

The Effectiveness of Virtual Reality as an Intervention to Decrease Chronic Low Back Pain in Adults as Compared to Standard Therapeutic Intervention: A Systematic Review

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PREVALENCE OF CHRONIC LOW BACK PAIN (LBP)

- According to the American Physical Therapy Association's "Move Forward" Low Back Pain Survey (2012)¹
 - More than **one-third** of Americans reported LBP impacts ability to perform daily tasks, exercise, and sleep
 - Nearly **3 in 4** Americans (72%) reported using pain medications to relieve symptoms
- National Institute of Neurological Disorders and Stroke (2014)²
 - **80%** of Americans experience LBP
 - Most common cause of **job-related disability**

PREVALENCE OF CHRONIC LOW BACK PAIN (LBP)

- Centers for Disease Control, Summary Health Statistics (2015)³
 - LBP ranked higher than neck pain, face/jaw pain, and pain related to severe headaches and migraines for adults in the U.S. aged 18 and older
 - **Greater than one-third** of Americans aged 45-75 and older experience LBP
- A qualitative study by Palazzo, Klinger, and Dorner et al examined barriers to exercise program adherence for patients experiencing chronic LBP (2016)⁴
 - Common reasons reported for failed adherence: repetitive exercise program, lack of feedback, **fear avoidance behaviors**, lack of support, **lack of motivation**
 - Solutions offered by patients: social networks, videos for guidance in good form , **virtual reality programs** that provide feedback, progressive challenge

NON-IMMERSIVE VIRTUAL REALITY

Immersive Virtual Reality⁵

- Non-invasive computer simulation
- User interacts with a three dimensional computer generated environment
- **User wears a head mounted display**
- User interacts via accessory devices such as keyboards, mice, or controllers, or with bodily motions
- Considered to be the **highest interactive implementation** of virtual reality

Non-Immersive Virtual Reality⁵

- Non-invasive computer simulation
- User interacts with a two dimensional computer generated environment
- **Display is usually a computer monitor or a TV screen**
- User interacts via accessory devices such as keyboards, mice, or controllers, or with bodily motions
- **Less costly** to implement than immersive virtual reality

PURPOSE

- To determine the effectiveness of virtual reality (VR) as an intervention to decrease chronic low back pain (LBP) in adults as compared to conventional physical therapy (PT) intervention.

METHODS

- **Search Terms:**

- (virtual reality OR VR OR virtual reality gaming OR gaming) AND (back pain OR chronic back pain OR low back pain OR LBP)

