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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
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| 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
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| 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
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| 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
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| 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
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| 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
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| 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
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| 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
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| 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
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| 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
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| 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
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