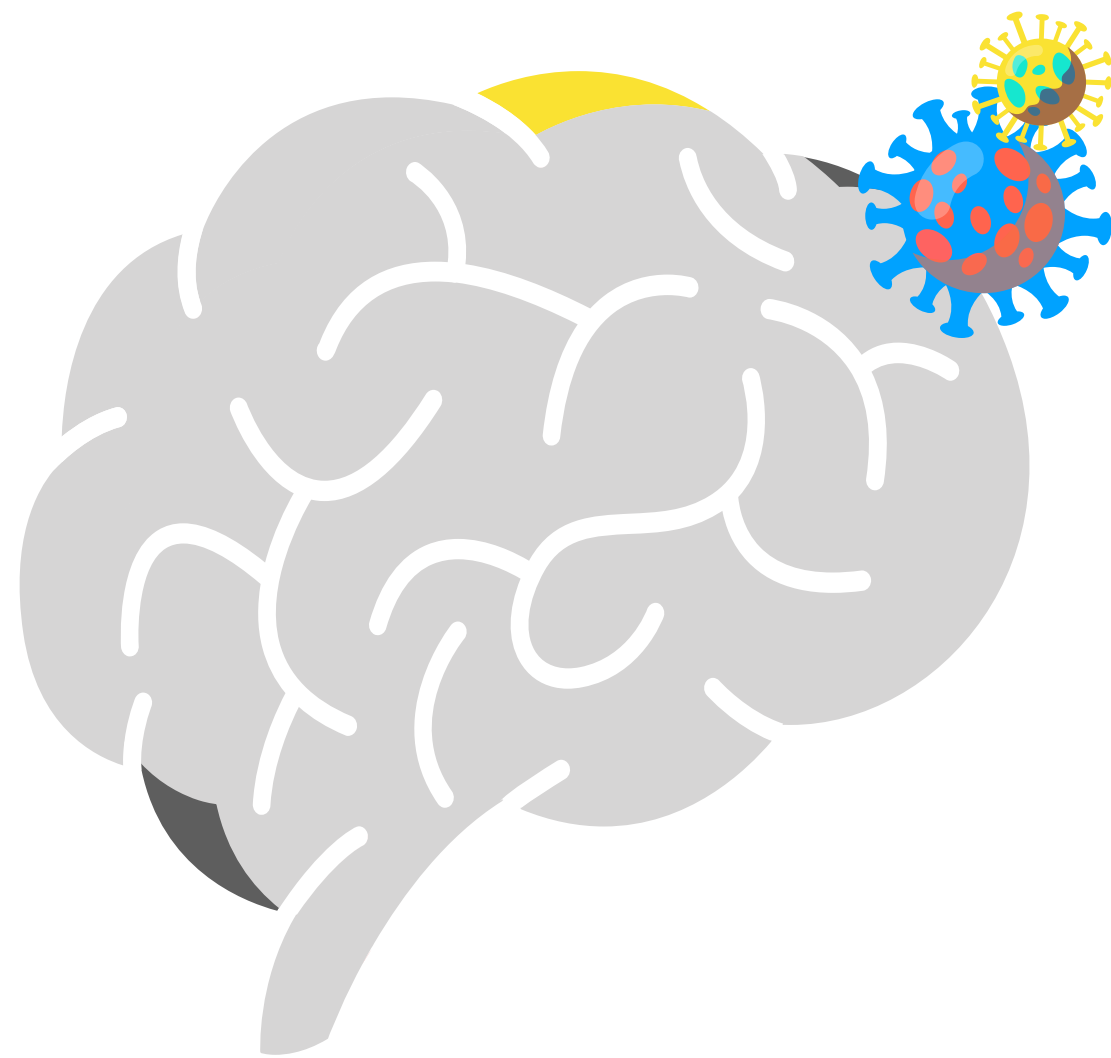


# Introduction





# Introduction



- Long COVID-19 syndrome
- Cognitive domains: memory, attention, and executive functions
- Possible mechanism (Dondaine et al., 2022): **Cerebral hypoxia**
- Prefrontal oxygenation

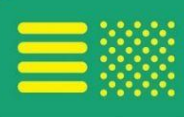




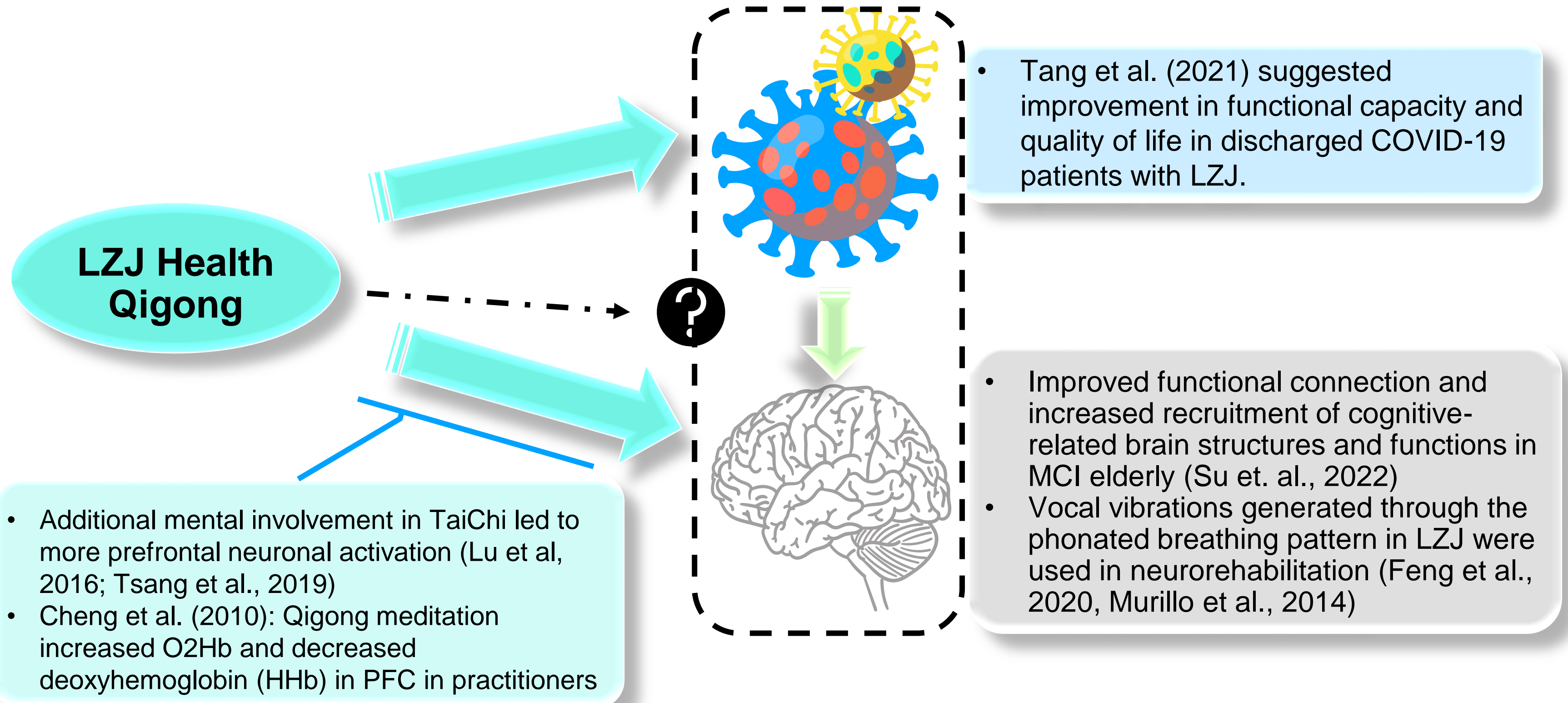
# Introduction



- LiuZiJue Health Qigong (LZJ)
- Producing Six sounds - “Xu, He, Hu, Si, Chui and Xi,” accompanied by low intensity body movements and mindfulness



# Introduction





# Aims & Objectives

**Aim:** to utilize the possible effects of LiuZiJue (LZJ) exercise, a low-risk and convenient Chinese exercise combining breathing and mindfulness, to improve prefrontal oxygenation (PO), which hopefully improve cognitive functions.

## **Objectives:**

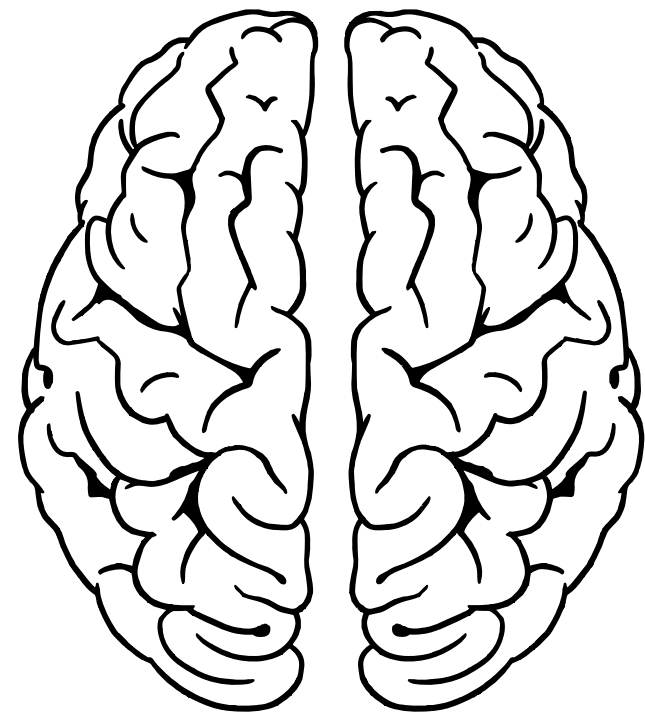
1. to study the effect of LZJ on prefrontal oxygenation by employing fNIRS in Adults with Long COVID-19 syndrome and healthy adults
2. to examine the effect of LZJ on cognitive functioning in adults with Long COVID-19 syndrome with psychometric assessments





# Hypotheses

- **H1:** after LZJ exercise intervention, adults with long COVID-19 syndrome and healthy adults will demonstrate increase in  $\Delta\text{HbO}$  concentration in prefrontal cortex (PFC) in fNIRS assessment.
- **H2:** after LZJ exercise intervention, subjective and objective outcome measures of cognitive problems in adults with long COVID-19 syndrome will be improved.



