CIBM Center for Biomedical Imaging

CIBM Annual Symposium 2022

Campus Biotech, Geneva | 30th November

Mindfulness based intervention in preterm young adolescents: Effects on neurobehavioural functioning and association with large-scale brain networks dynamics

Siffredi, V, Liverani, MC, Fernandez, N, Freitas, L, Borradori Tolsa, C, Van De Ville, D, Hüppi, P, Hà-Vinh Leuchter, R

Division of Development and Growth, Department of Paediatrics, Gynaecology and Obstetrics, Geneva University Hospitals and University of Geneva, Geneva;
Neuro-X Institute, Ecole polytechnique fédérale de Lausanne, Geneva, Switzerland & Department of Radiology and Medical Informatics, Faculty of Medicine, University of Geneva

BACKGROUND

- Adolescents born very preterm (VPT; <32 weeks' gestation) are at high risk of executive, behavioural and socio-emotional difficulties.
- Evidence showed beneficial effect of mindfulness-based intervention (MBI) on these abilities in typically developing and in clinical paediatric populations (e.g., ADHD, ASD and socio-emotional difficulties).
- A recent randomised controlled trial (RCT) in VPT young adolescents showed benefits of an 8-weeks-long MBI on executive, behavioural and socio-emotional functioning (Siffredi*, Liverani* et al., 2021).

AIMS

To assess the association between the benefits of MBI on neurobehavioral functioning and potential changes in large-scale brain dynamics using dynamic resting-state functional connectivity (FC) in VPT young adolescents.

METHODS

Participants 32 VPT young adolescents & 24 full-term (FT) controls aged 10-14.

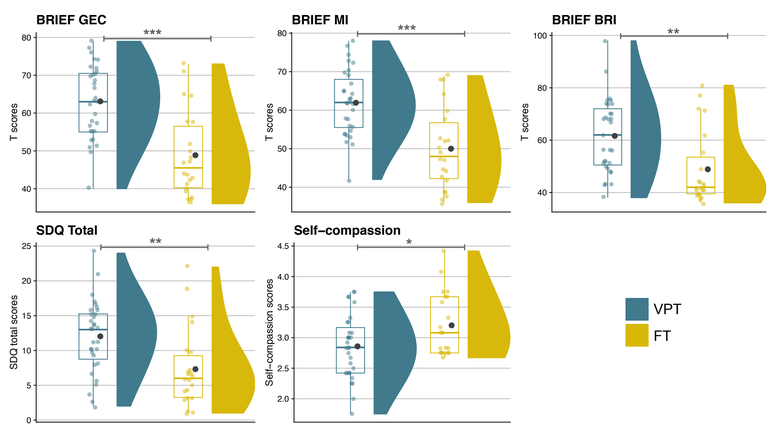
Neuropsychological measures Age-standardised measures assessing executive, behavioural and socio-emotional abilities (14 scores).

Innovation-Driven Co-Activation Patterns (iCAPs) Dynamic FC was extracted using iCAPs (Karahanoğlu & Van De Ville, 2015). For each participant, before and after MBI, iCAPs' temporal characteristics were extracted: 1. Total duration (total duration of overall activation as percentage of the total non-motion scanning time); 2. Occurrences (the number of activation blocks); 3. Coupling (same-signed co-activation for each pair of iCAPs); and 4. Anti-coupling (opposite-signed co-activation for each pair of iCAPs).

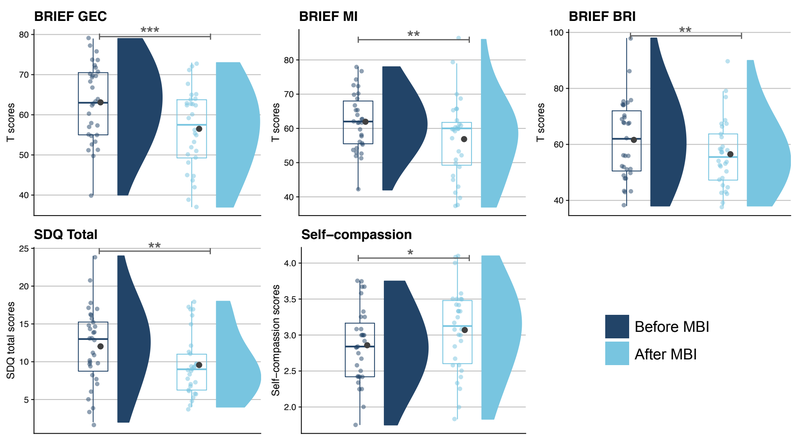
Statistical analyses 1. Comparison of the VPT and FT groups on neurobehavioural measures; 2. Assessment of the effect of MBI on neurobehavioral measures significantly affected in VPT; 3. Association between reliable changes in neurobehavioural outcomes and reliable changes in temporal properties of iCAPs (i.e., before and after the MBI) was explored using Partial Least Square Correlations (PLSC), a multivariate data-driven approach. The the reliable change index (RCI) was used to quantify change after MBI.

