Working UofT Thesis Reproducible Report Template using Quarto

by

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Abstract

This template allows users to create reproducible documents in the required UofT thesis formatting using quarto. This quarto book is written using YAML, R, markdown, and latex syntax. This approach supports integration with citation managers (e.g. Zotero) to manage bibliography and in-text citations, creates cross-referencable figures, tables, and document sections, generates tables and figures using R syntax, dynamically inserts acronyms, and allows integration of text and code. Future updates will introduce APA formatted word doc output options as well.

Acknowledgements

This would not be possible without the UofT latex template (ut-thesis) maintained by jessexknight and the acronymsdown package by rchaput

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List of Acronyms

ADHD Attention-Deficit/Hyperactivity Disorder
EF Executive Functions
RCT Randomized Controlled Trial
SSRT Stop Signal Reaction Time

Chapter 1

Introduction

1.1 Background

Neurodevelopmental disorders are persistent and impairing lifelong conditions resulting from combined genetic and environmental influences (Faraone et al., 2021). Attention-Deficit/Hyperactivity Disorder (ADHD) is a highly heritable (Pettersson et al., 2019) neurodevelopmental disorder diagnosed in approximately 8% of children and youth worldwide (Ayano et al., 2023) and is characterized by persistent inattention and/or hyperactivity symptoms causing impairment in multiple settings (American Psychiatric Association, 2022). Both ADHD and autism are associated with a range of challenges including difficulties with academic achievement, peer relationships, and behaviour regulation (French et al., 2024; Posar & Visconti, 2019). Interventions for ADHD include use of stimulant or non-stimulant medications, behavioural parent training, and environmental accommodations (Faraone et al., 2021). Although each of these may result in improvements at the group level, benefits are generally time limited and impairment remains in many individuals (Faraone et al., 2021).

1.2 Aim

Computerized Executive Functions (EF) training programs have shown consistent growth in development and investigation, with several commercial options currently available. The existing research on efficacy of these programs is variable and largely shows a lack of far transfer to untrained skills. Most videogame-based EF training programs in neurodevelopmental disorders have focused on ADHD, with more recent work exploring applications in autism. However, both disorders are characterized by high heterogeneity in clinical and EF characteristics pointing to potential key factors that may be associated with variability in response to EF training. There has been limited investigation on factors associated with heterogeneity in responses to treatment, which is essential to understand what intervention works best for whom. To address gaps in the research on currently available EF training programs, our team co-created Mega Team with youth co-designers with a focus on accessibility, affordability, and multi-skill training. Overall results of the main Randomized Controlled Trial (RCT) show near and far transfer in ADHD participants but not in autistic

participants (Cheung et al., in prep). This project will explore a broad range of baseline predictors to better understand patterns in individual factors of response to computerized EF training in a sample of ADHD and/or autism children.

Research Question: Do demographic (age and gender), clinical (use of stimulant medication, ADHD symptoms, autism traits), EF (response inhibition, working memory baseline performance, and EF-related impairment), and training (time on task) factors predict magnitude of response to treatment in near and far transfer (near: response inhibition and working memory; far: ADHD symptoms, daily EF impairment, planning, and fluency) outcome measures immediately after Mega Team training and at six month follow-up in ADHD children and autistic children?

Chapter 2

Methods

2.1 Participants

Children aged 6-12 years old with a diagnosis of ADHD (n = 186) or autism (n = 67) were randomized in the study (see Table 2.1). Children on medication were included if they were on a stable dose for the preceding month before training and not concurrently participating in a medication trial. Participants had a diagnosis of ADHD or autism with or without co-occurring ADHD. All other comorbidities were included in both participant groups. Overall inclusion criteria were: (a) 6 to 12 years old; (b) Full Scale Intelligence Quotient (FSIQ) > 70 on a standardized norm-referenced IQ measure; (c) reliable access to the internet; (d) either diagnosed with ADHD based on Diagnostic Statistical Manual fifth edition (American Psychiatric Association, 2022) criteria confirmed by responses on the Parent Interview for Child Symptoms (PICS) (Ickowicz et al., 2006) or diagnosed with ASD based on the DSM-5 criteria confirmed by ratings on the Autism Diagnostic Observation Schedule – Second Edition (ADOS-2) (Lord et al., 2012).