# Methodology

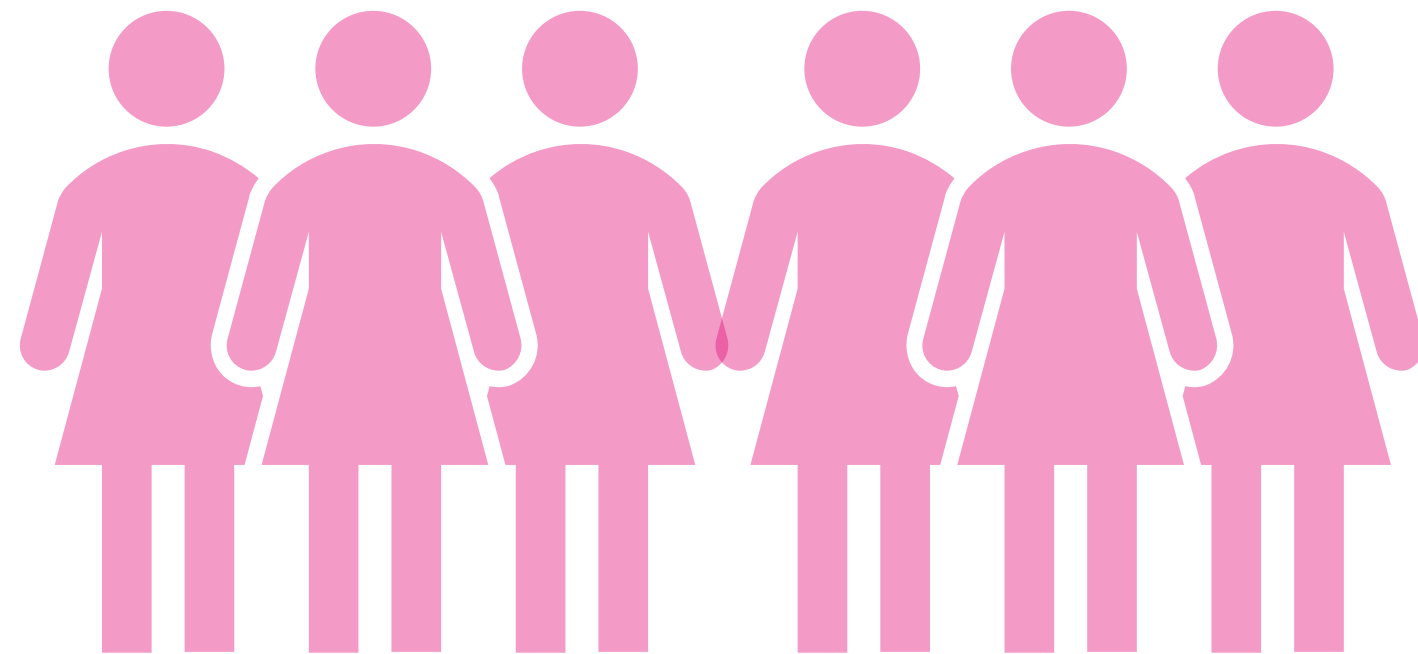




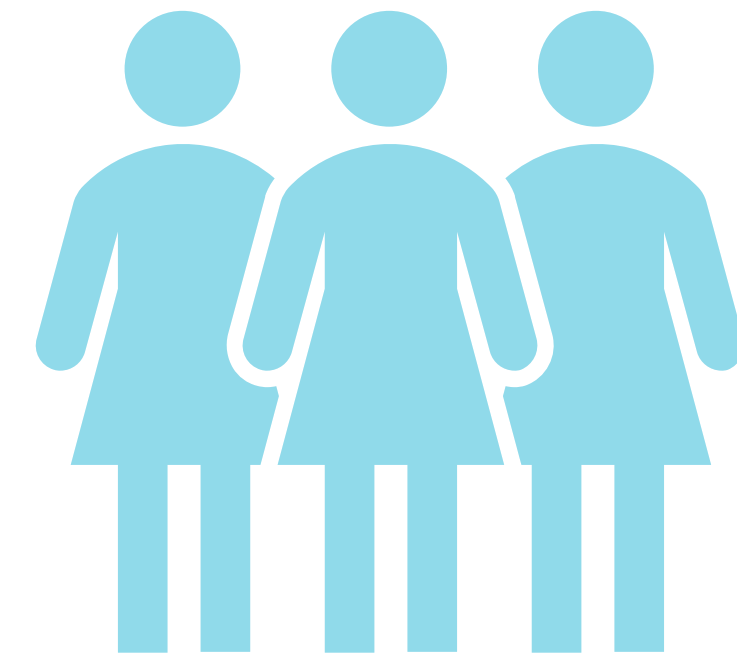


# Methodology – Participants

Total: 30 participants



**Disease group:**  
20 participants (mean, SD;  $50 \pm 18.1$  years)

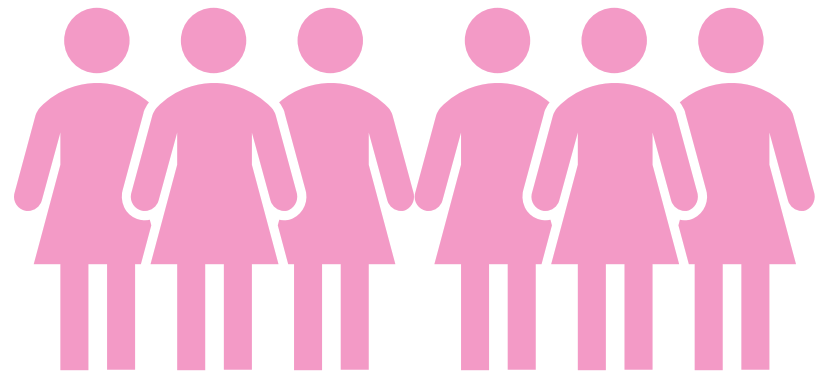


**Control group:**  
10 participants were in (mean, SD;  $47.8 \pm 18.7$  years)



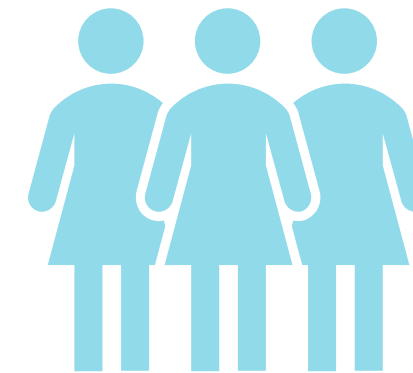
# Methodology – Inclusion & Exclusion

## Inclusion



### Disease Group:

- 1) Adults aged 18 or above;
- 2) Having no experience of LZJ Qigong;
- 3) Voluntarily practice LZJ.
- 4) Confirmed clinical diagnosis of COVID-19 with positive (PCR) / (RAT) and minimum of 4 weeks after diagnosis



### Control group:

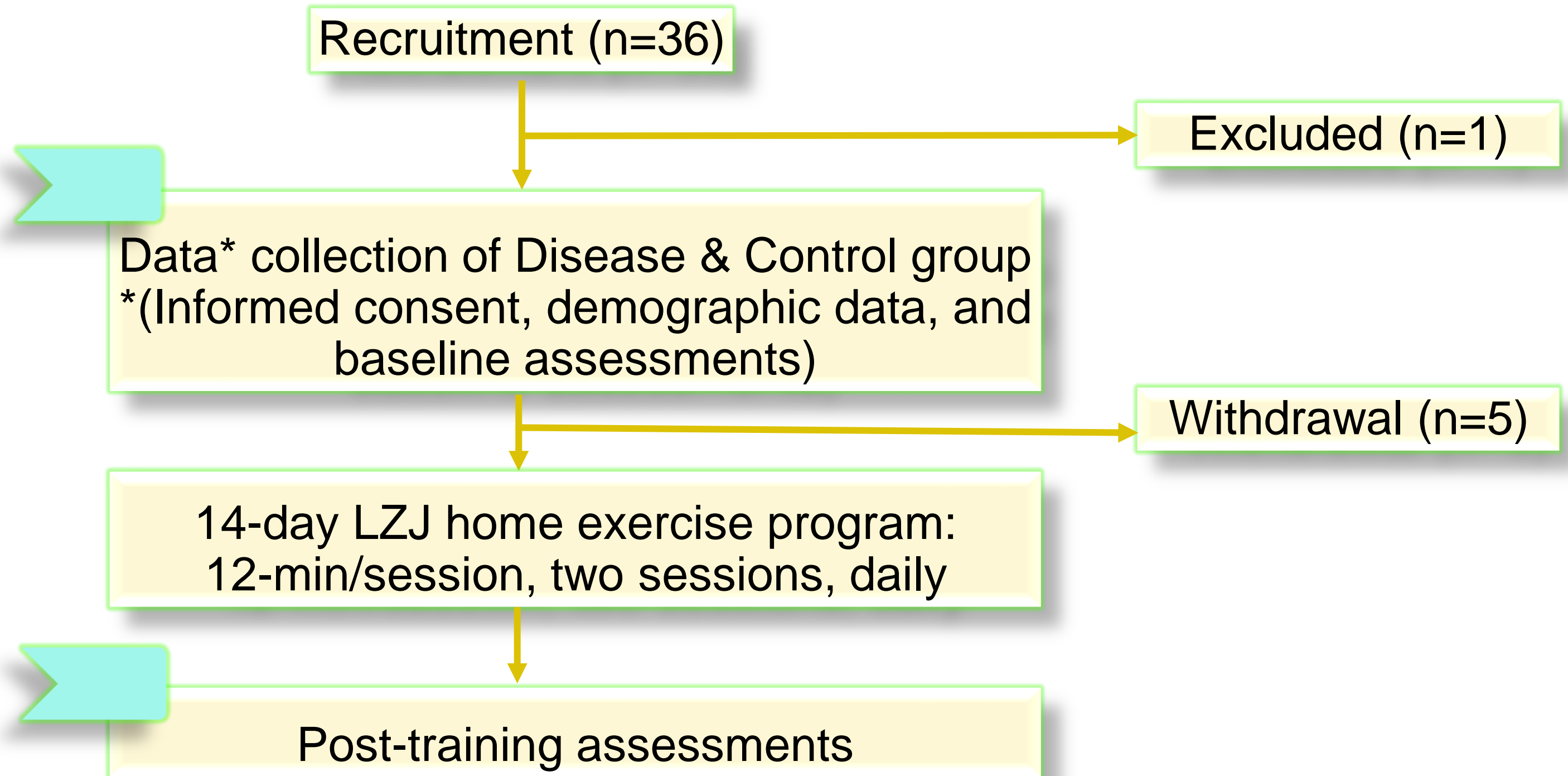
- 1+2+3) of inclusion in D group
- 4) Having no clinical history of COVID-19 infection

## Exclusion

- 1) Not compatible with performing intervention safely
- 2) Currently participating in a rehabilitation program
- 3) Involvement in physical training at an athletic level for at least 3 months prior to enrolling in the study.



# Methodology - Study design







# Methodology – fNIRS assessment procedures

Schematic representation of fNIRS assessment procedure in baseline and post-exercise measures for BOTH groups

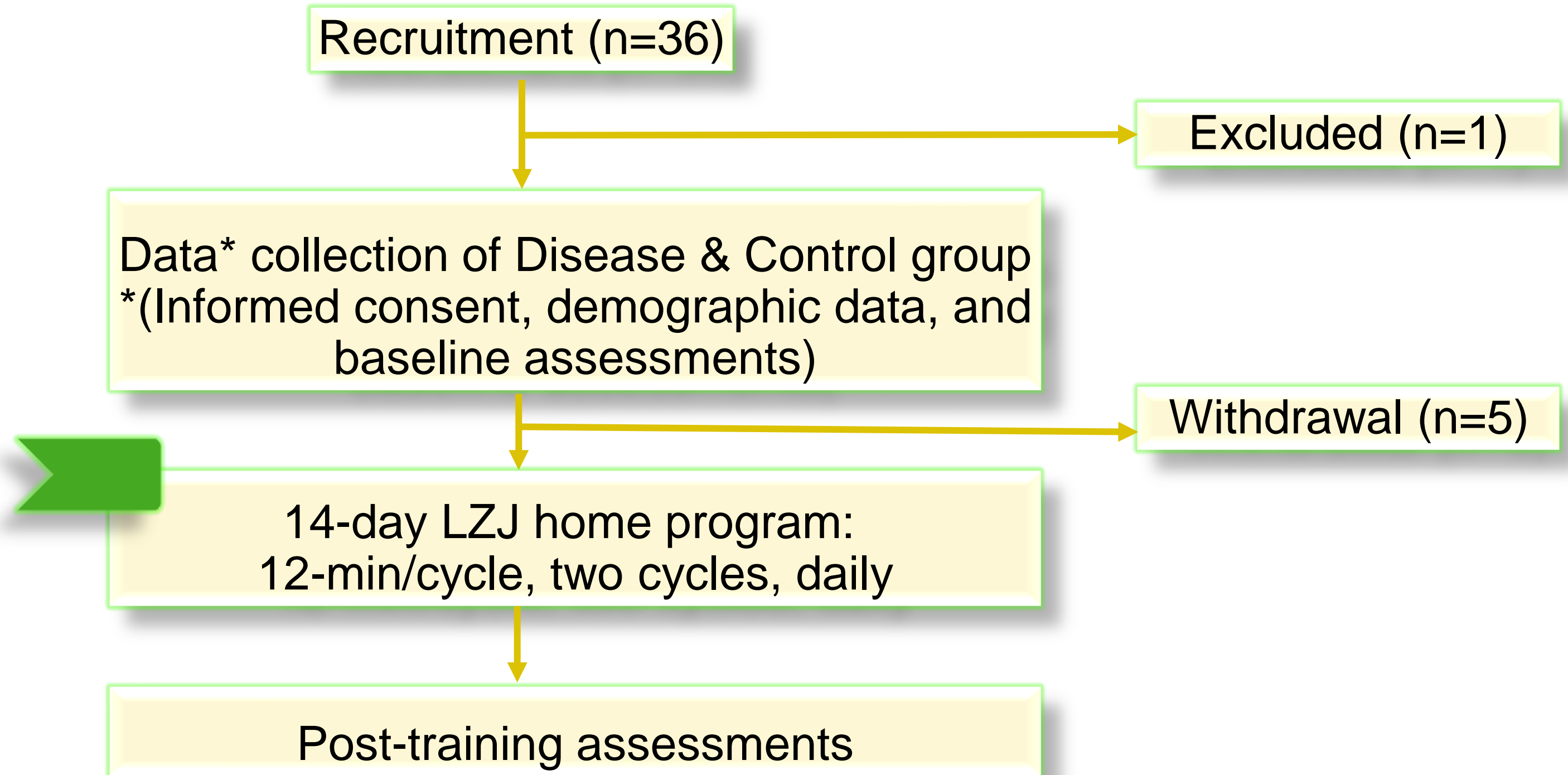
Conditions (R=Rest; L=LZJ)	R1	L1	R2	L2	R3	L3	R4	L4	R5	L5	R6	L6	R7
Duration (min)	2	2	2	2	2	2	2	2	2	2	2	2	2







# Methodology - Study design

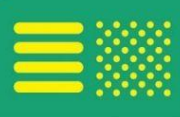




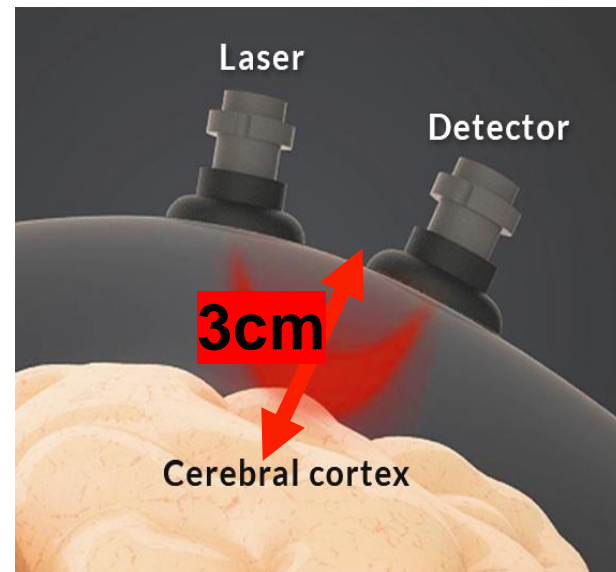
# Methodology – 14-day Intervention program

