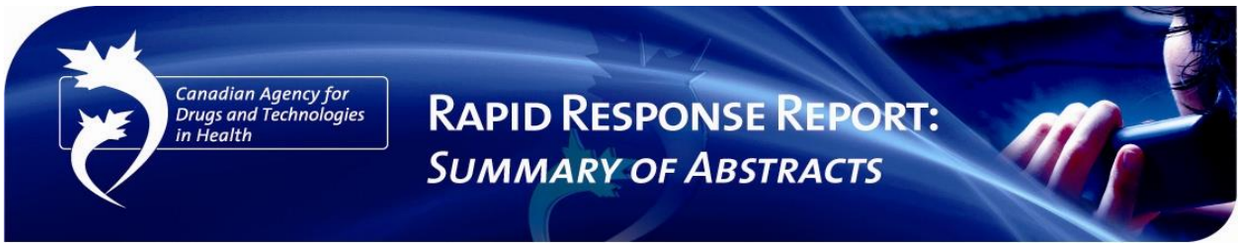

TITLE: Active Video Gaming and Virtual Reality for Children with Cerebral Palsy: Sustained Clinical Effectiveness

DATE: 8 September 2015

RESEARCH QUESTION

What is the long-term clinical effectiveness of active video gaming (AVG) or virtual reality (VR) for children with cerebral palsy (CP)?

KEY FINDINGS

One systematic review, three randomized controlled trials and two non-randomized studies were identified regarding the long-term clinical effectiveness of active video-gaming (AVG) or virtual reality (VR) for children with cerebral palsy (CP).

METHODS

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and August 21, 2015. Internet links were provided, where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

SELECTION CRITERIA

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

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Table 1: Selection Criteria	
Population	Children (aged 0 to 18) with cerebral palsy
Intervention	Active video gaming or virtual reality
Comparator	None
Outcomes	Long-term clinical effectiveness (e.g., sustained improvements beyond the treatment intervention period in motor performance or control, balance, attention, tolerance)
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies

RESULTS

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews (SRs), and meta-analyses are presented first. These are followed by randomized controlled trials (RCTs), and non-randomized studies.

One SR, three RCTs and two non-randomized studies were identified regarding the long-term clinical effectiveness of active video-gaming (AVG) or virtual reality (VR) for children with cerebral palsy (CP). No relevant health technology assessments were identified.

Additional references of potential interest are provided in the appendix.

OVERALL SUMMARY OF FINDINGS

One SR,[1] three RCTs,[2-4] and two non-randomized studies[5,6] were identified regarding the long-term clinical effectiveness of active video-gaming (AVG) or virtual reality (VR) for children with cerebral palsy (CP).

The SR[1] reported results from studies investigating the effect of AVG on health outcomes in patients with various conditions, including CP. The overall consensus was that AVG improved health outcomes, including when it was compared to usual care.[1] Disaggregated results specific to long-term follow-up and CP patients were not presented within the abstract.[1]

The results of individual studies are summarized in Table 2. Overall, the RCTs suggested a long-term benefit for upper limb function with the use of AVG,[2,4] but no improvement in balance with the use of VR.[3] The non-randomized studies[5,6] reported positive long-term physical and functional outcomes with the use of AVG[5] and VR.[6]

Table 2: Summary of Study Results			
Study Author, Publication Year	**Population; Sample Size**	**Intervention; Comparator**	**Outcomes**
Randomized Controlled Trials			
Chiu, 2014[2]	Hemiplegic children with CP; n = 62	Wii Sports Resort + usual therapy; Usual therapy	Improved grip strength and quantity of hand function based on carers' perception at 6 weeks of treatment and 6 weeks post-treatment

			No difference in coordination or hand function at any time point
Ramstrand, 2012[3]	Hemiplegic and diplegic children with CP; n = 18	Nintendo Wii Fit; No intervention	No difference in measures of balance (modified sensory organization test, reactive balance test and rhythmic weight shift test) after 5 weeks of treatment and 5 weeks post-treatment.
Rostami, 2012[4]	Children with spastic hemiparetic CP; n = 32	Modified constraint-induced movement therapy; Virtual reality; Combined treatment; No treatment	Combined treatment group experienced the highest gains in limb use, quality of movement, and speed and dexterity after 4 weeks of treatment, as well as 3 months after the treatment period.
Non-Randomized Studies			
Luna-Oliva, 2013[5]	Children with CP; n = 11	Xbox 360 Kinect™ non-immersive virtual reality videogame technology + conventional physiotherapy; No comparator	Significant differences observed after 8 weeks of treatment, and maintained at follow up (duration unspecified), in scores related to motor and process skills, balance, gait speed, running and jumping, and fine and manual finger dexterity.
Brien, 2011[6]	Adolescents with CP classified at Gross Motor Function Classification System level 1; n = 4	Intensive short-duration virtual reality; No comparator	Significant improvements observed in the Community Balance and Mobility Scale and 6-Minute Walk Test following 5 days of treatment and 1 month post-training.

CP = cerebral palsy

REFERENCES SUMMARIZED

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

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PubMed: PM26192642

Randomized Controlled Trials

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PubMed: PM24849793

3. Ramstrand N, Lygnegard F. Can balance in children with cerebral palsy improve through use of an activity promoting computer game? Technol Health Care. 2012;20(6):501-10.
PubMed: PM23187015

4. Rostami HR, Arastoo AA, Nejad SJ, Mahany MK, Malamiri RA, Goharpey S. Effects of modified constraint-induced movement therapy in virtual environment on upper-limb function in children with spastic hemiparetic cerebral palsy: a randomised controlled trial. NeuroRehabilitation. 2012;31(4):357-65.
PubMed: PM23232158

Non-Randomized Studies

5. Luna-Oliva L, Ortiz-Gutierrez RM, Cano-de la Cuerda R, Piedrola RM, Alguacil-Diego IM, Sanchez-Camarero C, et al. Kinect Xbox 360 as a therapeutic modality for children with cerebral palsy in a school environment: a preliminary study. NeuroRehabilitation. 2013;33(4):513-21.
PubMed: PM24018364

6. Brien M, Sveistrup H. An intensive virtual reality program improves functional balance and mobility of adolescents with cerebral palsy. Pediatr Phys Ther. 2011 Fall;23(3):258-66.
PubMed: PM21829120

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APPENDIX – FURTHER INFORMATION:

Systematic Reviews – Immediate/Short-Term Outcomes or Unclear Timeline of Outcomes

7. Dewar R, Love S, Johnston LM. Exercise interventions improve postural control in children with cerebral palsy: a systematic review. Dev Med Child Neurol. 2015 Jun;57(6):504-20. PubMed: PM25523410

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11. Mitchell L, Ziviani J, Oftedal S, Boyd R. The effect of virtual reality interventions on physical activity in children and adolescents with early brain injuries including cerebral palsy. Dev Med Child Neurol. 2012 Jul;54(7):667-71. PubMed: PM22283557

Review Articles

12. Snider L, Majnemer A, Darsaklis V. Virtual reality as a therapeutic modality for children with cerebral palsy. Dev Neurorehabil. 2010;13(2):120-8. PubMed: PM20222773