

How effective is Virtual Reality as a tool for cognitive and motor rehabilitation in patients with traumatic brain injuries?

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Introduction

This document outlines the search and screening procedure undertaken to obtain relevant studies which assess the effectiveness of Virtual Reality (VR) as a tool for cognitive and motor rehabilitation in patients affected by traumatic brain injury (TBI). Expanding on the screening guidelines laid out in the review protocol, this document presents the specific search strategies, search queries, and inclusion criteria used to determine pertinent studies. Adjustments were made to the inclusion criteria established in the review protocol to ensure high-accuracy results that address the objectives of the review. Filters for publication years were adjusted from 2010 - 2024, to 2016 - 2024, to better reflect when commercial VR technology began to be used in clinical settings [1]. A variety of search queries were used to refine the search results down based on the type of neurological condition the patient has, and the type of VR equipment used.

The screening process follows the predefined inclusion criteria, while emphasizing studies that explore the impact of VR on TBI conditions, and excluding studies that cover neurodegenerative conditions or unrelated technology. The screening process is then visualized through a PRISMA diagram, which displays the number of the studies excluded at each stage of the screening process and the reasoning behind their exclusion. This document provides a thorough insight into the reasoning behind the inclusion and exclusion criteria for this search and screening process, and the resulting studies selected.

Search Queries

Table 1: Search Queries

Database	Query	Number of Results	Filters
Google Scholar	("traumatic brain injury" OR "TBI") AND ("virtual reality" OR "VR") AND ("rehabilitation" OR "improved cognition" OR "cognitive rehabilitation" OR "motor rehabilitation" OR "motor skills") AND ("Oculus" OR "Meta" OR "Apple Vision" OR "PlayStation" OR "headset" OR "glasses" OR "Samsung" OR "Microsoft")	99	Year (2016-present), Language (English), Doctype (Review Articles)

Inclusion Criteria

Study design/type

Research extending the understanding of virtual reality, brain injuries or the correlation of the two will be included. Case studies and experiment trials including but not limited to randomized trials, cohort studies, clinical trials and case-control studies will be included.

Study condition/domain

Studies conducted on the rehabilitation of brain functions of individuals suffering from traumatic brain injury to single or multiple regions of the brain will be included. To ensure data consistency, individuals with neurodegenerative conditions were excluded, as they require a different rehabilitation process compared to TBI. Any research prior to 2016 will be excluded, since 2016 was the first big breakthrough year for VR devices with the commercial release of the Oculus Rift and its competitors - realistically more effective and accessible since there are more relevant studies. The primary focus is the rehabilitation of brain function through the use of virtual reality. Studies unrelated to virtual reality will be excluded. VR devices used are scoped to headset-like models from 2016 and onwards.

List of VR devices to be examined :

- Oculus series
- Meta Quest series
- Apple Vision Pro
- PlayStation VR series
- Samsung Gear VR
- Microsoft HoloLens
- Other VR glasses/headsets

Setting

Any setting where rehabilitation activities are conducted will be included (rehabilitation centers, hospitals, physiotherapy clinic, etc.)

Time frame

A date range for currency of research will be set from 2016 to 2024, as this outlines the point when virtual reality became a more prevalent tool in industries like healthcare.

Participants/population being studied

The population under study are individuals with damaged regions of the brain. The focus is the rehabilitation of brain functioning following such injuries through the use of VR.

Outcomes

The primary outcome of the study is to screen for studies that mainly cover the usage of VR in rehabilitation of TBI. Reports to be fully reviewed should focus on TBI rather than neurodegenerative diseases. It should not present multiple modern technologies used, but rather focus on VR only. Finally, relevant studies should be validated for the currency of findings to ensure findings have not since been disproven.

PRISMA Diagram

Following is a PRISMA diagram to illustrate the screening-search process, with specific inclusion criteria excluded papers failed to meet.