- A pre-recorded soundtrack: 2-min intervals
- Recommendation: be seated comfortably, quiet environment,

Exercise (L=LZJ)	L1	L2	L3	L4	L5	L6
Six sounds	Xu 噓	He 呵	Hu 呼	Si 嘶	Chui 吹	Xi 嘻
Duration (min)	2	2	2	2	2	2
Intensity & Frequency	12-min/cycle, 2 cycles/day, 14 days					



# Methodology – Outcome indicators



## 1. Primary Outcome: *Prefrontal oxygenation.*

- NIRSIT-LITE (OBELAB Inc., Seoul, Korea)
- Data were converted to changes of HbO and HbR concentration over bilateral prefrontal cortex by Modified Beer-Lambert law (MBLL)
- Increased  $\Delta\text{HbO}$  and corresponding decreased in  $\Delta\text{HbR}$  can be interpreted as a sign of functional brain activation



### Technical Specification

Penetration Distance	Regular 3 cm
Number of channels	15 channels
Optical elements	Source: 5 Detector: 7
Wavelength	780nm, 850nm
Sampling rate	8.138 Hz





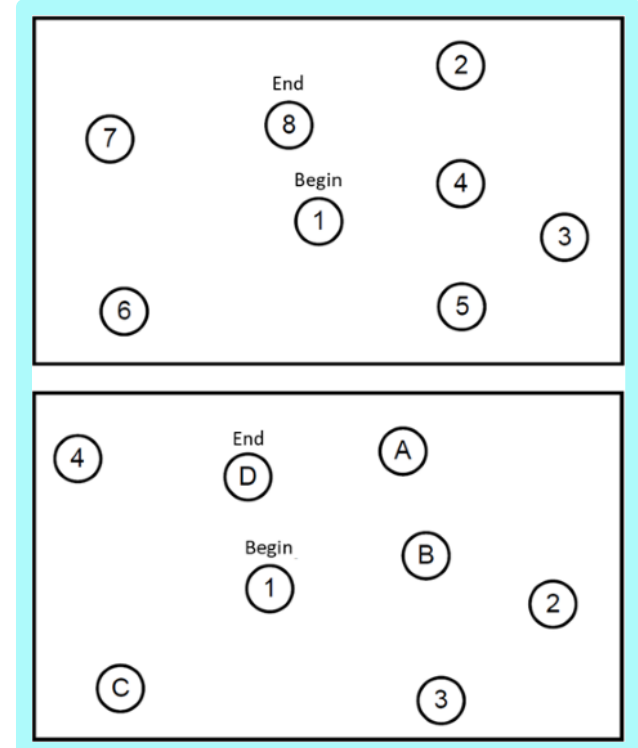
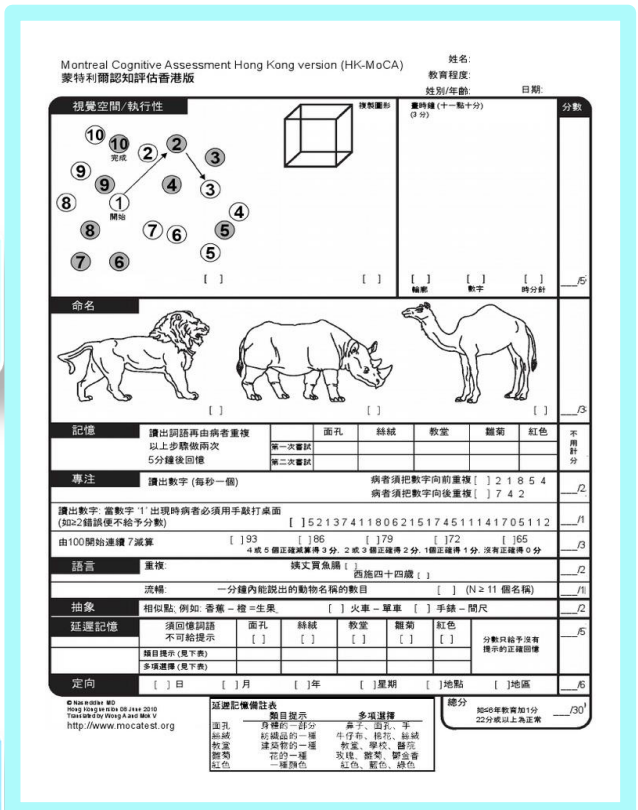
# Methodology – Outcome indicators

## 2. Secondary Outcome: *Cognitive functioning & Long COVID-19 syndrome.*

Outcome measures	Psychometric assessments
Global cognitive functioning	HK-MoCA
Attention	Trail Making Tests (part A & B)
Long COVID-9 Syndrome	C19 YRS

• Standardized assessments

• Self-rated questionnaire



# C19-YRS

**COVID-19 Yorkshire Rehabilitation Scale**

A digital assessment and monitoring tool to help manage individuals with Long COVID





# Results





# Results – Baseline Characteristics of participants

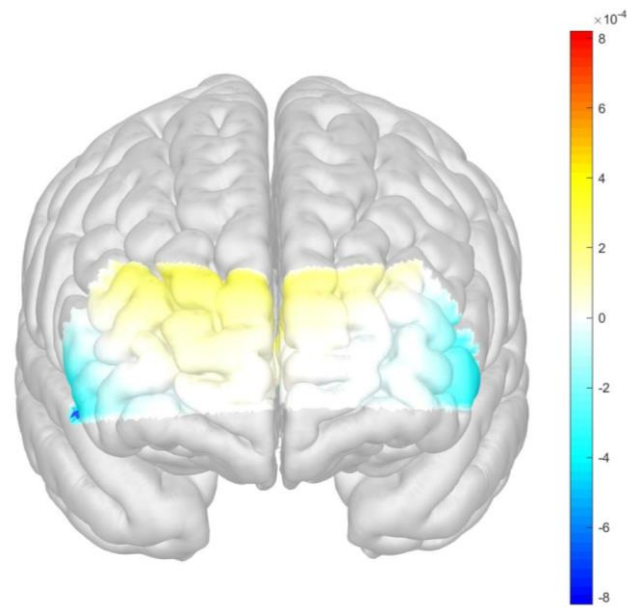
Characteristic	Disease (n = 20)	Control (n = 10)
Gender	M: 5 F: 15	M: 3 F: 7
Age (years)	51 ± 17.1	43.2 ± 18.5
Education (years)	12.25 ± 4.2	14.9 ± 3.2

Groups	Overall	Disease	Control
<b>Exercise hours in 14-day program</b>	5.12 ± 2.20	4.86 ± 2.42	5.67 ± 1.67

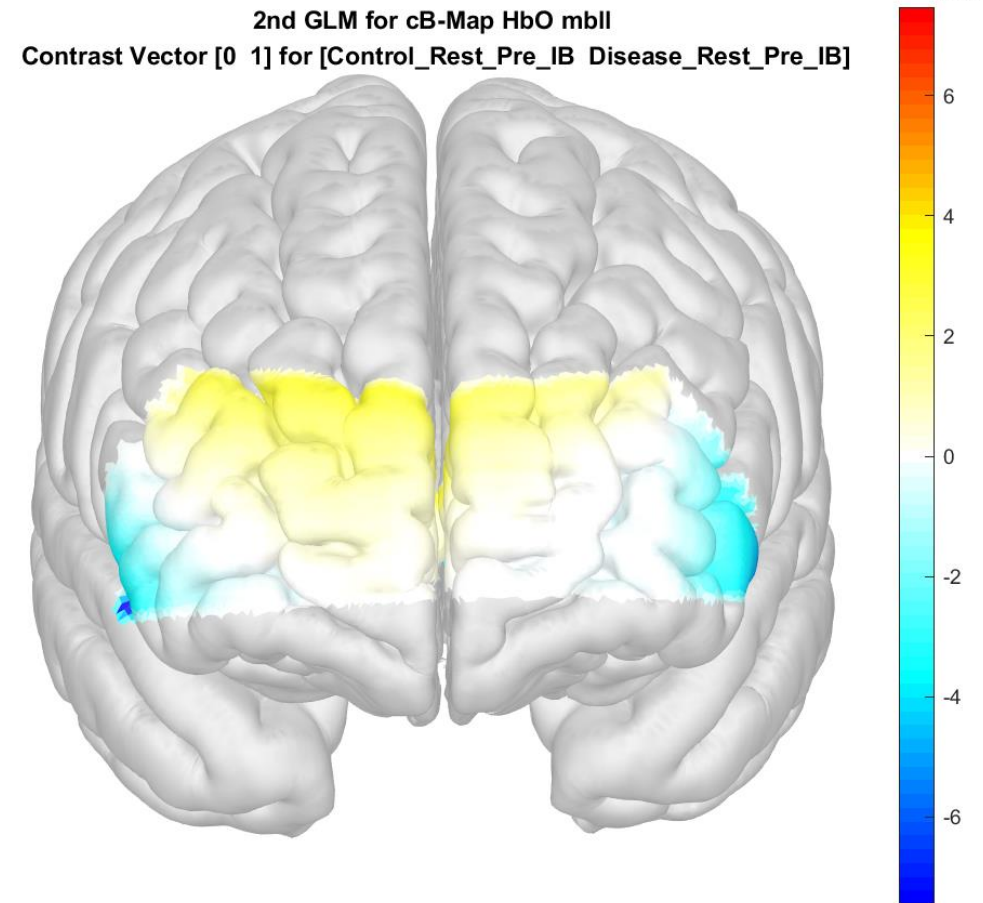
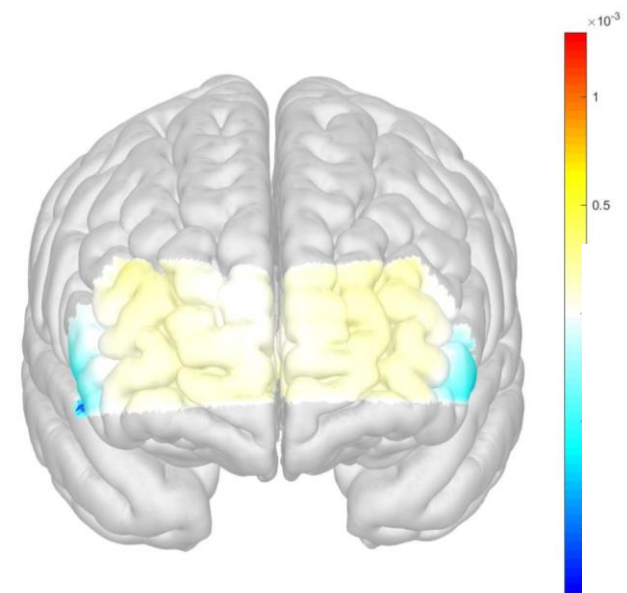


# Results – Baseline comparison between groups at Rest

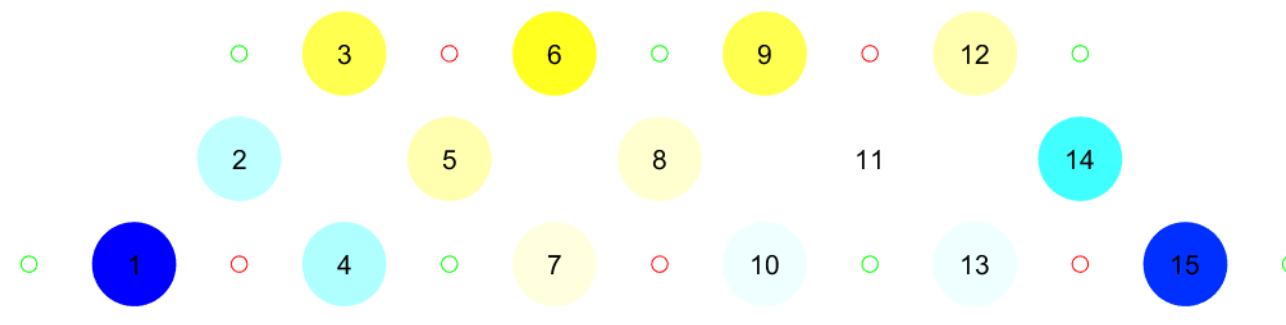
## Disease



## Control



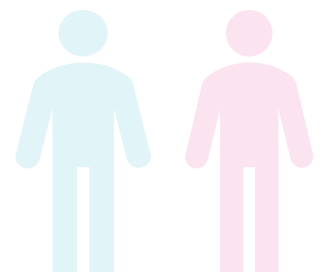
2nd GLM for cB-Map HbO mbl  
Contrast Vector [0 1] for [Control\_Rest\_Pre\_IB Disease\_Rest\_Pre\_IB]



