

How the design of cognitive training paradigms impact efficacy for paediatric cancer-related cognitive impairment: a systematic review

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Introduction: Cancer and its subsequent treatments have been shown to cause significant cognitive impairment, known as Cancer Related Cognitive Impairment (CRCI). It is thought that children may be particularly susceptible due to their developing brains, with up to 40-60% affected [1]. CRCI impacts a wide range of cognitive domains, including executive function, psychomotor processing speed, attention, and verbal and visual memory [2-4] impacting quality of life and daily living skills.

Aim: Treatment options for this cancer sequelae are limited, with many patients never receiving any medical rehabilitation efforts. This systematic review describes the design and implementation of cognitive training (CT) as a treatment for paediatric CRCI, recently reviewed as the most effective treatment option [5].

Methods and results: From an initial 4417 studies, five were included in the final review, covering over 150 participants that completed CT. Three of these studies tested the CT platform, 'Cogmed' [6-8]. The two other publications tested a cognitive remediation program [9] and 'Captain's log' [10]. All of the included studies showed some improvement on a specific cognitive measure (Figure 1), but the choice of neurocognitive tests was inconsistent, reducing the ability to compare across studies.

The included studies' heterogeneity makes assessment of design difficult. Aspects such as a gamification, format, training conditions and individual performance likely played large roles in their efficacy, but the reporting of these factors was limited. Additionally, dosage and compliance varied greatly between studies, further reducing comparability. The included studies also had great variability in the timepoints that they tested, limiting the evidence for sustained improvement. There were also gaps in the cognitive domains targeted, with several of those known to be impacted in CRCI not included. This systematic review provides a range of recommendations on how to design and test the effectiveness of CT in paediatric CRCI.

	Executive Function / Working Memory			Attention			Memory		
	0 Mo	3 Mo	6 Mo	0 Mo	3 Mo	6 Mo	0 Mo	3 Mo	6 Mo
Butler 2008 [9]	●			●			●		
Hardy 2011* [10]		●							
Hardy 2013 [6]		●		●					
Conklin 2015 [7]	●			●					
Carlson-Green 2017* [8]			●						

*Studies did not include a control group. # Mo = Months since intervention completion

- There were no improvements
- There were improvements in the intervention group, that were not significant when compared to the control group
- There were improvements in the intervention group that were not maintained over time
- There were immediate improvements in the intervention group, when compared to controls
- There were sustained long-term improvements in the intervention group

Figure 1: A summary of the significant results across cognitive domains in the included studies.

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