IMH Research News

A publication brought to you by the Research Division, Institute of Mental Health | May - July 2023

# **Attention please!** Home-based brain-computer interface attention training program for Attention Deficit Hyperactivity Disorder


Children with attention deficit hyperactivity disorder (ADHD) are at a greater risk for long-term negative outcomes, with many of them continuing to show symptoms in adulthood. Early intervention during periods of enhanced brain plasticity can significantly improve the trajectory of ADHD. We wanted to create a home-based intervention which will reduce reliance on our clinic's services and appeal to more children with ADHD. Together with our collaborators, we utilized brain-computer interface (BCI) technology to develop a novel intervention that can be administered in the patient's own home. This journey started in 2007, and after two pilot trials, we managed to complete a randomized controlled trial with our training program Cogoland in 2016 to prove its clinical efficacy.

**Table 1.** Feasibility outcome measures.

| | Total | Home | Clinic |
|---|---|---|---|
| **Completion and retention** | | | |
| Treatment completion (24 sessions) | 90% (18/20) | 95% (9/10) | 95% (9/10) |
| Retention (post-intervention) | 100% (20/20) | 100% (10/10) | 100% (10/10) |
| **Technical issues** | | | |
| Headband disconnecting | 30% (6/20) | 30% (3/10) | 30% (3/10) |
| Game application hanging/crashing | 0% (0/20) | 0% (0/10) | 0% (0/10) |
| Gameplay defect | 0% (0/20) | 0% (0/10) | 0% (0/10) |
| **Other difficulties** | | | |
| Game set up by parents[a,b] | - | 20% (2/10) | - |
| Game set up by child[a,b] | - | 0% (0/10) | - |
| Require parent supervision[a,b] | - | 20% (2/10) | - |
| Gameplay[b] | 25% (5/20) | 20% (2/10) | 30% (3/10) |
| **Adverse events** | | | |
| Serious adverse events | 0 | 0 | 0 |
| Sleep problems | 0 | 0 | 0 |
| Somatic complaints | 5% (1/20) | 10% (1/10) | 0 |
| Other complaints[c] | 5% (1/20) | 0 | 10% (1/10) |

[a]feedback of parents/child for home-based group
[b]provided qualitative feedback of difficulty
[c]pre-existing vocal tics became more frequent on days the child played the game

The technology was licensed to Neeuro subsequently, which developed Cogoland into a game software application that can be downloaded onto a mobile device. The child wears a headband with dry electroencephalogram (EEG) sensors while playing the game. Brainwaves detected by the headband are transmitted to the tablet, analyzed by the game system's algorithm and translated into quantifiable attention scores. The scores are reflected on the tablet, providing real-time feedback to participants about their attention level. The higher the child's attention score, the faster the avatar's movement. To test out the feasibility of this home-based solution, we did one study with 20 children (aged 6-12), who were randomized to complete the 8-week program either in the clinic (n=10) or at home (n=10).

**Almost all our participants completed the program in its entirety, with most reporting that they enjoyed the game and found it useful. 80% of parents in the home-based group reported that their child could undergo the BCI training with little to no supervision**. There were no significant differences in the improvement of ADHD symptoms between the groups, indicating that conducting the intervention at home is comparable to at the clinic. The game can be played without on-site therapist supervision, offering an additional treatment option without stretching limited clinic resources. The Cogoland software application and EEG headband is currently available for purchased at the Child Guidance Clinic as an additional treatment option for inattentive symptoms in children with ADHD.

Contributed by:
**Dr Lim Choon Guan**
Senior Consultant & Deputy Chief
Department of Developmental Psychiatry
Institute of Mental Health

**Ms Soh Chui Pin** & **Ms Shernice Lim Shi Yun**
Associate Psychologists
Department of Developmental Psychiatry
Institute of Mental Health

IMH Research News

A publication brought to you by the Research Division, Institute of Mental Health | May - July 2023

# **Treatment delays for mental disorders in Singapore:** results from the Singapore Mental Health Study 2016

| | Prompt treatment Weighted % (n) | Delayed treatment Weighted % (n) | Time-to-treatment in years (median) |
|---|---|---|---|
| Mood disorders | 40.5 (40) | 59.5 (43) | 5 |
| Anxiety disorders | 43.7 (15) | 56.3 (26) | 1 |
| Alcohol use disorders | 7.3 (4) | 92.7 (9) | 4 |
| Any mental disorder | 39.3 (59) | 60.8 (78) | 9 |

Mental disorders that are left untreated can progress and become more complex, leading to adverse clinical outcomes. Timely intervention is therefore crucial to mitigate the effects of mental disorders. However, a large proportion of individuals with mental disorders still do not seek prompt treatment and only receive the necessary care after long delays. These treatment delays, which refer to the time lag between the onset and treatment for a disorder, represent an unmet need for mental health care and need to be further understood. Therefore, this study aimed to examine the prevalence and correlates of treatment delays for mental disorders in Singapore, as well as the perceived effectiveness of treatment received.

The 2016 Singapore Mental Health Study was a cross-sectional, nationwide study conducted from 2016 to 2018 to examine the prevalence of mental disorders in Singapore. **Out of 137 respondents who had ever sought professional help for a mental disorder, 60.8% had received delayed treatment** (i.e., at least one year after onset of the disorder). The proportion of respondents who received delayed treatment was 59.5% for mood disorders, 56.3% for anxiety disorders, and 92.7% for AUD. The median delay was 5 years for mood disorders, one year for anxiety disorders, and 4 years for AUD. **The likelihood of receiving delayed treatment was significantly higher among respondents with older age, higher educational qualification, lifetime AUD, or earlier onset of disorder.** 58.4% of respondents with lifetime treatment contact had received treatment that they considered effective.

Our results showed that treatment delays for mental disorders in Singapore are common, and that certain population groups are more susceptible to receiving delayed treatment. These findings highlight the need to increase help-seeking behaviours and improve the accessibility and availability of mental health services to ensure that people receive the necessary help in a timely manner.

Study reference: Tan, R. H. S., Koh, Y. S., Vaingankar, J. A., Abdin, E., Sambasivam, R., Chong, S. A., & Subramaniam, M. (2023). Treatment delays for mental disorders in Singapore: results from the Singapore Mental Health Study 2016. Social psychiatry and psychiatric epidemiology, 10.1007/s00127-023-02440-0. Advance online publication. https://doi.org/10.1007/s00127-023-02440-0

Contributed by:
**Ms Rachel Tan**
Research Assistant, Research Division
Institute of Mental Health