Group comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in baseline at rest

Channel	Mean. D	Var. D	Mean. C	Var. C	Mean diff.	p Value*
ch1	1.4	0.06	10.0	0.08	-8.6	p < 0.001
ch2	-1.8	0.16	-5.6	0.05	3.7	p < 0.001
ch3	-0.7	0.06	1.3	0.02	-2.0	p < 0.001
ch4	-1.5	0.02	-2.7	0.01	1.2	p < 0.001
ch5	-0.1	0.01	-3.5	0.02	3.4	p < 0.001
ch6	-1.2	0.01	-2.3	0.02	1.1	p < 0.001
ch7	-0.2	0.02	-4.4	0.02	4.1	p < 0.001
ch8	-1.2	0.01	-2.6	0.02	1.4	p < 0.001
ch9	-1.7	0.01	-4.3	0.01	2.6	p < 0.001
ch10	-0.5	0.03	-1.6	0.02	1.1	p < 0.001
ch11	-2.7	0.01	-2.5	0.01	-0.2	p < 0.001
ch12	-2.9	0.02	-4.8	0.01	1.9	p < 0.001
ch13	0.0	0.02	-3.4	0.02	3.4	p < 0.001
ch14	-1.4	0.01	-2.4	0.02	1.0	p < 0.001
ch15	-3.2	0.06	12.6	0.09	-15.8	p < 0.001

\* test by independent t test

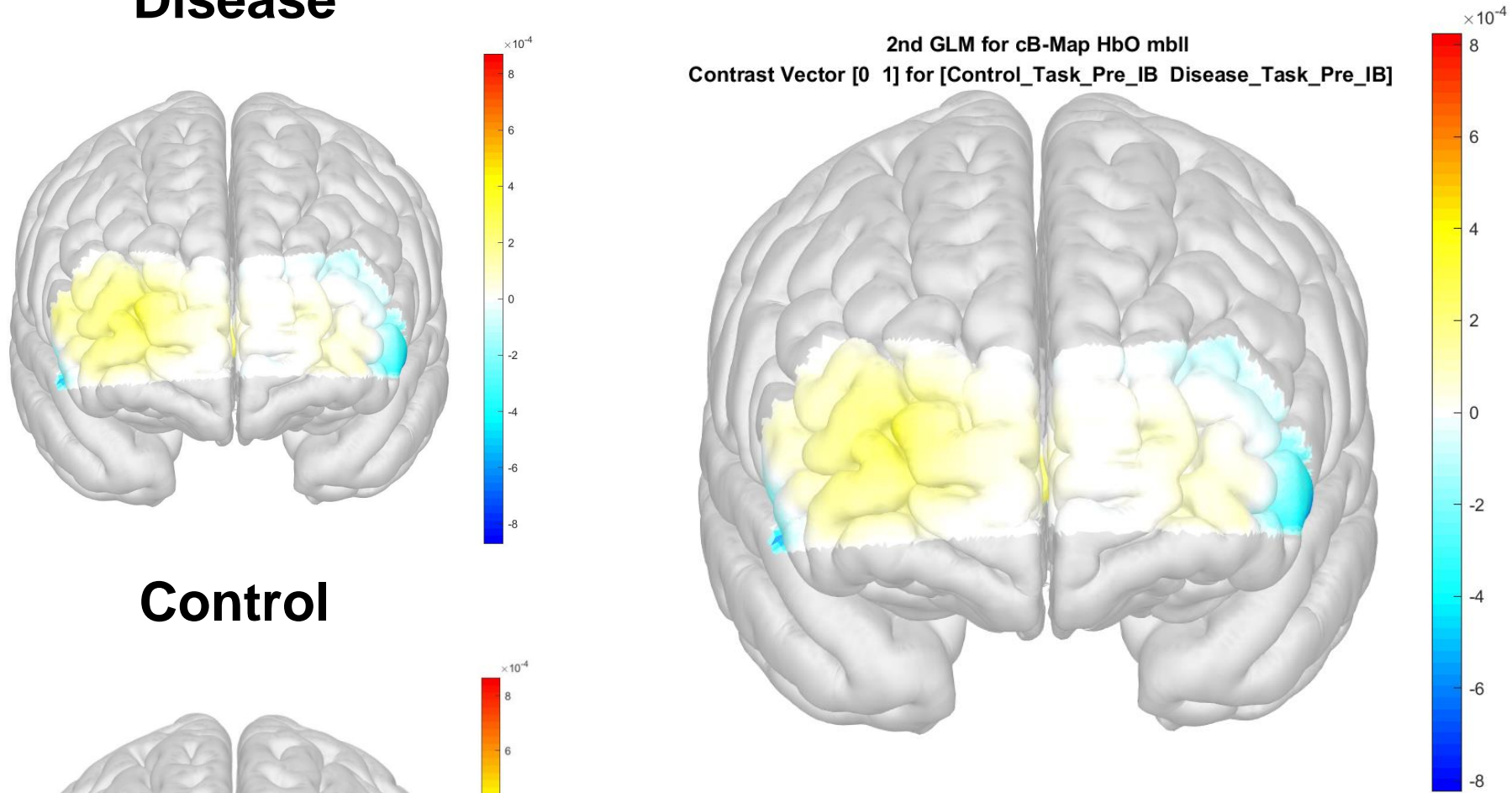




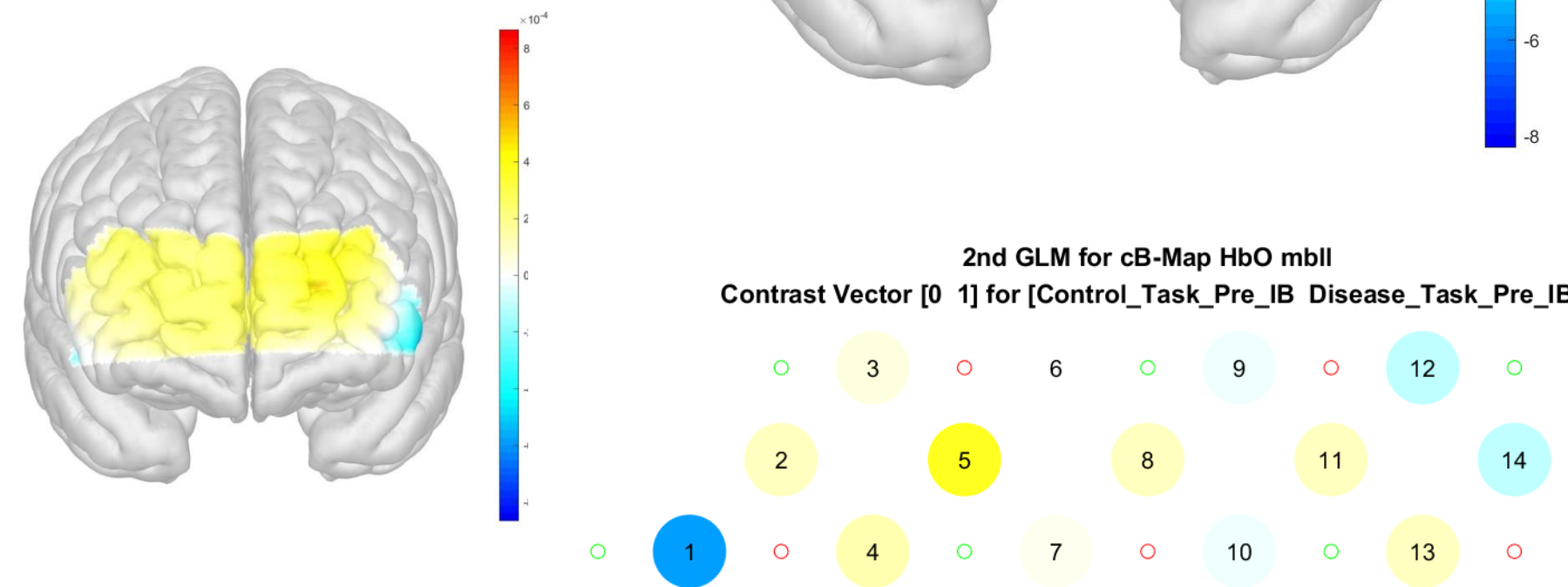


# Results – Baseline comparison between groups doing LZJ

## Disease



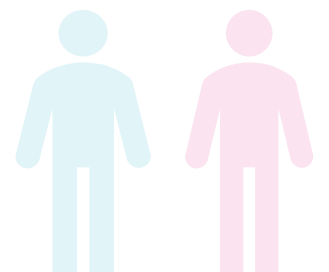
## Control



Group comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in baseline at LZJ

Channel	Mean. D	Var. D	Mean. C	Var. C	Mean diff.	p Value*
ch1	1.0	0.06	8.2	0.04	-7.2	p <0.001
ch2	-2.4	0.11	-6.3	0.04	3.8	p <0.001
ch3	-0.7	0.06	1.0	0.02	-1.7	p <0.001
ch4	-2.0	0.03	-2.9	0.01	0.9	p <0.001
ch5	-0.7	0.01	-4.1	0.02	3.4	p <0.001
ch6	-1.3	0.01	-2.7	0.01	1.4	p <0.001
ch7	-0.5	0.02	-4.5	0.02	4.1	p <0.001
ch8	-1.6	0.01	-3.3	0.02	1.8	p <0.001
ch9	-1.7	0.01	-4.7	0.01	2.9	p <0.001
ch10	-0.6	0.02	-1.6	0.02	1.1	p <0.001
ch11	-3.1	0.01	-2.9	0.01	-0.1	p <0.05
ch12	-3.0	0.01	-5.0	0.01	2.0	p <0.001
ch13	-0.3	0.02	-3.5	0.02	3.2	p <0.001
ch14	-1.1	0.01	-2.6	0.01	1.5	p <0.001
ch15	-3.2	0.06	11.7	0.06	-14.9	p <0.001

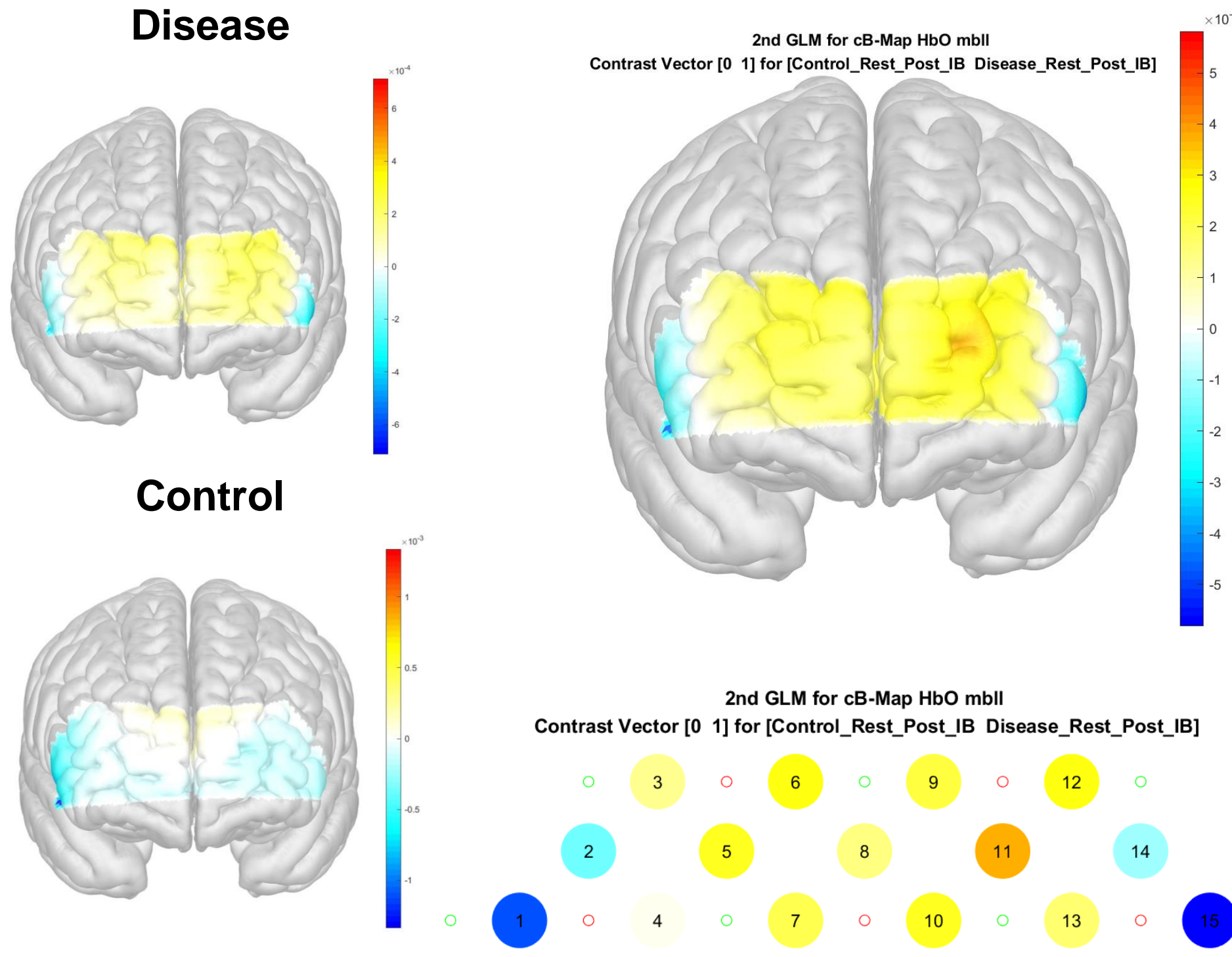
\* test by independent t test







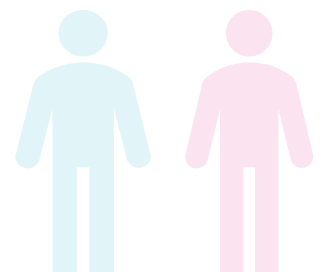
# Results – Post-training comparison between groups at Rest



