The physical impact of electronic game play on children

Leon Straker\textsuperscript{a}, Lynn Jensen\textsuperscript{a}, Jan Piek\textsuperscript{b}, Clare Pollock\textsuperscript{a}, Rebecca Abbott\textsuperscript{b}, Amity Campbell\textsuperscript{b}, Erin Howie\textsuperscript{a}, Danielle Larke\textsuperscript{a}, Amy Bufton\textsuperscript{a}, Leandra Gonsalves\textsuperscript{a}, Anne Smith\textsuperscript{a}

\textsuperscript{a}School of Physiotherapy and Exercise Science, Curtin University, Perth, WA, AUSTRALIA
\textsuperscript{b}School of Psychology and Speech Pathology, Curtin University, Perth, WA, AUSTRALIA

1. Electronic game play is a substantial part of life for many children

The electronic game business is substantial, with industry figures showing: over 2 billion copies of ‘Angry Birds’ software sold; ‘Grand Theft Auto 5’ gross sales in the first 24 hours of release of USD 1 billion; 27 million daily ‘League of Legends’ players and a world championship prize for ‘League of Legends’ of USD 1 million. Electronic games first became commercially available in the 1970s with Pong, and have since been made available on an array of technology including consoles connected to a television screen, computers, hand-held dedicated game devices, and more recently mobile touch screen devices such as tablet computers and smart phones. Electronic games are available in many genres, with games targeting nearly all age groups and interests.

Given the range of devices and games available it is not surprising that the majority of children in affluent communities now frequently play electronic games. Australian data show that 85% of 5-14 year olds play electronic games (Australian Bureau of Statistics 2011) and international studies show the average daily exposure to electronic games is 30-90 minutes (Rideout 2013). USA data suggest the daily exposure to electronic games is increasing. Recent data from Western Australia show 8-14 year old boys play electronic games for ~2 hours per day and girls of the same age play for ~1.5 hours per day (Houghton, Hunter et al. 2015).

Electronic game play contributes to children’s ‘screen time’, which is a recent topic of public health guidelines. For example, in Australia and several other countries the guidelines recommend a maximum of 2 hours of screen time for entertainment purposes for children 5 years old and older, with a 1 hour maximum for children 2-4 years old and no screen time exposure recommended for 0-1 year old children (Department of Health 2014). However the majority of children (¾ of 2-4 year olds and 5+ year olds) in Australia exceed these guidelines (Australian Bureau of Statistics 2013).

Given the widespread, frequent and substantial exposure of children to electronic games, it is important to understand the physical, mental, emotional, social and other consequences. This presentation summarises the results of studies by us and others that assess the physical impacts of: sedentary behaviour/physical activity; movement skills; and musculoskeletal risk.

2. Physical impacts of electronic game play

2.1 Sedentary behaviour/physical activity

In laboratory studies, we (Straker and Abbott 2007) and others have shown that playing electronic games using a game pad, hand held device, keyboard/mouse or steering wheel results in a physiological load very similar to resting and watching television – in heart rate, respiration rate, estimated energy expenditure, trunk and limb muscle activity and movement. Time that children spend playing games with these input devices therefore contributes to a child’s overall sedentary behaviour exposure. Excessive sedentary behaviour is linked with chronic diseases in adulthood such as type 2 diabetes, obesity, heart disease, stroke, breast and colon cancer and osteoporosis, as well as all-cause mortality (Biswas, Oh et al. 2015). As sedentary behaviour habits developed in childhood appear to track into adulthood (Biddle, Pearson et al. 2010), childhood sedentary behaviour appears to be critical to long term health.

In field studies we have shown that school-aged children spend 2/3 of their day being sedentary(Abbott, Straker et al. 2013). However in a randomised controlled trial where daily activity was compared when children had home access to sedentary electronic games and no access to electronic games, we were only able to find a small improvement of 5 minutes less sedentary time in the after school period when electronic games were removed (Straker, Abbott et al. 2013).

In the same RCT we also monitored children in a third condition in which they were provided with active-input electronic games. In earlier laboratory studies we (Straker and Abbott 2007) and others have shown that whole body/ whole limb movement input devices substantially increase physiological load. However in
the home based RCT, replacement of traditional sedentary electronic games with active-input electronic games only resulted in a 6 minute reduction in sedentary time in the after school period.

2.2 Motor skills

Aside from displacing moderate or vigorous physical activity with sedentary time and thus impacting on cardiometabolic health risk, such displacement may also reduce gross motor skill experience and therefore skill level. However sedentary electronic games do require fine motor skills, therefore playing these electronic games may enhance fine motor skill development. Further, the newer active-input electronic games may be able to enhance gross motor skill. This may be particularly useful for children who have withdrawn from usual social sports physical activities, although the transfer of motor skill from virtual to real environments is likely dependent on the fidelity of the virtual task.

To test the impact on motor skills in a laboratory study, we compared the movement patterns of children playing table tennis on three active-input electronic game devices (Bufton, Campbell et al. 2014). Hand movement was substantially greater performing both forehand and backhand strokes in all three virtual game systems. The device without a hand held controller had the most different hand movement, suggesting holding a ‘bat’ analogue may be important for fidelity.

We also evaluated the impact of 4 months of active-input electronic game play compared with 4 months of traditional sedentary electronic game play in children with Developmental Coordination Disorder (Straker, Campbell et al. 2011). Clinical assessment of balance and object control skills did not show a beneficial effect from the active-input game exposure, although children did perceive that their skills were enhanced.

2.2 Musculoskeletal system risk

Laboratory studies by us and others have shown that children’s postures and movements, and thus musculoskeletal system risk, are influenced by the technology being used. Desktop computer use was characterised by more upright and symmetrical postures, but also more monotonous postures, compared with pen and paper play (Ciccarelli, Straker et al. 2011) (Straker, Maslen et al. 2009). Laptop computer use was characterised by more flexed trunk, neck and head postures (Briggs, Straker et al. 2004). Active-input games were characterised by large body movements, though some children using some devices also displayed repetitive movements. These have also been observed in young children playing on tablet computers (Straker, Coleman et al. 2008).

3. Conclusion

Electronic game play is common amongst children and is likely to have physical consequences for their health and development. Guidelines for wise use of electronic games by children have been developed (Straker, Abbott et al. 2014) and should be further promoted to enable children to have the enjoyment of playing electronic games with minimum risk.

Acknowledgements

We thank the study participants and their parents, the research staff and students and the National Health and Medical Research Council of Australia for funding (projects 229011, 533526 and fellowships 425513, 1019980).

References


