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| **Comments**   * Currently, there is limited evidence to indicate that video gaming (using the Nintendo Wii, Sony PlayStation and Xbox Kinect platforms) is effective for the rehabilitation of post-stroke patients. * However, video gaming can be a useful adjunct to conventional therapy: patients report high enjoyment of the games and exhibit higher compliance with the intervention program, potentially leading to better results compared to conventional therapy alone. * All the studies reviewed have small sample sizes, and care must be taken when generalizing the results to a wider post-stroke population. |

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| **Evidence Table** | | | | |
| **Article** | **Study Design & Number of Participants** | **Methods** | **Results** | **Comments** |
| 1. Bower K. J., Clark R., McGinley J., et al. **Clinical feasibility of the Nintendo Wii for balance training post-stroke: a phase II randomized controlled trial in an inpatient setting**. *Clin Rehabil*. 2014 | * Single-blind RCT * 30 adults, mean age 63.6 * Less than 3 months post-stroke | * The “Balance Group” (n=17) using Wii Fit * The “Upper Limb Group” (n=13) using Wii Sports * Sessions were 45 mins, 3x/week over 2-4 weeks | * The “Balance Group” showed significant improvements in balance * The “Upper Limb Group” exhibited non-significant changes in arm function | * The lack of a true control group makes it hard to determine the effectiveness of the interventions * The sample size is small * The authors reported the participants had high compliance with Wii gaming interventions |
| 2. Chen M-H., Huang L-L., Lee C-F., et al. **A controlled pilot trial of two commercial video games for rehabilitation of arm function after stroke**. *Clin Rehabil*. 2014 | * 24 adults, 3-24 months post-stroke * Sequential allocation to 3 groups | * Conventional group * Wii group * XaviX group [a computer game] * 30 mins/session, 3x/week over 8 weeks | * The Wii and XaviX groups showed significant improvements in ROM and the Fugl-Meyer Assessment (FMA), between pre- and post-intervention testing * Between-groups differences were not significant | * Small sample size * Insufficient evidence to conclude that computer gaming is better than conventional therapy * Authors reported high enjoyment of computer games |
| 3. Fritz S., Peters D., Merlo A., Donley, J. **Active video-gaming effects on balance and mobility in individuals with chronic stroke: a randomized controlled trial**. *Top Stroke Rehabil*. 2013;20(3):218-225. doi:10.1310/tsr2003-218 | * Single-blind RCT * 28 adults, older than 55, less than 3 years post-stroke | * The intervention group (n= 15) played Wii or PlayStation games for 50-60 mins/day, 4 days/week, for 4 weeks * The control group (n= 13) did not participate in any computer gaming | * No significant difference in results between the intervention group and the control group * Small improvements in balance noted within the intervention group | * Small sample size * Insufficient evidence to conclude that computer gaming is effective |

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| 4. Joo L., Yin T., Xu D., et al. **A feasibility study using interactive commercial off-the-shelf computer gaming in upper limb rehabilitation in patients after stroke**. *J Rehabil Med*. 2010;42(5):437-441. doi:10.2340/16501977-0528 | * Case series * 16 adults, mean age 64.5, less than 3 months post-stroke | * Participants had 6 sessions of upper-limb exercise with a Wii, over 2 weeks * Wii activities were held in addition to conventional therapy | * Small but statistically significant improvements in FMA and Motricity Index scores | * The lack of a control group makes it impossible to determine if the improvements seen are due to the Wii exercises or to conventional therapy |
| 5. Lee, G. **Effects of training using video games on the muscle strength, muscle tone, and activities of daily living of chronic stroke patients**. *J Phys Ther Sci.* 2013;25(5):595-597 | * Single-blind RCT * 14 adults, older than 60, less than 1-year post-stroke | * The intervention group (n= 7) had activities with the Kinect (1 hr/session, 3 sessions/week, for 6 weeks) * The control group (n= 7) had conventional therapy (30 mins/session, 3 sessions/week, for 6 weeks) | * The intervention group had significant differences in upper-limb muscle strength and Functional Independence Measure (FIM), compared to the control group | * This RCT is well-designed, with a true control group * However, the sample size is small |
| 6. Morone G., Tramontano M., Iosa M., et al. **The efficacy of balance training with video game-based therapy in subacute stroke patients: A randomized controlled trial**. *Biomed Res Int.* 2014;2014:1-6. doi:10.1155/2014/580861 | * Single-blind RCT * 50 subjects, less than 3-months post-stroke | * The intervention group had Wii activities, 20 mins/session, 3 sessions/week, for 4 weeks, in addition to conventional therapy * The control group had conventional therapy, and 20 mins of additional balance therapy per session, 3 sessions/week, for 4 weeks | * The intervention group showed significant improvement in balance (as measured by the Berg Balance Scale) | * Gaming activities with the Wii are beneficial when used as an adjunct to conventional therapy for improving balance in post-stroke patients |
| 7. Mouawad M., Doust C, Max M., McNulty P. **Wii-based movement therapy to promote improved upper extremity function post-stroke: A pilot study**. *J Rehabil Med.* 2011;43(6):527-533. doi:10.2340/16501977-0816 | * Single-blind RCT * 7 adults, older than 41 * Less than 38 months post-stroke * 5 healthy controls, older than 41 | * All participants had Wii activities for 1 hr/day over 10 consecutive days | * The post-stroke subjects exhibited significant improvements with the Wolf Motor Function Test (WMFT) and the FMA * The post-stroke subjects also showed significant improvements in passive and active range of motion in their upper limb * The healthy control subjects did not achieve significant changes | * Although the results of this study are promising, the very small sample size (n= 12) limits its generalization to a wider stroke population |
| 8. Pietrzak E., Cotea C., Pullman S. **Using commercial video games for upper limb stroke rehabilitation: is this the way of the future?** *Top Stroke Rehabil*. 2014;21(2):152-162. doi:10.1310/tsr2102-152. | * Systematic review * Thirteen studies identified: 6 full articles (3 RCTs) and 7 abstracts | * Gaming activities were generally held in sessions lasting 30 to 60 mins * Most participants had 8-12 sessions, spread out over 2-3 weeks |  | * Limited evidence that video gaming improves upper-limb functionality in stroke patients * However, it can be a useful adjunct to conventional therapy |