Group comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in post-training at Rest

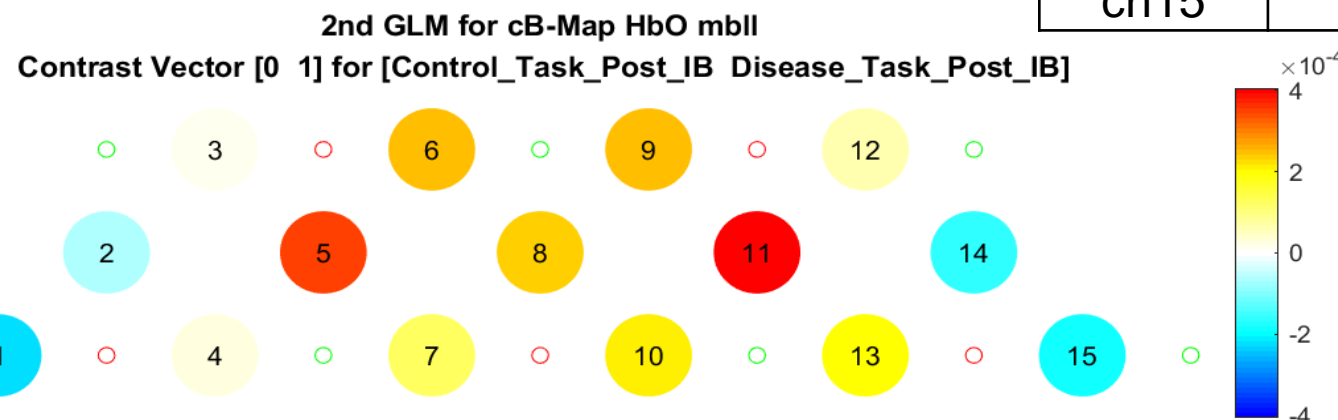
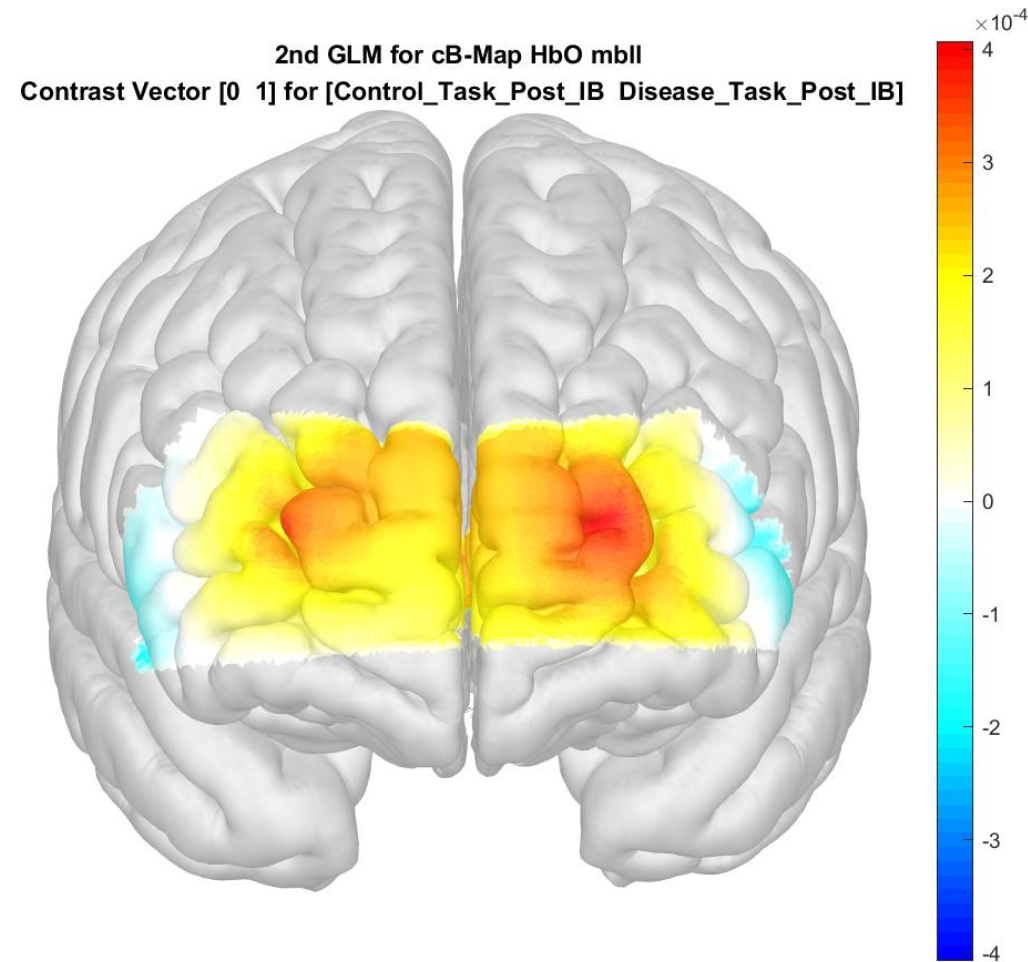
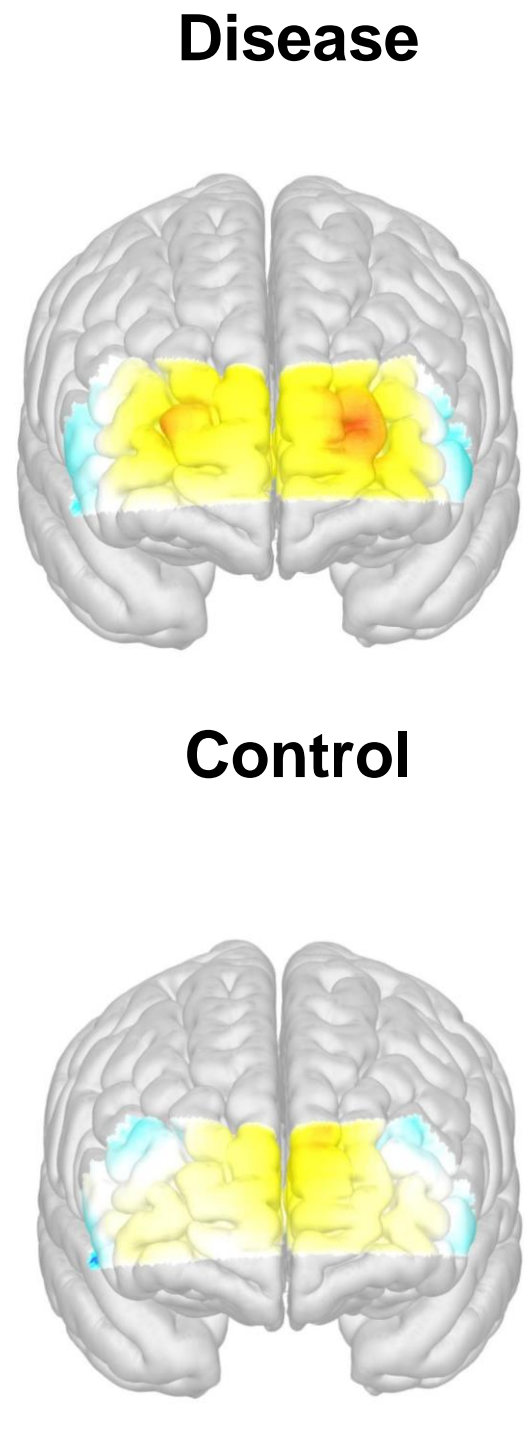
Channel	Mean. D	Var.D	Mean. C	Var.C	Mean diff.	p Value*
ch1	-3.1	0.11	0.0	0.12	-3.1	p < 0.001
ch2	0.9	0.12	-3.5	0.04	4.5	p < 0.001
ch3	-8.0	0.05	-1.1	0.03	-6.8	p < 0.001
ch4	-3.2	0.02	3.2	0.02	-6.4	p < 0.001
ch5	-0.6	0.02	2.3	0.01	-2.9	p < 0.001
ch6	-6.3	0.04	-0.3	0.01	-5.9	p < 0.001
ch7	-4.4	0.02	-1.1	0.01	-3.3	p < 0.001
ch8	-5.0	0.03	0.7	0.01	-5.7	p < 0.001
ch9	-4.3	0.03	1.6	0.01	-5.9	p < 0.001
ch10	-7.2	0.03	-0.6	0.01	-6.6	p < 0.001
ch11	-3.0	0.04	0.7	0.01	-3.7	p < 0.001
ch12	-2.9	0.10	-1.1	0.02	-1.7	p < 0.001
ch13	-2.3	0.03	2.3	0.02	-4.5	p < 0.001
ch14	-7.2	0.08	-0.6	0.02	-6.7	p < 0.001
ch15	-0.4	0.14	-4.0	0.06	3.7	p < 0.001

\* test by independent t test





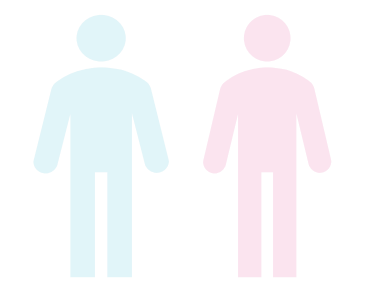
# Results – Post-training comparison between groups doing LZJ



Group comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in post-training at LZJ

Channel	Mean. D	Var. D	Mean. C	Var. C	Mean diff.	p Value*
ch1	-3.0	0.08	-2.0	0.10	-1.0	p < 0.001
ch2	0.2	0.11	-4.1	0.04	4.3	p < 0.001
ch3	-7.9	0.05	-2.3	0.02	-5.6	p < 0.001
ch4	-3.4	0.02	3.0	0.03	-6.5	p < 0.001
ch5	-1.0	0.02	2.2	0.01	-3.2	p < 0.001
ch6	-6.6	0.04	-0.4	0.02	-6.2	p < 0.001
ch7	-4.5	0.02	-1.1	0.02	-3.3	p < 0.001
ch8	-5.3	0.02	0.5	0.01	-5.7	p < 0.001
ch9	-4.6	0.03	1.8	0.02	-6.4	p < 0.001
ch10	-7.2	0.03	-0.6	0.01	-6.5	p < 0.001
ch11	-3.4	0.03	0.1	0.01	-3.5	p < 0.001
ch12	-3.3	0.04	-2.0	0.01	-1.4	p < 0.001
ch13	-2.8	0.03	2.1	0.02	-4.9	p < 0.001
ch14	-7.4	0.07	-0.4	0.02	-7.0	p < 0.001
ch15	-1.3	0.12	-4.1	0.08	2.8	p < 0.001