2.2 Measures

Stop Signal Task: The Stop Signal Task measures response inhibition (Logan et al., 1997). This computerized task is composed of one practice block and four assessment blocks which contain 24 trials each. Participants were instructed to make a speeded response to either the X or O stimulus on the screen and withhold their response if the stimulus was preceded by a beep. The Stop Signal Task is made up of go trials and stop trials. Go trials are trials when the participant is expected to make a speeded response. Stop trials are trials when a stop signal (e.g. auditory tone) is presented, and participants are expected to withhold their speeded response. The percentage of stop trials a participant successfully inhibits their response on is referred to as the percent stop inhibition (PSI) and is used in determining validity of administration. **Stop signal reaction time (SSRT)** was calculated as an estimate of the participants' response inhibition in milliseconds – a faster SSRT indicates better response inhibition. This task was administered at all three assessment visits. **Swanson, Nolan and Pelham Questionnaire, fourth edition (SNAP-IV)**: The SNAP-IV; (Swanson et al., 1981) measures ADHD symptoms. Caregivers rated their child's behaviours on a 4-

Table 2.1: Demographics

Characteristic	ADHD		Autism	
	Mega Team N = 94	**TAU** N = 92	**Mega Team** N = 33	**TAU** N = 32
Age	9.33 (1.62)	9.27 (1.63)	9.06 (1.85)	8.38 (1.74)
Gender				
Cisgender Boy	72 (77%)	70 (76%)	23 (72%)	25 (78%)
Cisgender Girl	22 (23%)	21 (23%)	9 (28%)	6 (19%)
Gender Diverse	0 (0%)	1 (1.1%)	0 (0%)	1 (3.1%)
Takes Stimulant Medication	56 (60%)	54 (59%)	8 (24%)	7 (22%)
ADHD	94 (100%)	92 (100%)	16 (48%)	17 (53%)
Autism	0 (0%)	1 (1.1%)	33 (100%)	32 (100%)
ODD	13 (14%)	8 (8.7%)	1 (3.0%)	1 (3.1%)
Tics	8 (8.5%)	7 (7.6%)	2 (6.1%)	2 (6.3%)
OCD	1 (1.1%)	2 (2.2%)	0 (0%)	0 (0%)
Anxiety*	10 (11%)	21 (23%)	4 (12%)	1 (3.1%)
Other	18 (19%)	26 (28%)	5 (15%)	4 (13%)
IQ	104 (15)	102 (14)	100 (15)	103 (15)
Baseline ADHD Symptoms	34 (9)	35 (9)	29 (12)	32 (13)
Baseline Autism Traits	5.9 (4.7)	6.5 (5.8)	16.4 (5.1)	16.8 (7.5)

Note: M (SD); n (%); TAU: Treatment as Usual; ODD: Oppositional Defiant Disorder; OCD: Obsessive Compulstive Disorder; IQ: Intelligence Quotient. ADHD symptoms: SNAP Total score; Autism Traits: SCQ Total score. *$p < 0.05$ comparing Mega Team versus TAU within the diagnosis group.

point Likert scale from "not at all" to "very much" on 26 statements describing inattention (9 items), hyperactivity/impulsivity (9 items), and oppositional (8 items) behaviours. The **SNAP total sum** reflects the number and severity of symptoms, with higher scores reflecting greater ADHD symptoms. The SNAP-IV shows acceptable internal consistency and demonstrates parent scores predictive of an ADHD diagnosis for scores above 1.8 on inattention and above 2.4 for hyperactivity/impulsivity (Bussing et al., 2008). The SNAP-IV was administered at baseline, 5 weeks post treatment, and at 6 month follow-up. See Appendix A for complete measure.

