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## **MEDIA RELEASE**

Monday, 29 October 2012

### **Study Shows BCI-Based Attention Training Programme Can Be Potential Treatment for ADHD**

1. The Institute of Mental Health (IMH), in collaboration with the Institute for Infocomm Research (I<sup>2</sup>R), a research institute of the Agency for Science, Technology and Research (A\*STAR), and Duke-NUS Graduate Medical School, has completed a study which has shown promising results for the use of a brain-computer interface (BCI)-based training programme as a potential new treatment for Attention Deficit Hyperactivity Disorder (ADHD).

2. The study on 20 children with ADHD was led by Principal Investigator, Dr Lim Choon Guan, Consultant and Deputy Chief from the Department of Child & Adolescent Psychiatry, IMH. Co-Principal Investigators include A/Prof Daniel Fung, Chairman Medical Board and Senior Consultant from the Department of Child and Adolescent Psychiatry, IMH, Prof Ranga Krishnan and A/Prof Lee Tih-Shih from Duke-NUS Graduate Medical School, Dr Guan Cuntai, A\*STAR's Institute for Infocomm Research, Prof Cheung Yin Bun and Dr Zhao Yudong from the Singapore Clinical Research Institute.

3. Twenty unmedicated children with ADHD (16 males, 4 females) who had significant inattentive symptoms (combined and inattentive ADHD subtypes) were recruited for this study.

4. As a pre-requisite for participation in the study, the children must be diagnosed as having inattentive or combined subtypes of ADHD, be aged between 6 to 12 years, and

not be on any medication for ADHD. The children must not have sensory disabilities or significant learning disability.

5. The children received training through a BCI-based game system three times a week for eight weeks. The BCI-based game system consisted of a headband with electroencephalography (EEG) sensors that transmitted EEG readings to the computer through Bluetooth-enabled technology. The children would wear the headband around their foreheads, with an electrode clipped to the earlobes.

6. The BCI-based training system involved a core technology to accurately quantify a person's attention levels based on a Brain-Computer Interface and a computerised 3D graphic game, which was developed by I<sup>2</sup>R specifically for the study. In this training game, the child controlled an avatar via the signals detected by the EEG electrodes. In order to move the avatar, the child would need to focus. The BCI-based game system would measure the attention level and the game would proceed at a proportional speed. The higher the concentration level of the child, the higher the speed of the avatar's movement.

7. In addition, the training programme included academic tasks at the end of every alternate session. The intention was to train the child to learn to focus in the same way when performing academic work.

8. Following the 8-week training program, both parent-rated inattentive and hyperactive-impulsive symptoms on the ADHD Rating Scale showed significant improvement. Those with more severe symptoms were also the ones who showed greater improvement. When these children received monthly training sessions subsequently, the behavioural improvements were sustained but did not further improve.

9. Said Dr Lim Choon Guan on the results, "Many parents prefer to train their children to overcome their difficulties rather than rely on medication but find behavioural management strategies hard to implement or deliver results. We are excited by this early result as it points to a potentially new and effective way to treat children with ADHD."

10. Said Dr Guan Cuntai, Department Head of I<sup>2</sup>R's Neural & Biomedical Technology Department, "We are very pleased to see how technologies developed by researchers at I<sup>2</sup>R can be transferred to clinical use to help patients. Brain-computer Interface is an emerging technology with vast potentials in various applications. We will continue to work with clinicians closely to create more innovative solutions for patient care."

11. Standard treatment for ADHD currently includes mainly medication and psychosocial or behavioural treatment. Studies have also shown that many patients frequently forget to take medication. Many parents are also concerned about the side effects of medication and express that they are not keen to have their children to just rely on medication for symptom control in the long term. Behavioural interventions, although more acceptable to parents, are much more difficult to implement, time-consuming, resource-intensive and take time to show results.

12. Added Dr Lim, "There are of course limitations to our current study. This was a small study with no comparison group, and parents who completed the behavioural rating scale could have been biased as they knew their children were receiving intervention. This could have resulted in exaggerated treatment effect. We will still need a larger and better-designed clinical trial to prove that it works, and the team plans to have a larger trial in the future over the next 2 years.'

13. ADHD is one of the most common disorders seen at the Child Guidance Clinic. In 2011, about 800 children seen at the clinic were diagnosed with ADHD. According to a study published in the American Journal of Psychiatry in 2007 which analysed international research on ADHD prevalence over the years, the worldwide prevalence of ADHD in children has been estimated to be 5%.

14. More information on the study can be accessed on PLOS ONE at: <http://dx.plos.org/10.1371/journal.pone.0046692>

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**About the Institute of Mental Health, Singapore**

The Institute of Mental Health (IMH) is the only tertiary psychiatric care institution in Singapore. Located on the sprawling 25-hectare campus of Buangkok Green Medical Park in the north-eastern part of Singapore, IMH offers a multidisciplinary and comprehensive range of psychiatric, rehabilitative and counseling services. The 2010-bedded hospital aims to meet the needs of three groups of patients – children and adolescents (age below 19 years), adults, and the elderly. Besides clinical services, IMH also coordinates and oversees training of clinicians, nurses and allied health professionals in psychiatry and conducts research related to mental health. Over the years, IMH has established a significant reputation for quality psychiatry research. For more information, visit: [www.imh.com.sg](http://www.imh.com.sg).

**About the Institute for Infocomm Research**

The Institute for Infocomm Research (I<sup>2</sup>R pronounced as i-squared-r) is a member of the Agency for Science, Technology and Research (A\*STAR) family. Established in 2002, our mission is to be the globally preferred source of innovations in 'Interactive Secured Information, Content and Services Anytime Anywhere' through research by passionate people dedicated to Singapore's economic success. I<sup>2</sup>R performs R&D in information, communications and media (ICM) technologies to develop holistic solutions across the ICM value chain. Our research capabilities are in information technology, wireless and optical communication networks, interactive and digital media, signal processing and computing. We seek to be the infocomm and media value creator that keeps Singapore ahead.

For more information, please visit <http://www.i2r.a-star.edu.sg>

### **About the Duke-NUS Graduate Medical School**

The Duke-NUS Graduate Medical School Singapore (Duke-NUS) was established in 2005 as a strategic collaboration between the Duke University School of Medicine, located in N. Carolina, USA and the National University of Singapore (NUS). Duke-NUS offers a graduate entry, 4-year M.D. (Doctor of Medicine) training programme based on the unique Duke model of education, with one year dedicated to independent study and research projects of a basic science or clinical nature. Duke-NUS also offers M.D/PhD and PhD programmes. As a player in Singapore's biomedical community, Duke-NUS has identified five Signature Research Programmes: Cancer & Stem Cell Biology, Neuroscience and Behavioral Disorders, Emerging Infectious Diseases, Cardiovascular & Metabolic Disorders, and Health Services and Systems Research. For more information, please visit [www.duke-nus.edu.sg](http://www.duke-nus.edu.sg).