RESULTS

Neuropsychological measures: VPT vs FT

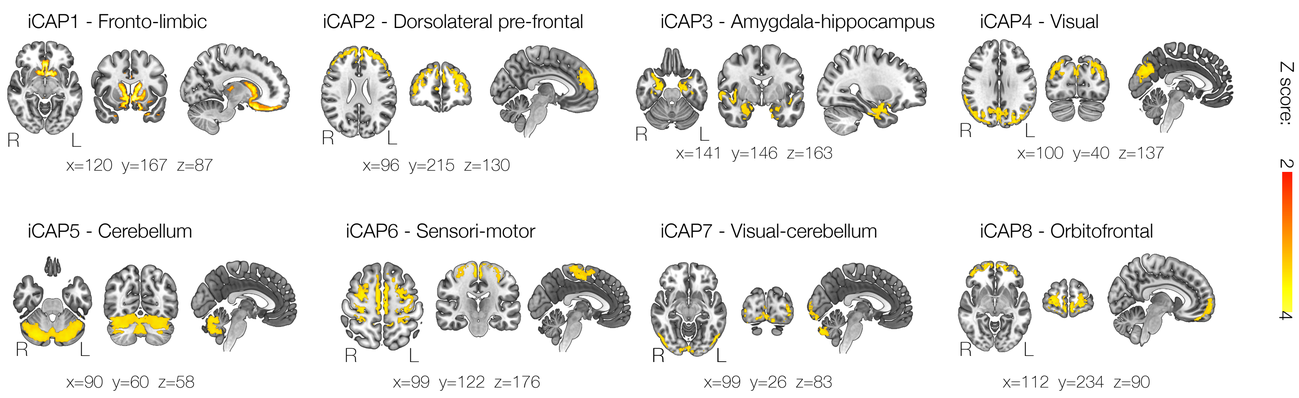


Effect of MBI on neurobehavioural measures in VPT

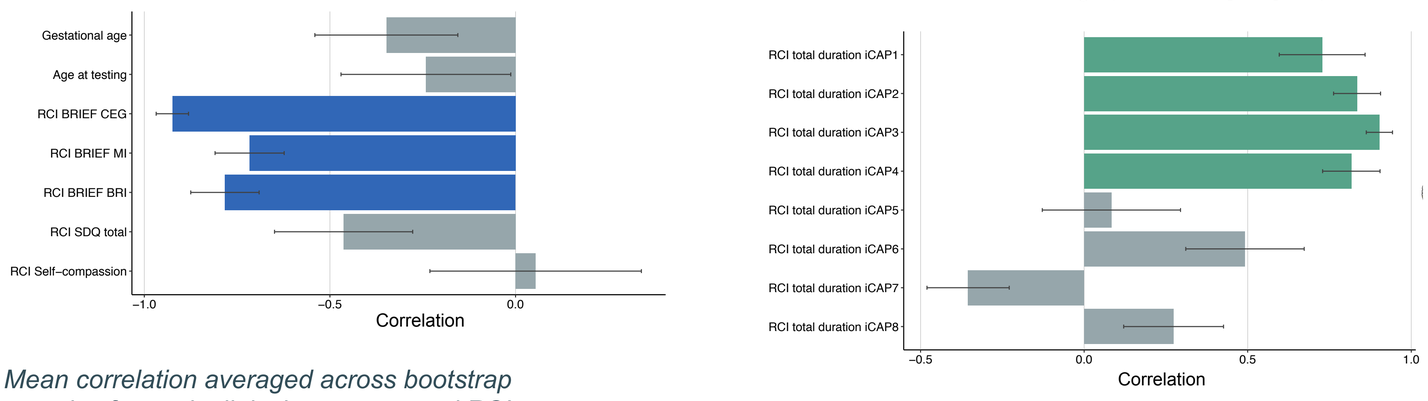


*** q<0.001, ** q<0.01, * q<0.1

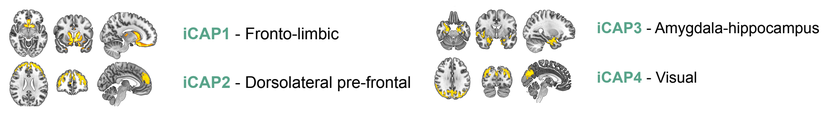
iCAPs



Association between neurobehavioural & iCAPs temporal changes after MBI



Mean correlation averaged across bootstrap samples for each clinical measures and RCI total iCAPs duration (y-axes); robust loadings are represented in blue and green



CONCLUSION

- In VPT young adolescents, the improvement in executive functioning after an MBI, previously observed in a gold-standard RCT, was associated with reliable changes in temporal characteristics of large-scale brain networks:
  1. Longer activation in fronto-limbic and amygdala-hippocampus networks known to be related with self-regulation (Lutz et al., 2016).
  2. Longer activation in the dorsolateral pre-frontal network known to be associated with attentional control (Kennedy et al., 2022).
  3. Longer activation in visual networks that have been related to attentional awareness of relevant sensory stimuli (Sezer et al., 2022).

UNIVERSITÉ DE GENÈVE | HUG Hôpitaux Universitaires Genève | EPFL | campus biotech

vanessa.siffredi@unige.ch
@van_siffredi