2.3 Procedure

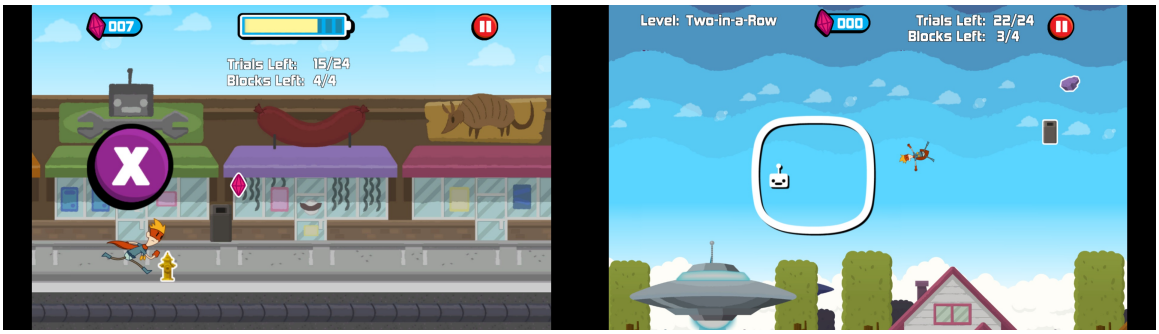
The current analysis was part of an RCT examining the efficacy of Mega Team training in ADHD children and youth and in ASD children and youth. For a comprehensive description of the procedure and measures, please see the main efficacy paper (Cheung et al., in prep). Participants were recruited from a community sample via flyers distributed in online parent groups and advocacy organizations (e.g. CHILD-BRIGHT Network). Informed consent was obtained from the caregivers, and assent was obtained from the children at the beginning of the study. Ethics approval was obtained through the SickKids Research Ethics Board. The trial was registered at ClinicalTrials.gov, trial number NCT03502239.

2.4 Intervention

The Mega Team intervention trains response inhibition and working memory. There are four minigames in Mega Team. Two minigames are played on a laptop and two are played on a tablet. In the laptop minigames participants play as various superhero characters dodging obstacles and collecting gems to save other members of their superhero team (see Figure 2.1).

Figure 2.1: Mega Team games

(a) Response inhibition training task (b) Working memory training task



2.5 Analysis

Data were screened for validity…

Chapter 3

Results

3.1 ADHD Group

A multiple linear regression model for change in response inhibition after 5 weeks of intervention with all the predictors (age, gender, baseline response inhibition, working memory, EF impairment, ADHD symptoms, autism traits, stimulant medication use, and time on task) entered revealed a significant model fit indicating that the baseline characteristics entered predicted response to treatment, accounting for 45% of the variance ($F = 4.7$, $p < 0.001$, $R^2 = 0.45$). Baseline response inhibition (β = -0.30, p = 0.02) and baseline working memory (β = -0.40, p = 0.0014) predicted improvement in response inhibition after 5 weeks regardless of treatment group such that lower (i.e., worse) baseline response inhibition and higher (i.e., better) baseline working memory (on the N-Back 1-back condition) predicted greater improvement after 5 weeks. Additionally, the model showed a significant interaction effect of baseline response inhibition by randomization group moderating change in response inhibition at 5 weeks post-treatment (β = -0.65, p = 0.01), ruling out the potential for regression to the mean explaining the result.

This result showed that lower (i.e., worse) baseline response inhibition was associated with a larger improvement in the Mega Team treatment group than in the TAU control group in response inhibition after 5 weeks of treatment. No other factors were significant predictors or moderators of change in response inhibition after 5 weeks of treatment (see Table 3.1).

Table 3.1: Multiple Linear Regression Model Results Predicting Response Inhibition and Working Memory in ADHD group