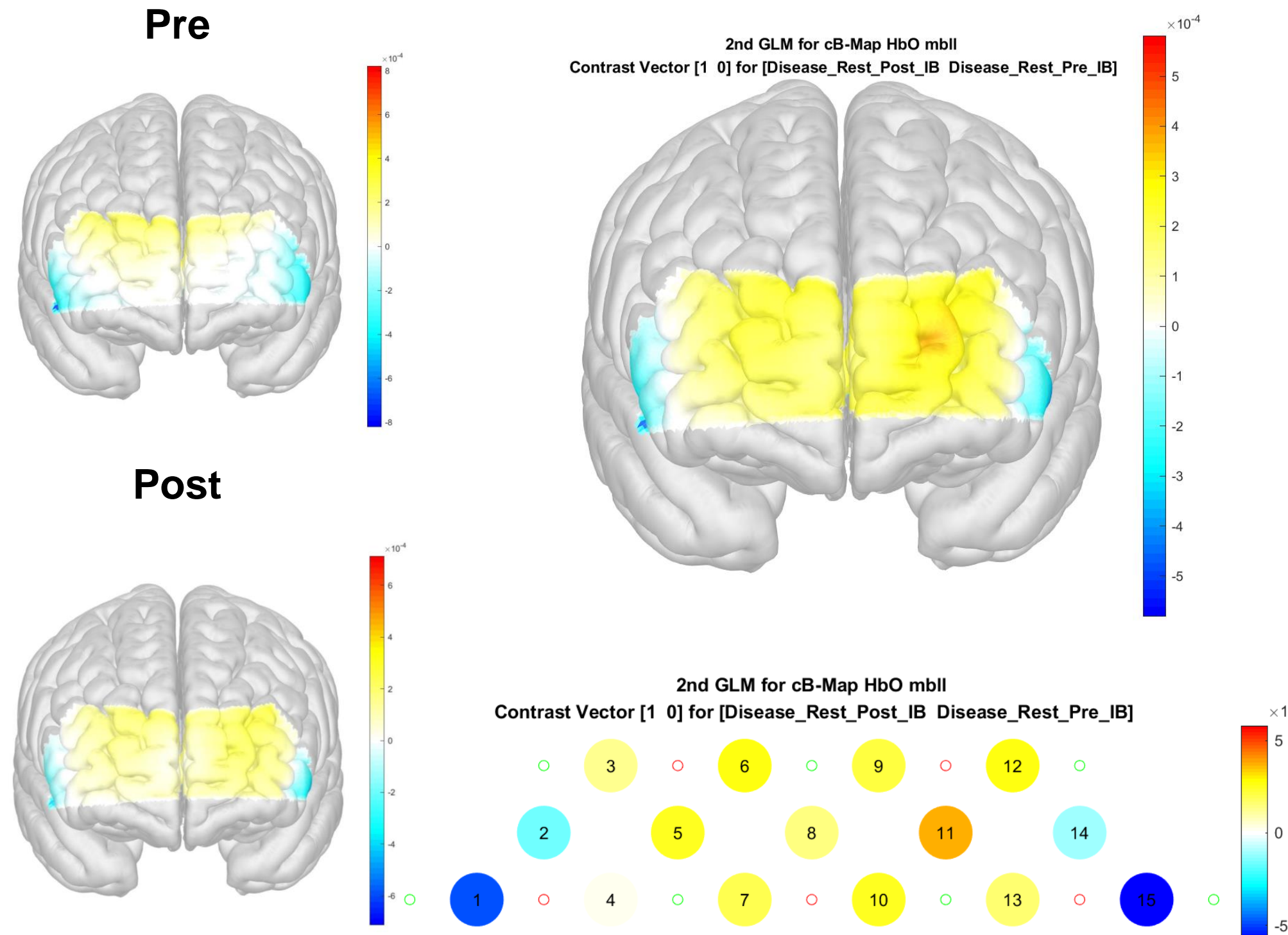
\* test by independent t test







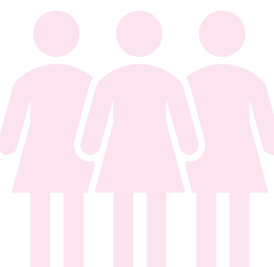
# Results – Training effect in Disease group at Rest



Pre and post training comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in disease group at rest

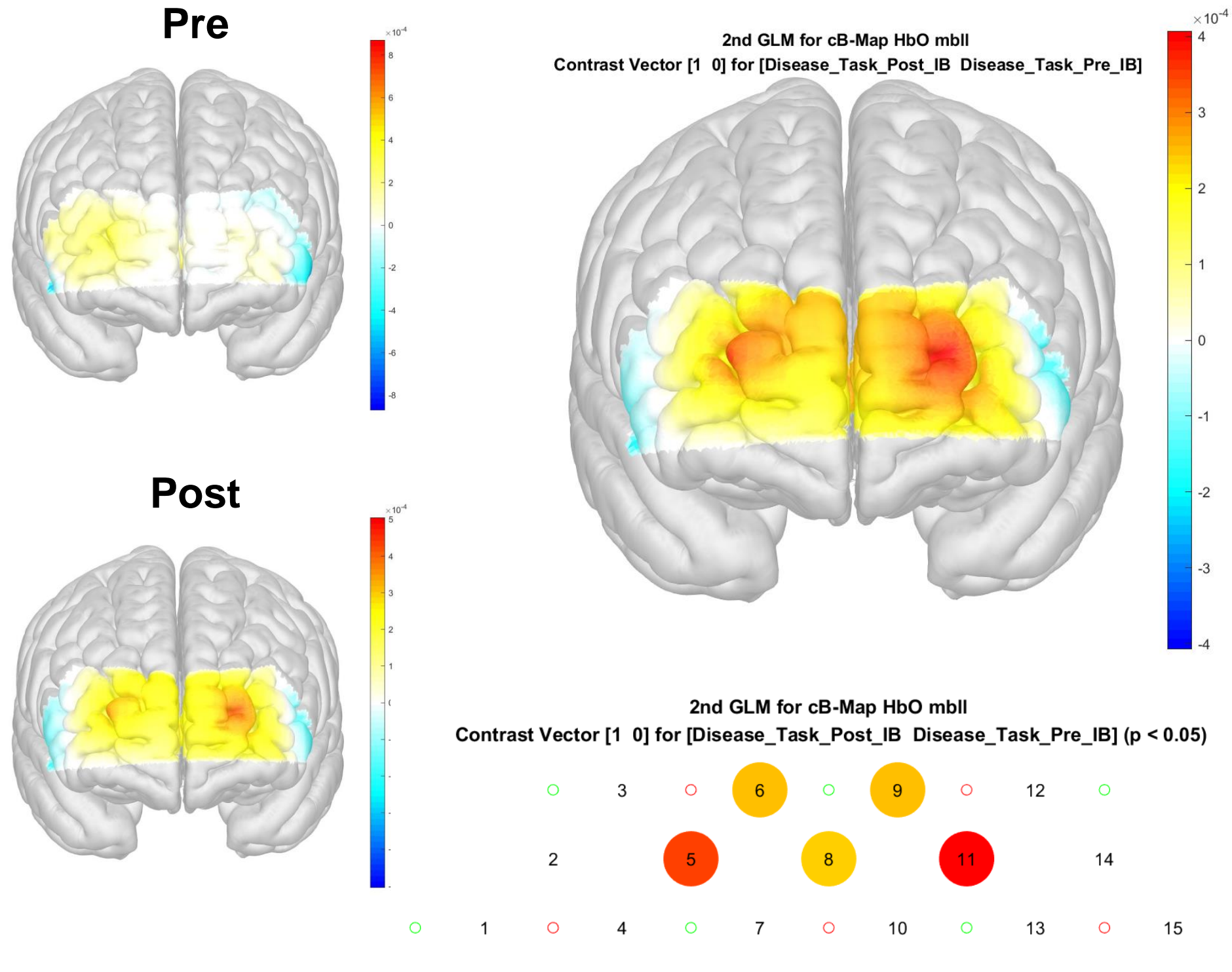
Channel	Mean. Pre	Var. Pre	Mean. Post	Var. Post	Mean diff.	$p$ Value*
ch1	1.4	0.06	-3.1	0.11	4.5	$p < 0.001$
ch2	-1.8	0.16	0.9	0.12	-2.8	$p < 0.001$
ch3	-0.7	0.06	-8.0	0.05	7.3	$p < 0.001$
ch4	-1.5	0.02	-3.2	0.02	1.7	$p < 0.001$
ch5	-0.1	0.01	-0.6	0.02	0.5	$p < 0.001$
ch6	-1.2	0.01	-6.3	0.04	5.0	$p < 0.001$
ch7	-0.2	0.02	-4.4	0.02	4.2	$p < 0.001$
ch8	-1.2	0.01	-5.0	0.03	3.8	$p < 0.001$
ch9	-1.7	0.01	-4.3	0.03	2.6	$p < 0.001$
ch10	-0.5	0.03	-7.2	0.03	6.7	$p < 0.001$
ch11	-2.7	0.01	-3.0	0.04	0.3	$p < 0.001$
ch12	-2.9	0.02	-2.9	0.10	0.0	$p = 0.8$
ch13	0.0	0.02	-2.3	0.03	2.2	$p < 0.001$
ch14	-1.4	0.01	-7.2	0.08	5.9	$p < 0.001$
ch15	-3.2	0.06	-0.4	0.14	-2.8	$p < 0.001$

\* test by paired t test





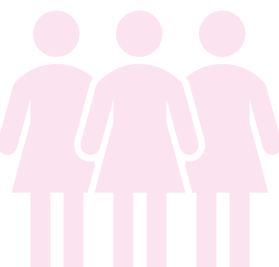
# Results – Training effect in Disease group doing LZJ



Pre and post training comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in disease group at LZJ

Channel	Mean. Pre	Var.Pre	Mean. Post	Var.Post	Mean diff.	$p$ Value*
ch1	1.0	0.06	-3.0	0.08	4.01	$p < 0.001$
ch2	-2.4	0.11	0.2	0.11	-2.69	$p < 0.001$
ch3	-0.7	0.06	-7.9	0.05	7.24	$p < 0.001$
ch4	-2.0	0.03	-3.4	0.02	1.43	$p < 0.001$
ch5	-0.7	0.01	-1.0	0.02	0.29	$p < 0.001$
ch6	-1.3	0.01	-6.6	0.04	5.36	$p < 0.001$
ch7	-0.5	0.02	-4.5	0.02	4.01	$p < 0.001$
ch8	-1.6	0.01	-5.3	0.02	3.67	$p < 0.001$
ch9	-1.7	0.01	-4.6	0.03	2.88	$p < 0.001$
ch10	-0.6	0.02	-7.2	0.03	6.62	$p < 0.001$
ch11	-3.1	0.01	-3.4	0.03	0.33	$p < 0.001$
ch12	-3.0	0.01	-3.3	0.04	0.34	$p < 0.001$
ch13	-0.3	0.02	-2.8	0.03	2.50	$p < 0.001$
ch14	-1.1	0.01	-7.4	0.07	6.24	$p < 0.001$
ch15	-3.2	0.06	-1.3	0.12	-1.87	$p < 0.001$

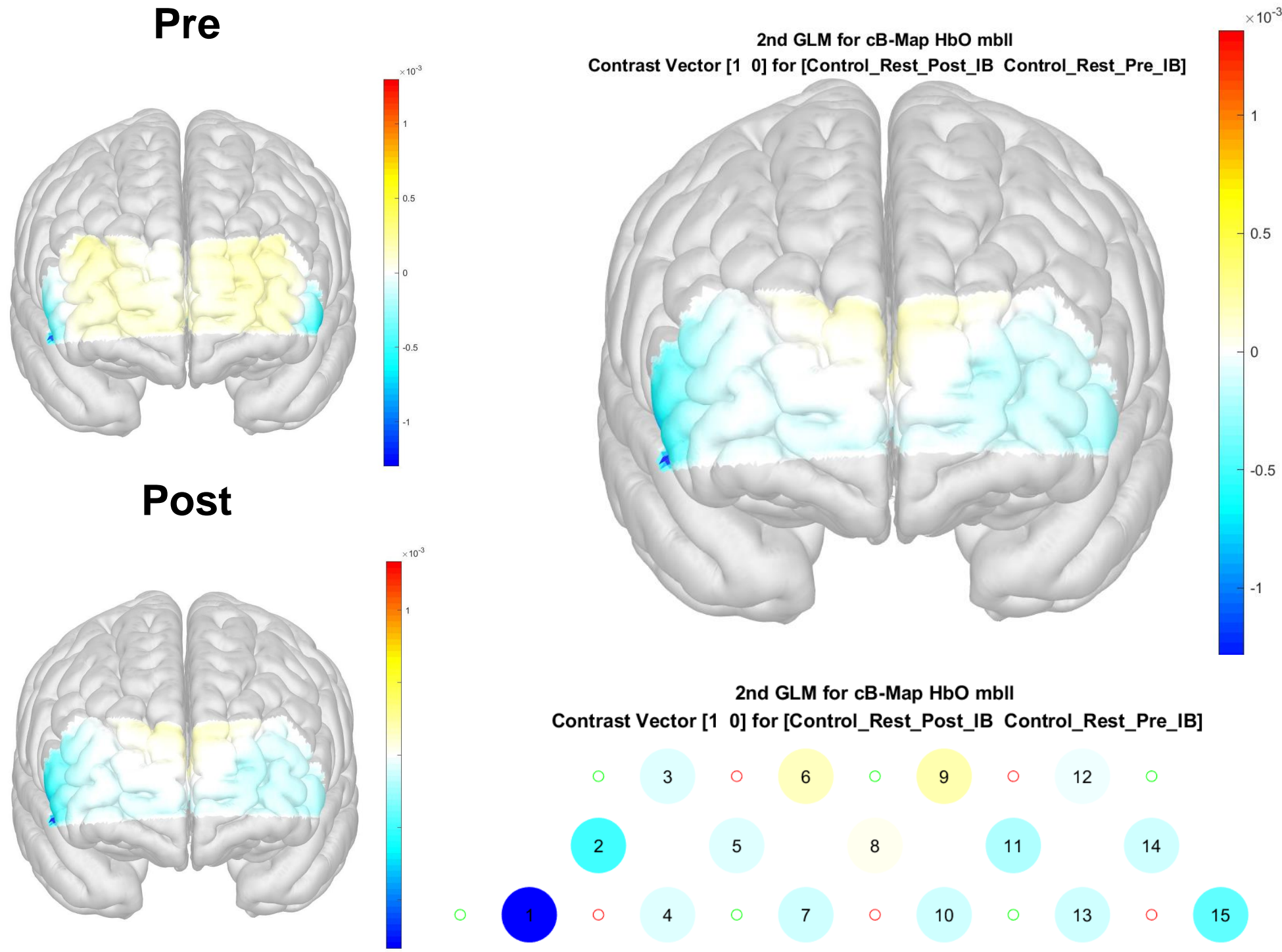
\* test by paired t test







# Results – Training effect in Control group at Rest



Pre and post training comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in control group at rest