- **Search Limits:**

- English language
- Human subjects

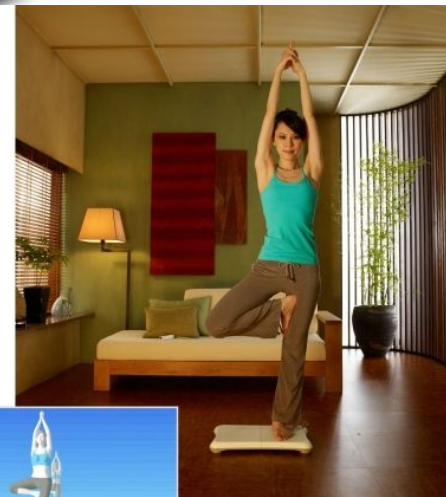
- **Databases:**

- MEDLINE/Pubmed, Proquest, CINAHL, Cochrane Library, ScienceDirect

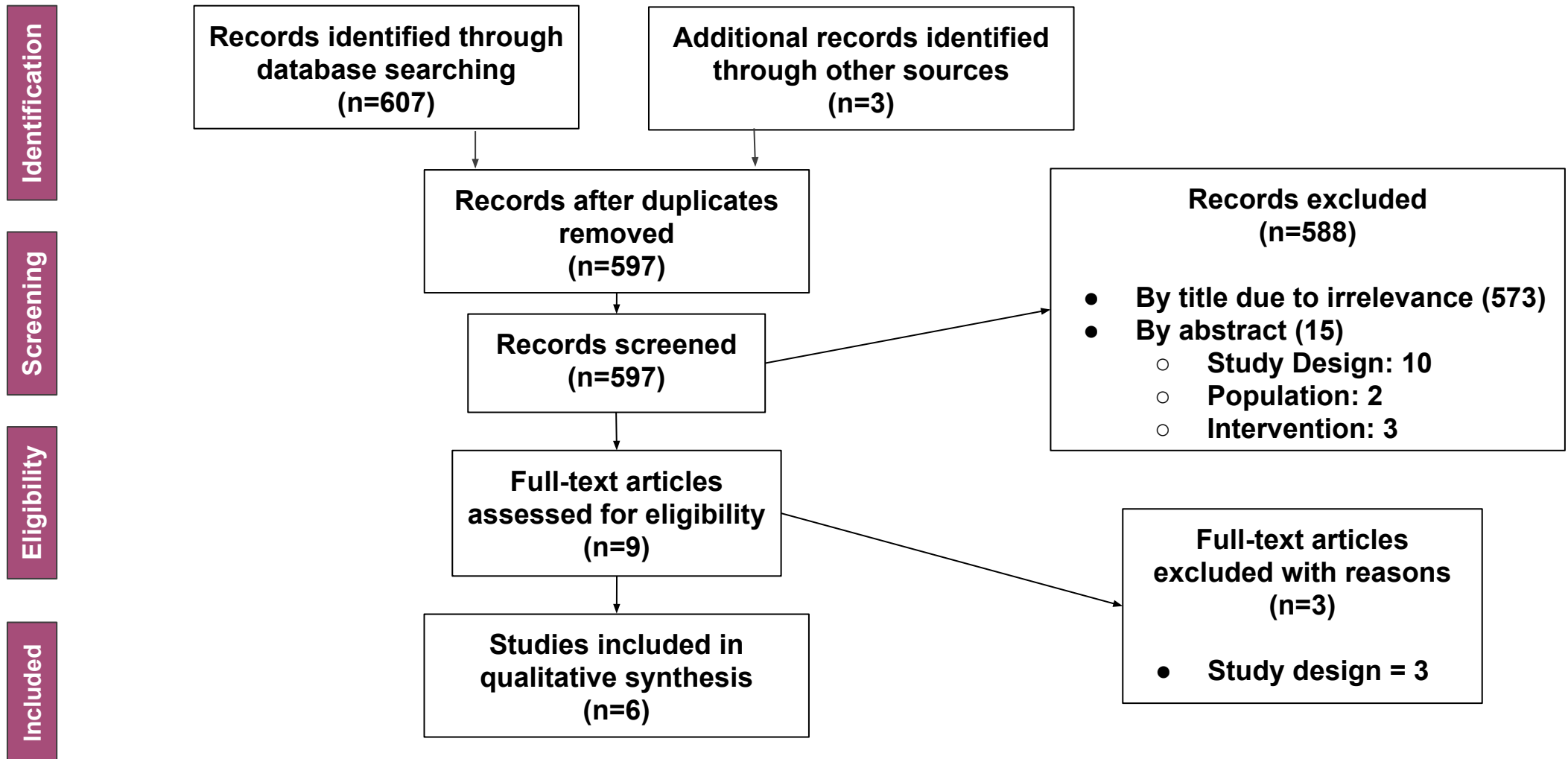
SELECTION CRITERIA

- **Selection Criteria:**
 - Diagnosis of chronic low back pain (> 2 months)
 - Adults 18 years and older
 - Randomized controlled trials (RCT)
 - Interventions including VR
 - Assessment using a valid and reliable pain scale

EXAMPLE VIRTUAL REALITY SYSTEMS



PRISMA



PEDro SCORING

Study	1	2	3	4	5	6	7	8	9	10	11	Total
<i>Yelvar et.al</i>	Y	Y	N	Y	N	N	Y	Y	Y	Y	Y	7
<i>Thomas et. Al</i>	Y	Y	Y	Y	N	N	N	Y	Y	Y	Y	7
<i>Kim et. al</i>	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	6
<i>Park et. al</i>	Y	Y	Y	Y	N	N	N	Y	Y	N	N	5
<i>Monteiro-Junior et.al</i>	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	10
<i>Zavarize et.al</i>	N	Y	N	Y	N	N	N	Y	Y	N	Y	5