Predictors	Outcomes											
	Δ SSRT 5 Week F = 4.7* R^2 = 0.45		**Δ SSRT 6 Month** F = 6.7* R^2 = 0.55		**Δ 1-back 5 Week** F = 2.9* R^2 = 0.32		**Δ 1-back 6 Month** F = 2 R^2 = 0.25		**Δ 2-back 5 Week** F = 3.2* R^2 = 0.35		**Δ 2-back 6 Month** F = 3.5* R^2 = 0.38	
	β	p	β	p	β	p	β	p	β	p	β	p
Stimulants	0.14	0.5	-0.18	0.4	0.23	0.3	-0.04	0.9	-0.29	0.2	0.18	0.4
Treatment Group	0.15	0.3	-0.15	0.9	-1.0	0.066	-0.12	0.4	-0.93	0.4	-0.25	0.4
SNAP Total	0.16	0.2	0.19	0.11	-0.03	0.8	0.11	0.5	0.03	0.8	0.10	0.5
SCQ Score	0.13	0.2	0.10	0.3	-0.03	0.8	-0.02	>0.9	-0.12	0.3	-0.21	0.071
SSRT	-0.30	**0.022**	-0.65	**<0.001**	-0.12	0.4	-0.17	0.3	-0.17	0.2	-0.20	0.12
Target Accuracy (1-back)	-0.40	**0.001**	-0.38	**0.001**	-0.56	**<0.001**	-0.59	**<0.001**	0.15	0.2	0.05	0.7
Target Accuracy (2-back)	0.06	0.6	-0.02	0.9	0.15	0.3	0.02	0.9	-0.43	**0.003**	-0.55	**<0.001**
BRIEF-2 GEC	-0.11	0.5	-0.12	0.4	0.01	>0.9	-0.23	0.2	-0.08	0.6	-0.10	0.5
Age	0.21	0.066	-0.04	0.7	-0.08	0.5	0.29	**0.034**	0.22	0.063	0.19	0.12
Gender	0.02	>0.9	0.59	**0.011**	0.31	0.2	-0.14	0.6	-0.09	0.7	0.10	0.7
Time on task	-0.15	0.5	-0.05	0.8	0.46	**0.037**	0.02	>0.9	0.17	0.5	0.07	0.7
Stimulants * Treatment Group	-0.16	0.6	0.43	0.11	-0.10	0.7	0.17	0.6	0.45	0.2	-0.04	>0.9
Treatment Group * SNAP Total	0.05	0.8	0.01	>0.9	-0.20	0.4	0.01	>0.9	0.09	0.7	0.25	0.3
Treatment Group * SCQ Score	-0.24	0.14	-0.13	0.4	-0.11	0.5	-0.12	0.5	-0.02	>0.9	0.01	>0.9
Treatment Group * SSRT	-0.43	**0.010**	-0.19	0.2	0.10	0.6	0.09	0.7	0.24	0.2	0.00	>0.9
Treatment Group * Target Accuracy (1-back)	0.22	0.2	0.43	**0.013**	0.10	0.6	0.23	0.3	0.27	0.2	0.61	**0.002**
Treatment Group * Target Accuracy (2-back)	-0.06	0.7	-0.14	0.4	-0.06	0.8	-0.10	0.6	-0.27	0.15	-0.19	0.3
Treatment Group * BRIEF-2 GEC	-0.06	0.8	-0.06	0.8	0.10	0.7	0.26	0.3	-0.15	0.5	-0.13	0.6
Treatment Group * Age	-0.11	0.5	-0.03	0.9	0.33	0.076	-0.19	0.3	0.05	0.8	-0.07	0.7
Treatment Group * Gender	0.04	0.9	-0.53	0.11	-0.54	0.13	0.00	>0.9	-0.03	>0.9	-0.21	0.6

Note: SSRT - Stop Signal Reaction Time. *p-value < 0.0035 (Bonferroni corrected); Bold p-value < 0.05.

3.2 Autism Group

In the autism group....

Chapter 4

Discussion

4.1 Main Findings

This project aimed to explore the impact of...

4.1.1 ADHD Group

In the current study...

4.1.2 Autism Group

Results showed...

4.2 Strengths & Limitations

Strengths of this study include...

4.3 Implications & Future Directions

Future research directions...

References

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders : DSM-5-TR* (5th edition, text revision.). American Psychiatric Association Publishing. https://doi/book/10.1176/appi.books.9780890425787

Ayano, G., Demelash, S., Gizachew, Y., Tsegay, L., & Alati, R. (2023). The global prevalence of attention deficit hyperactivity disorder in children and adolescents: An umbrella review of meta-analyses. *Journal of Affective Disorders*, *339*, 860–866. https://doi.org/10.1016/j.jad.2023.07.071

Bussing, R., Fernandez, M., Harwood, M., Hou, W., Garvan, C. W., Swanson, J. M., & Eyberg, S. M. (2008). Parent and teacher SNAP-IV ratings of attention deficit/hyperactivity disorder symptoms: Psychometric properties and normative ratings from a school district sample. *Assessment*, *15*(3), 317–328. https://doi.org/10.1177/1073191107313888

Cheung, T. C. K., Ram, N., Anagnostou, E., Ameis, S. H., Sananes, R., Bedard, A.-C., & Crosbie, J. (in prep). *Cognitive rehabilitation (Mega Team) and its effects on emotional and behavioural regulation in ADHD and ASD children*.