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| 9. Rand D., Givon N., Weingarden H., et al. **Eliciting Upper Extremity Purposeful Movements Using Video Games: A Comparison With Traditional Therapy for Stroke Rehabilitation**. *Neurorehabil Neural Repair*. 2014:1545968314521008 - . doi:10.1177/1545968314521008 | * Single-blind RCT * 29 adults (mean age 59) * Less than 7 years post-stroke | * Intervention group (n= 15) played Kinect or PlayStation games for 50-60 mins/session * Control group (n= 14) had conventional therapy with balls, blocks and cones | * FMA scores between the two groups did not differ significantly at the end of the study * The intervention group has five times the number of “purposeful” movements in upper extremities, compared to the control group | * A major flaw of this article is that it did not specify the frequency of the therapy sessions (for either group), over the 3-month study |
| 10. Saposnik G., Teasell R., Mamdani M., et al. **Effectiveness of virtual reality using Wii gaming technology in stroke rehabilitation: A pilot randomized clinical trial and proof of principle**. *Stroke*. 2010;41(7):1477-1484. doi:10.1161/STROKEAHA.110.584979 | * Single-blind RCT * 22 adults (mean age 61.3) * Less than 2 months post-stroke | * Intervention group (n= 11) had 8 sessions of Wii activities (60 mins/session) over 14 weeks * Control group (n= 11) had 8 sessions of recreational therapy (60 mins/session) over 14 weeks | * At the end of the study, the intervention group showed significant improvements as measured by the WMFT, compared to the control group | * Good evidence suggesting that video gaming can help improve function in post-stroke patients * However the sample size is small |
| 11. Saposnik G, Levin M. **Virtual reality in stroke rehabilitation: A meta-analysis and implications for clinicians**. *Stroke*. 2011;42(5):1380-1386. doi:10.1161/STROKEAHA.110.605451 | * Systematic review of studies between 1996 - 2010 * Twelve studies identified (5 RCTs, 7 observational studies) * 195 total participants | * Gaming sessions were generally between 50-60 mins * Sessions were held every day, or every other day * The studies varied between 2 and 5 weeks in length |  | * 11 of 12 studies showed a significant improvement in outcomes, for the intervention group |
| 12. Sin H., Lee G. **Additional Virtual Reality Training Using Xbox Kinect in Stroke Survivors with Hemiplegia**. *Am J Phys Med Rehabil*. 2013;92:871-880. doi:10.1097/PHM.0b013e3182a38e40 | * Single-blind RCT * 40 adults, older than 60 * Less than 9 months post-stroke | * The intervention group (n= 20) received 30 mins of training, then played Kinect games in 30-min sessions, 3 sessions/week, for 6 weeks * The control group received conventional therapy in 30-min sessions, 3 sessions/week, for 6 weeks | * At the end of the study, FMA and Box and Block Test scores improved for both groups, compared to the baseline values * The intervention group showed significant functional improvement in their upper extremity, compared to the control group | * Although the intervention group improved more than the control group, it also totaled more intervention time (due to the training before each gaming session) * It is hard to determine if the improvements seen are due to the Kinect gaming, or to the additional intervention time |
| 13. Thomson, K., Pollock, A., Bugge, C. et al. **Commercial gaming devices for stroke upper limb rehabilitation: A systematic review**. *International Journal of Stroke*. Vol 9, June 2014, 479–488 | * Systematic review of studies performed between 2007 and 20013 * Nineteen studies retained (3 RCTs, 1 case control, 9 cohort studies, 5 case reports, 1 qualitative study) * Total of 215 participants | * Computer gaming sessions differed widely between the studies, ranging from 10 minutes to 2 hours of play/session | * Twelve of the studies found statistically significant benefits in the intervention groups, compared to the control groups | * The focus of the studies was on upper-limb rehabilitation rather than on impact on ADLs |