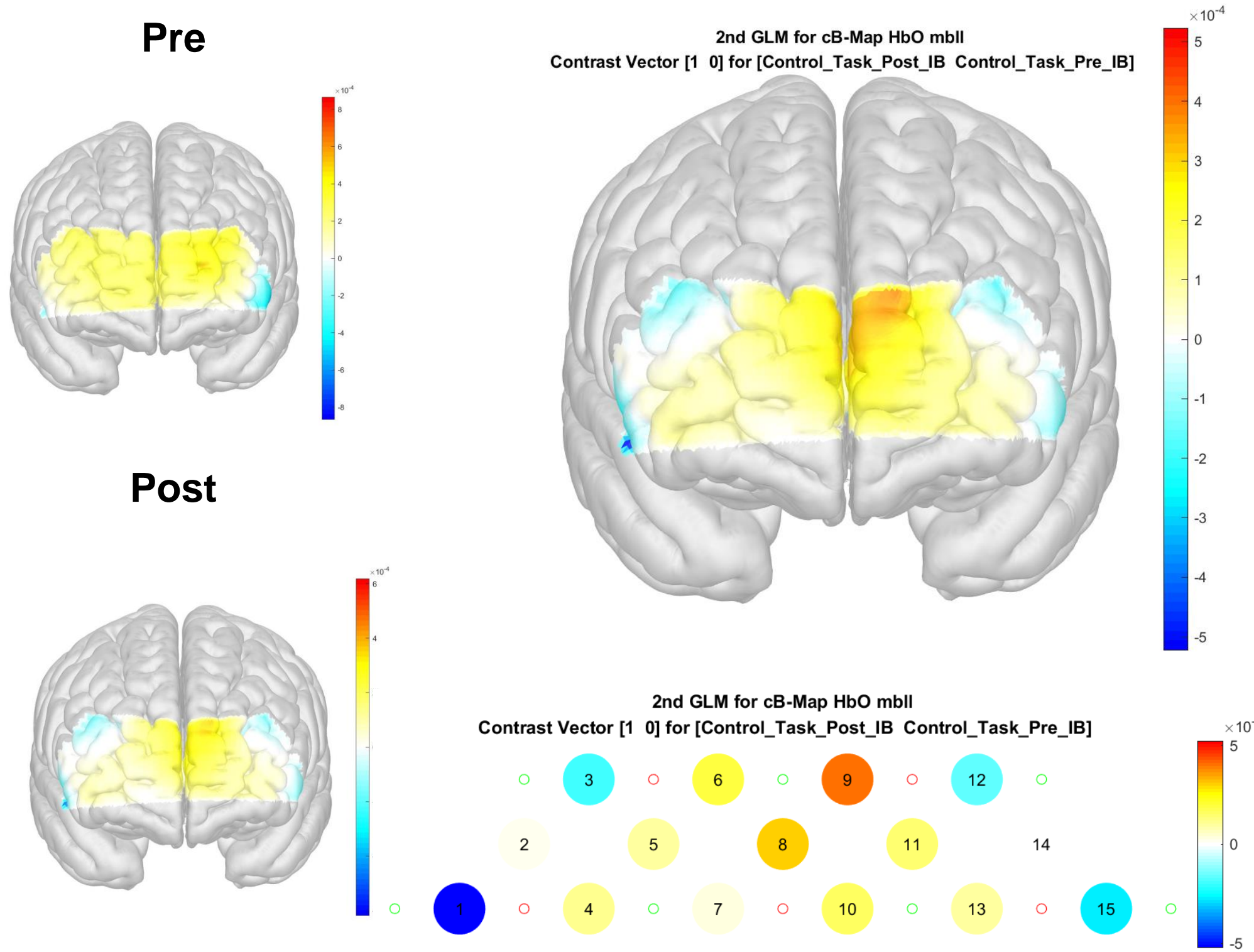
Channel	Mean. Pre	Var.Pre	Mean. Post	Var.Post	Mean diff.	p Value*
ch1	10.0	0.08	0.0	0.12	10.0	p <0.001
ch2	-5.6	0.05	-3.5	0.04	-2.0	p <0.001
ch3	1.3	0.02	-1.1	0.03	2.5	p <0.001
ch4	-2.7	0.01	3.2	0.02	-5.9	p <0.001
ch5	-3.5	0.02	2.3	0.01	-5.8	p <0.001
ch6	-2.3	0.02	-0.3	0.01	-2.0	p <0.001
ch7	-4.4	0.02	-1.1	0.01	-3.3	p <0.001
ch8	-2.6	0.02	0.7	0.01	-3.3	p <0.001
ch9	-4.3	0.01	1.6	0.01	-5.9	p <0.001
ch10	-1.6	0.02	-0.6	0.01	-1.0	p <0.001
ch11	-2.5	0.01	0.7	0.01	-3.2	p <0.001
ch12	-4.8	0.01	-1.1	0.02	-3.7	p <0.001
ch13	-3.4	0.02	2.3	0.02	-5.7	p <0.001
ch14	-2.4	0.02	-0.6	0.02	-1.8	p <0.001
ch15	12.6	0.09	-4.0	0.06	16.6	p <0.001

\* test by paired t test





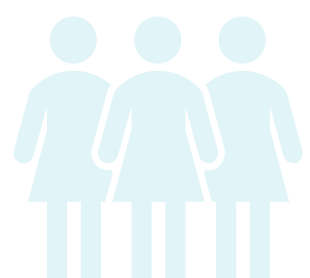
# Results – Training effect in Control group doing LZJ



Pre and post training comparison of mean  $\Delta\text{HbO}$  ( $\times 10^{-4}$  mol/L) in 15 channels in control group at LZJ

Channel	Mean. Pre	Var.Pre	Mean. Post	Var.Post	Mean diff.	$p$ Value*
ch1	8.2	0.04	-2.0	0.10	10.2	$p < 0.001$
ch2	-6.3	0.04	-4.1	0.04	-2.2	$p < 0.001$
ch3	1.0	0.02	-2.3	0.02	3.3	$p < 0.001$
ch4	-2.9	0.01	3.0	0.03	-6.0	$p < 0.001$
ch5	-4.1	0.02	2.2	0.01	-6.3	$p < 0.001$
ch6	-2.7	0.01	-0.4	0.02	-2.3	$p < 0.001$
ch7	-4.5	0.02	-1.1	0.02	-3.4	$p < 0.001$
ch8	-3.3	0.02	0.5	0.01	-3.8	$p < 0.001$
ch9	-4.7	0.01	1.8	0.02	-6.4	$p < 0.001$
ch10	-1.6	0.02	-0.6	0.01	-1.0	$p < 0.001$
ch11	-2.9	0.01	0.1	0.01	-3.0	$p < 0.001$
ch12	-5.0	0.01	-2.0	0.01	-3.0	$p < 0.001$
ch13	-3.5	0.02	2.1	0.02	-5.6	$p < 0.001$
ch14	-2.6	0.01	-0.4	0.02	-2.3	$p < 0.001$
ch15	11.7	0.06	-4.1	0.08	15.8	$p < 0.001$

\* test by paired t test







# Results – Psychometric assessments

## Between Groups comparison

	<i>Session</i>	<i>Disease</i>	<i>Control</i>	<i>Mean difference</i>	<i>Statistical value (t-test)</i>	<i>P value (2-tailed)</i>
<i>MOCA (marks)</i>	<i>Pre</i>	26.1±3.076	28.2±1.874	2.1	-2.313	<b>0.029**</b>
	<i>Post</i>	27±2.828	28.9±1.287	1.9	-2.526	<b>0.017**</b>
<i>TMT-A (s)</i>	<i>Pre</i>	34.403±12.817	35.91±5.077	1.507	-0.459	0.650
	<i>Post</i>	28.868±9.788	27.712±6.112	-1.156	0.396	0.695
<i>TMT-B (s)</i>	<i>Pre</i>	74.278±37.244	64.22±16.289	-10.058	1.027	0.313
	<i>Post</i>	64.447±29.553	56.224±15.844	-8.223	0.992	0.330

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; \*\*\*\* $p < 0.001$

## Objective Measures of Cognitive Functioning





# Results – Psychometric assessments

Disease group: Training effect

	<i>Pre</i>	<i>Post</i>	<i>Mean difference</i>	<i>Statistical value (t-test)</i>	<i>P value (2-tailed)</i>
<i>MOCA (marks)</i>	26.1±3.076	27±2.828	0.9	-1.872	<b>0.077*</b>
<i>TMT-A (s)</i>	34.403±12.81	28.868±9.788	-5.535	2.943	<b>0.008***</b>
<i>TMT-B (s)</i>	74.278±37.24	64.447±29.553	-9.831	1.507	0.148

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; \*\*\*\* $p < 0.001$

Objective Measures of Cognitive Functioning



# Results – Psychometric assessments

Disease group: Training effect

	<i>Pre session (marks)</i>	<i>Post session (marks)</i>	<i>Mean difference (marks)</i>	<i>Statistical value (t-test)</i>	<i>P value (2-tailed)</i>
<i>Overall health</i>	7.2±1.795	7.35±2.231	0.15	-0.256	0.801
<i>Breathless</i>	0.8±0.789	0.35±0.368	-0.45	2.015	<b>0.058*</b>
<i>Cough</i>	0.7±0.632	0.2±0.211	-0.5	2.032	<b>0.056*</b>
<i>Fatigue</i>	0.8±0.789	0.45±0.474	-0.35	1.277	0.217
<i>Pain/Discomfort</i>	0.85±0.842	0.95±1	0.1	-0.317	0.755
<i>Cognition</i>	1.1±1.053	1.1±1	0	0	1

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; \*\*\*\* $p < 0.001$

Subjective Complaint of long COVID-19 Symptoms



# Results – Psychometric assessments

Control group: Training effect

	<i>Pre</i>	<i>Post</i>	<i>Mean difference</i>	<i>Statistical value (t-test)</i>	<i>P value (2-tailed)</i>
<i>MOCA (marks)</i>	28.2±1.874	28.9±1.287	0.7	-0.978	0.354
<i>TMT-A(s)</i>	35.91±5.077	27.712±6.112	-8.198	4.402	<b>0.002***</b>
<i>TMT-B(s)</i>	64.22±16.28	56.224±15.844	-7.996	1.505	0.167

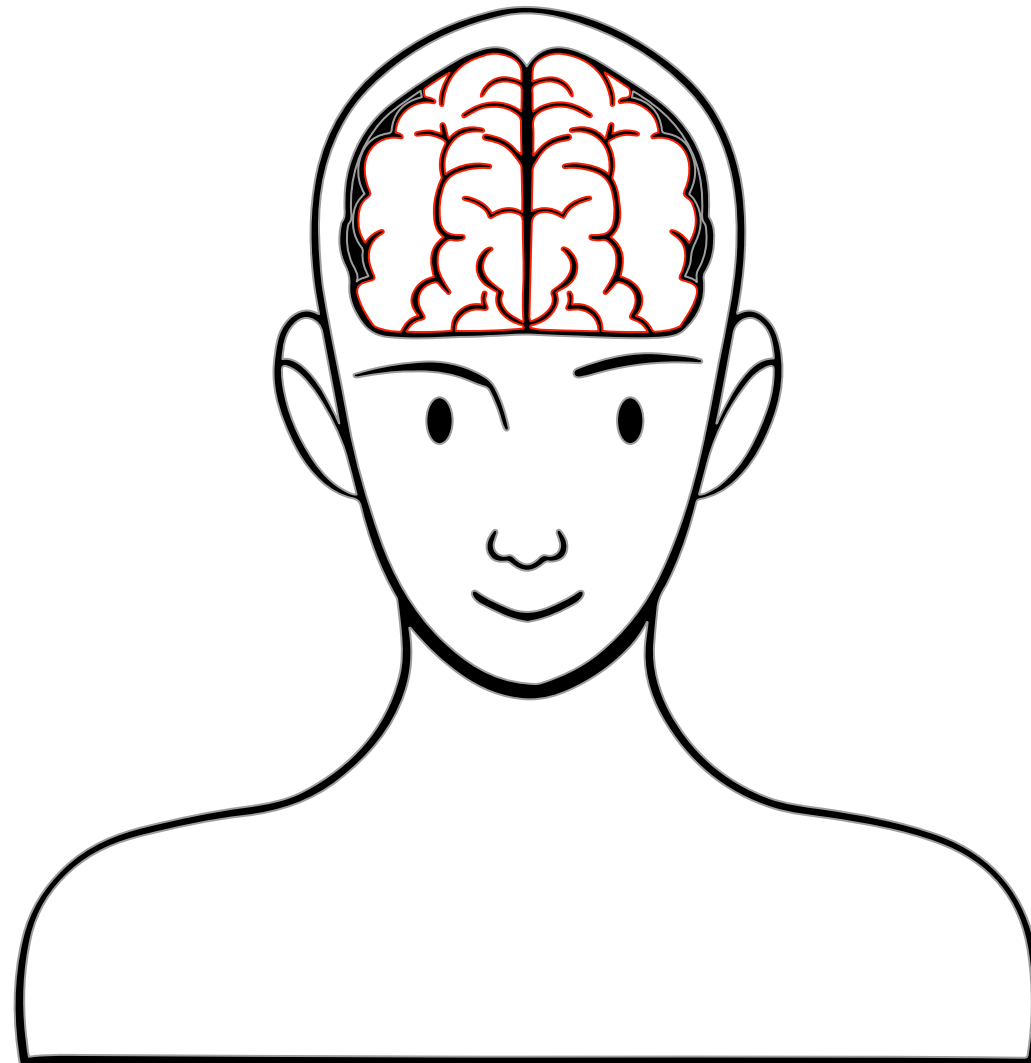
\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$ ; \*\*\*\* $p < 0.001$