Faraone, S. V., Banaschewski, T., Coghill, D., Zheng, Y., Biederman, J., Bellgrove, M. A., Newcorn, J. H., Gignac, M., Al Saud, N. M., Manor, I., Rohde, L. A., Yang, L., Cortese, S., Almagor, D., Stein, M. A., Albatti, T. H., Aljoudi, H. F., Alqahtani, M. M. J., Asherson, P., … Wang, Y. (2021). The world federation of ADHD international consensus statement: 208 evidence-based conclusions about the disorder. *Neuroscience & Biobehavioral Reviews*, *128*, 789–818. https://doi.org/10.1016/j.neubiorev.2021.01.022

French, B., Nalbant, G., Wright, H., Sayal, K., Daley, D., Groom, M. J., Cassidy, S., & Hall, C. L. (2024). The impacts associated with having ADHD: An umbrella review. *Frontiers in Psychiatry*, *15*. https://doi.org/10.3389/fpsyt.2024.1343314

Ickowicz, A., Schachar, R. J., Sugarman, R., Chen, S. X., Millette, C., & Cook, L. (2006). The parent interview for child symptoms: A situation-specific clinical research interview for attention-deficit hyperactivity and related disorders. *Canadian Journal of Psychiatry.*, *51*(5), 325–328. https://doi.org/10.1177/070674370605100508

Logan, G. D., Schachar, R. J., & Tannock, R. (1997). Impulsivity and inhibitory control. *Psychological Science*, *8*(1), 60–64. https://doi.org/10.1111/j.1467-9280.1997.tb00545.x

Lord, C., Rutter, M., DiLavore, P., Risi, S., Gotham, K., & Bishop, S. (2012). *Diagnostic observation schedule, second edition (ADOS-2) manual (part I): Modules 1-4*. Western Psychological Services.

Pettersson, E., Lichtenstein, P., Larsson, H., Song, J., Agrawal, A., Børglum, A. D., Bulik, C. M., Daly, M. J., Davis, L. K., Demontis, D., Edenberg, H. J., Grove, J., Gelernter, J., Neale, B. M.,

Pardiñas, A. F., Stahl, E., Walters, J. T. R., Walters, R., Sullivan, P. F., … Polderman, T. J. C. (2019). Genetic influences on eight psychiatric disorders based on family data of 4 408 646 full and half-siblings, and genetic data of 333 748 cases and controls. *Psychological Medicine*, *49*(7), 1166–1173. https://doi.org/10.1017/S0033291718002039

Posar, A., & Visconti, P. (2019). Long-term outcome of autism spectrum disorder. *Turkish Archives of Pediatrics/Türk Pediatri Arşivi*, *54*(4), 207–212. https://doi.org/10.14744/TurkPediatriArs.2019.16768

Swanson, J. M., Nolan, W., & Pelham, W. (1981). *Paper presented at the meeting of the american psychological association*.

Appendix A

Questionnaire

CADDRA
CANADIAN ADHD RESOURCE ALLIANCE

Patient Name:
Date of Birth: MRN/File No:
Physician Name: Date:

SNAP-IV 26 – Teacher and Parent Rating Scale

Name: _____ Gender: _____ Age: _____

Grade: _____ Ethnicity: ☐ African-American ☐ Asian ☐ Caucasian ☐ Hispanic Other: _____

Completed by: _____ Type of Class: _____ Class size: _____

For each item, check the column which best describes this child:	Not At All	Just A Little	Quite A Bit	Very Much
1. Often fails to give close attention to details or makes careless mistakes in schoolwork or tasks				
2. Often has difficulty sustaining attention in tasks or play activities				
3. Often does not seem to listen when spoken to directly				
4. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties				
5. Often has difficulty organizing tasks and activities				
6. Often avoids, dislikes, or reluctantly engages in tasks requiring sustained mental effort				
7. Often loses things necessary for activities (e.g., toys, school assignments, pencils, or books)				
8. Often is distracted by extraneous stimuli				
9. Often is forgetful in daily activities				
10. Often fidgets with hands or feet or squirms in seat				
11. Often leaves seat in classroom or in other situations in which remaining seated is expected				
12. Often runs about or climbs excessively in situations in which it is inappropriate				
13. Often has difficulty playing or engaging in leisure activities quietly				
14. Often is "on the go" or often acts as if "driven by a motor"				
15. Often talks excessively				
16. Often blurts out answers before questions have been completed				
17. Often has difficulty awaiting turn				
18. Often interrupts or intrudes on others (e.g. butts into conversations/ games)				
19. Often loses temper				
20. Often argues with adults				
21. Often actively defies or refuses adult requests or rules				
22. Often deliberately does things that annoy other people				
23. Often blames others for his or her mistakes or misbehavior				
24. Often touchy or easily annoyed by others				
25. Often is angry and resentful				
26. Often is spiteful or vindictive				