Average: 6.7

Range: 5-10 (Moderate to Good Evidence)

RESULTS

- Samples ranged from 21-52 subjects (207 total)
- Average age of subjects ranged from 24-68 years old
- Five of 6 studies reported baseline average LBP ranging from 6-7 on a visual analog scale
- VR intervention ranged from 15-30 minutes (avg. = 23.3)
 - Frequency ranged from 3-5 sessions/week (avg. = 3.5)
 - Duration ranged from 2-8 weeks (avg. = 5.5)

RESULTS

- Of the 6 studies selected:
 - All used non-immersive VR
 - All reported significant within group differences in pain reduction for VR groups
 - All were compared to control groups receiving traditional therapeutic exercises
 - Interventions included VR as the sole treatment or in conjunction with therapeutic exercises
- Four of 6 studies compared between group differences:
 - Two found statistically significant reductions in pain favoring VR intervention groups
 - Wii Fit Yoga
 - VR Walking program (viewed on screen, with video glasses)

RESULTS

- Other clinically significant benefits reported in the studies:
 - Improved functional outcomes^{6,7,9} (Sit to Stand, TUG, 6MWT, ODI)
 - Decrease in fear avoidance behavior^{7,9} (Tampa Kinesiophobia Scale, FABQ)
 - Improved well-being¹⁰ (RAND-36 Mental Health Composite)

LIMITATIONS

- Variable treatment parameters
 - Frequency (3-5 sessions), time per session (15-30 min), treatment duration (2-8 wks)
- Variable VR interventions
 - Commercial systems: Wii Fit (recreational games, yoga, task-specific training)
 - VR passive walking program, tablet games
 - VR dodgeball (system developed through research)
- Lack of between group comparisons in two studies
- Lack of follow-up to determine long term effects of interventions
- Limited databases used

CONCLUSIONS

- Moderate to strong evidence suggesting that non-immersive VR is a promising intervention to consider as part of a therapeutic exercise program for patients with chronic LBP, but research is limited to suggest it is superior to therapeutic exercise programs alone.
- Further research is needed to determine which specific non-immersive VR programs and treatment parameters are most effective for quality evidence-based practice.

CLINICAL RELEVANCE

- VR is a novel opportunity for **task-specific training** in a stimulated, safe environment
- Emerging evidence showing that VR:
 - Increases functional outcomes attained in therapy^{6,7,9}
 - Improves emotional well-being¹⁰
 - Helps to break the cycle of fear avoidance behaviors^{7,9}

CLINICAL RELEVANCE

- Recommended VR session parameters for pain reduction:
 - 20-25 minutes per session
 - 3-5 times a week for 4-6 weeks
- Clinicians should consider VR as an adjunct to conventional PT to improve delivery of patient care

FUTURE RESEARCH

- Future studies should:
 - Examine pain reduction in VR only groups as compared to conventional PT groups
 - Examine effectiveness of VR programs in maintaining improved pain outcomes over time through follow-up assessments
 - Determine impact of VR interventions in improving patient adherence to plan of care for chronic LBP
 - Establish more consistent treatment parameters for non-immersive VR programs to improve application to practice
 - Compare efficacy of non-immersive and immersive VR programs in treatment of chronic LBP

CURRENT RESEARCH ON VR AND LBP

- *Video-game based exercises for older people with chronic low back pain: a protocol for a feasibility randomised controlled trial (the GAMEBACK trial)¹² (2017)*
- *Attitudes toward a virtual reality physical activity intervention among veterans with chronic low back pain¹³ (2017)*
 - Supplement– Journal of Pain prints abstracts of presentations where data is yet to be published

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QUESTIONS?