Objective Measures of Cognitive Functioning





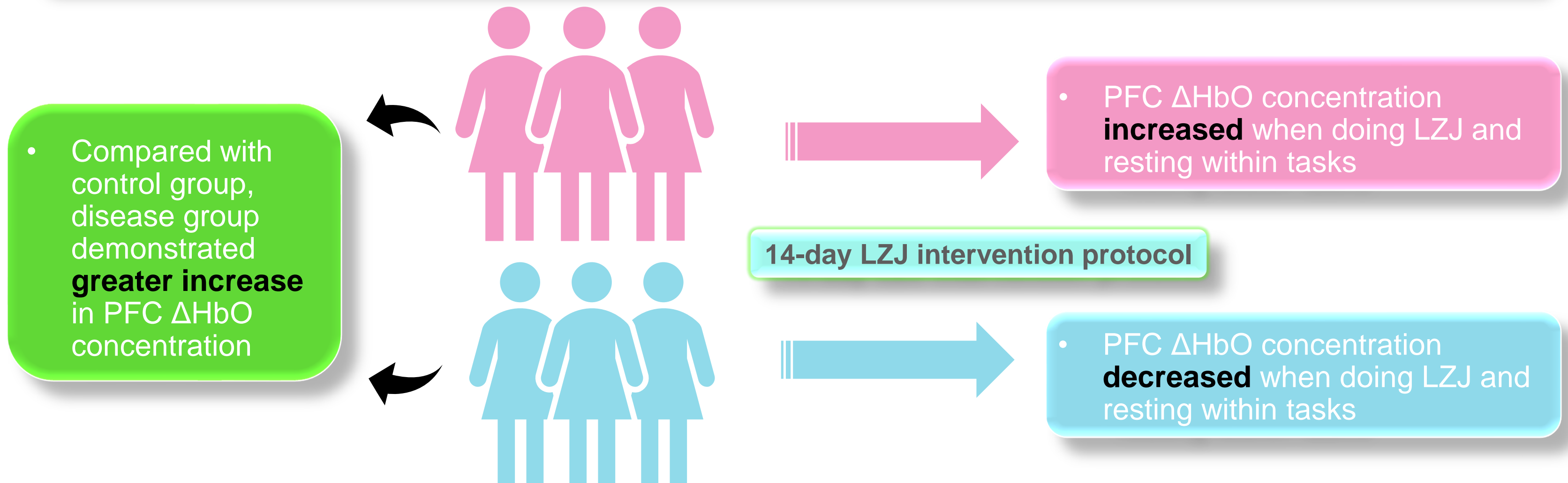
# Key Findings





# Key Findings

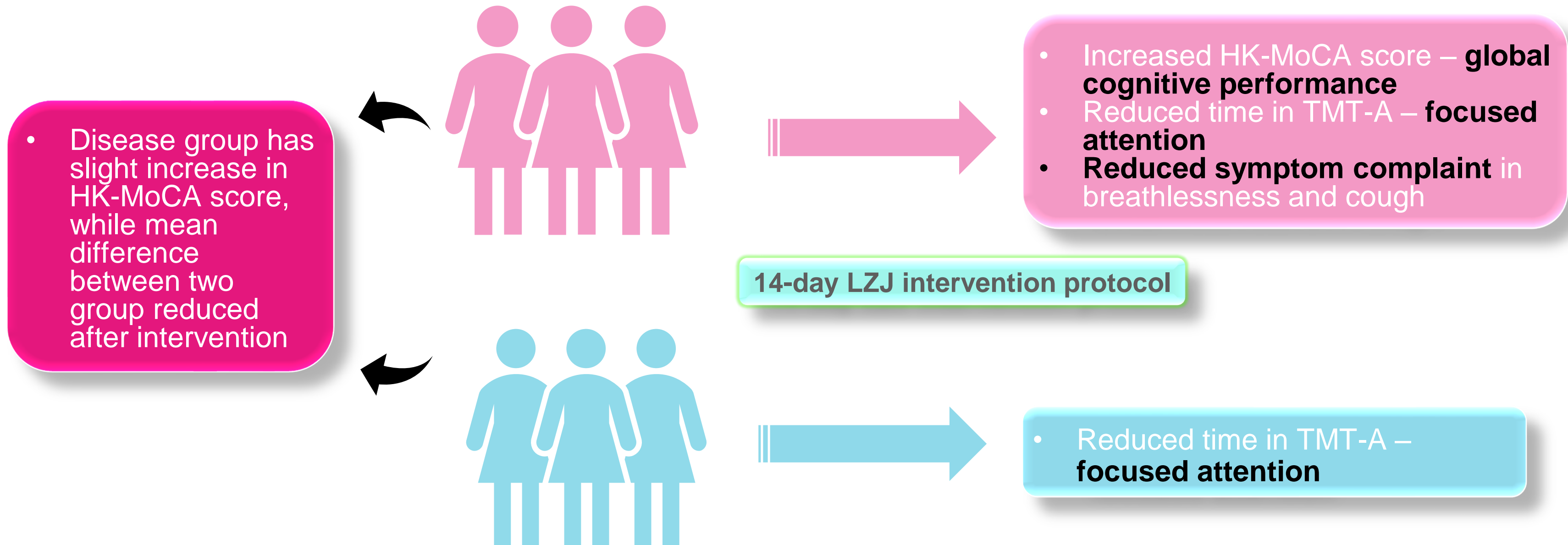
- **H1:** after LZJ exercise intervention, adults with long COVID-19 syndrome and healthy adults will demonstrate increase in  $\Delta\text{HbO}$  concentration in prefrontal cortex (PFC) in fNIRS assessment.





# Key Findings

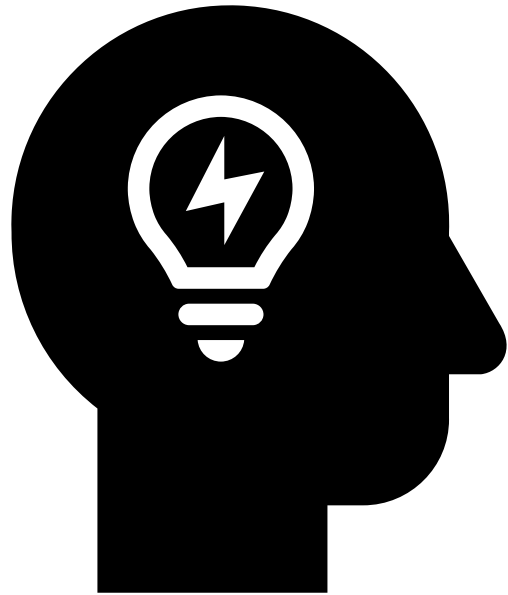
- **H2:** after LZJ exercise intervention, subjective and objective outcome measures of cognitive problems in adults with long COVID-19 syndrome will be improved.



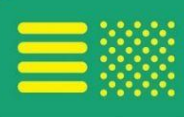




# Discussion



Increase in  $\Delta\text{HbO}$  showed **Better brain activities**  
(Liang, et al, 2021; Bak, Shin & Jeong, 2022)



# Discussion

## Altered brain activity & blood flow pattern:

- Altered functional connectivity in the prefrontal cortex (Liu et al., 2019; Chen et al., 2022)
- Increased blood flow in PFC

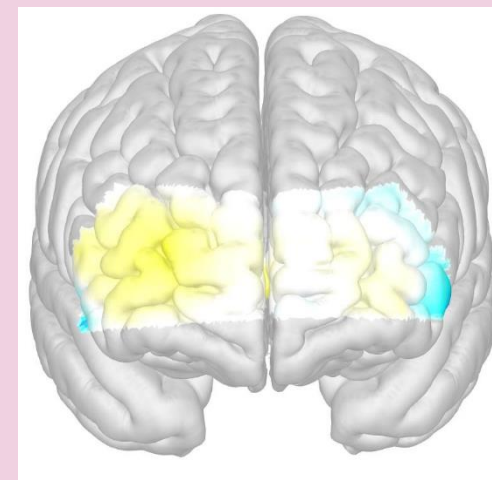
## Lower baseline

- more responsive to intervention

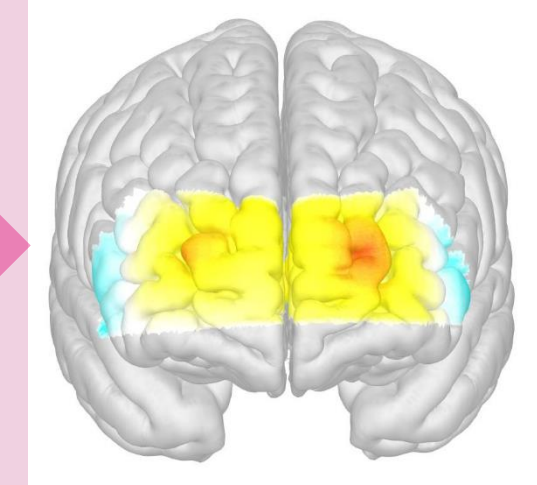
14-day LZJ intervention protocol

Disease group doing LZJ

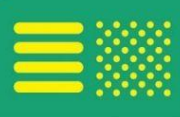
Pre



Post



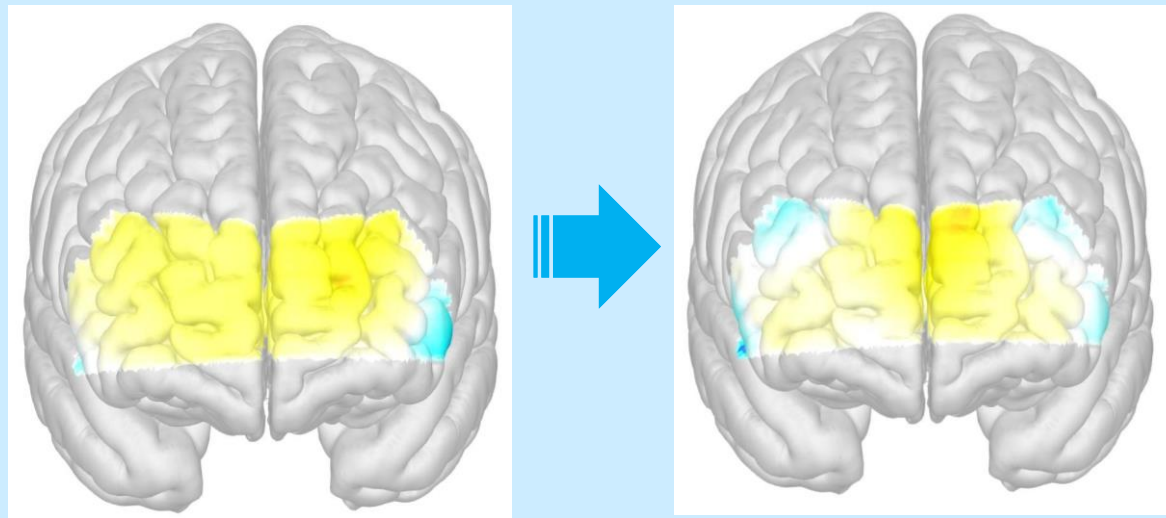
Increase  $\Delta$ HbO concentration in PFC



# Discussion

14-day LZJ intervention protocol

Healthy group doing LZJ and rest  
Pre Post



Decreased  $\Delta\text{HbO}$  concentration in PFC

## Improvement in cognitive assessment

- TMT-A: improved focused attention

## Increased prefrontal efficiency:

- Regular practice allow effective function with less oxygenated blood flow

## Enhanced autonomic regulation:

- Increased vagal regulation → increased parasympathetic activity → reduced oxygen consumption (Wei et al., 2015)





# Discussion



**Disease group: increase brain activity to achieve cognitive efficiency**

**Healthy group: decrease brain activity to maintain the same cognitive efficiency**

**Bi-directional adjustment of the Qigong, to make the body to achieve equilibrium.**



# Limitation

- No known the effect of live as usual and control for LZJ.
- A pilot study, need more large-scale study



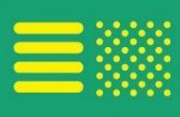
The End  
~Thank you~





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