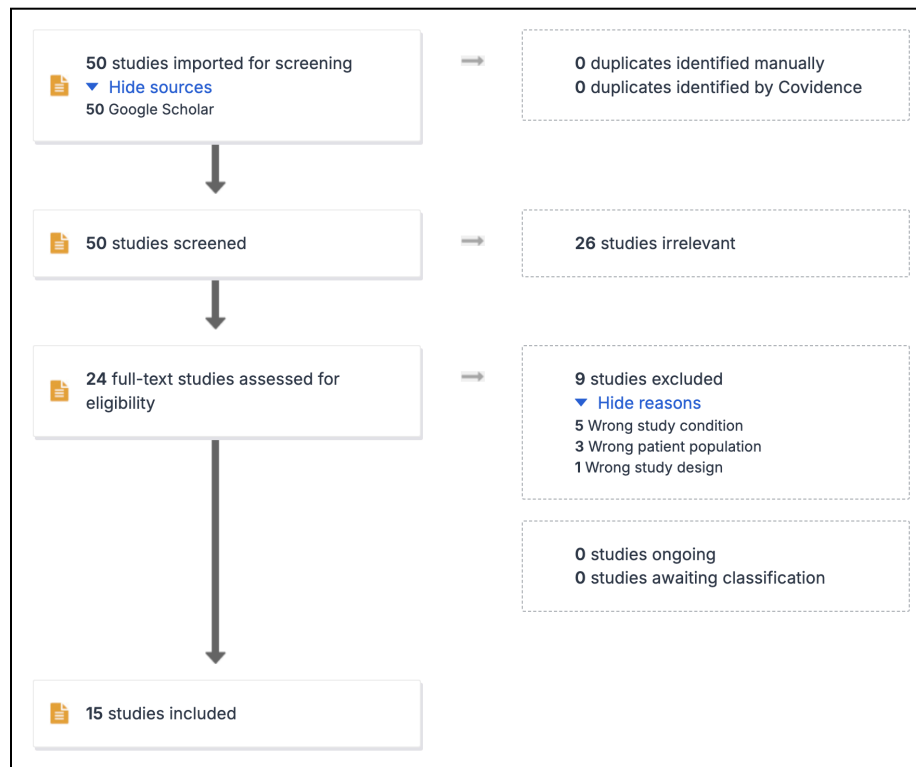


Figure 1: PRISMA Flow Diagram.

List of Included Papers

The following table outlines the final list of papers that made it to the end of the screening process:

Title	Author(s)	Year	URL
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Cognitive rehabilitation post traumatic brain injury: A systematic review for emerging use of virtual reality technology	Alashram, Anas R; Annino, Giuseppe; Padua, Elvira; Romagnoli, Cristian; Mercuri, Nicola Biagio	2019	https://d1wqtxts1xzle7.cloudfront.net/94102383/j.jocn.2019.04.02620221112-1-1gknw42-libre.pdf?1668246433=&response-content-disposition=inline%3B+filename%3DCognitive_rehabilitation_post_traumatic.pdf&Expires=1731889331&Signature=IJ1LGULYRgjV7qMOnnSaG1IM-E~SUiK1kTJ3OZ5bp3a-5XmoEn~FkTo0QCr69dZKVkmuKPWb5LXhANvQ-BFSdA2ENQ~TzNmtUxmDCVVuWcb3Fu8ZYOmsxwiM1cFJ1bi1LHVKBwQKhGLcmydh8l6yRb1nPj9jrtpoysOuwsUOoRpKH5z9O0xZmO99RfgjG~MyGxcq2qkE5zYQ6YxKpT6U9xh2EJFoFEALSfzZ87YHw6~a4MBhpntYnzHRikwsDg3ddoazw05rc2ubt-clDcCqarn7mLQjxwy4nuFZbzoNaQwvzUgnEA1NZMJ2R1SqK0M4c0G6tpgHmsaUNkbzV47Ltw_&Key-Pair-Id=APKAJL_OHF5GGSLRBV4ZA
Effects of physical therapy interventions on balance ability in people with traumatic brain injury: A systematic review	Alashram, Anas R; Annino, Giuseppe; Raju, Manikandan; Padua, Elvira	2020	https://content.iospress.com/download/neurorehabilitation/nre203047?id=neurorehabilitation%2Fnre203047
Vision-based serious games and virtual reality systems for motor rehabilitation: A review geared toward a research methodology	Ayed, Ines; Ghazel, Adel; Jaume-i-Capo, Antoni; Moya-Alcover, Gabriel; Varona, Javier; Martínez-Bueso, Pau	2019	https://d1wqtxts1xzle7.cloudfront.net/63427589/Vision-based-serious_games.DEF.201920200526-6595-146nu12-libre.pdf?1590481977=&response-content-disposition=inline%3B+filename%3DVision_based_serious_games_DEF.pdf&Expires=1731890855&Signature=dgqYWvAlZW3RE5OCRjyAOISk8rpqd8MaMsmj9vcptbYFaWfbu5Rn7arwdvWrc0H~wWkrNbFkozSybZe0aNkilA5i9AaO1~xteftX2O-JGCxgXa1U3BDIWZka4nNM-t~bglqjQMjQiAGasXgUj4SmMKojE32fWvPXKXQABD647nyr8IJFgK~h14qosWqlPIHdfV6ISUwItARRsfGKpZBBBqKvZGtMhZSpBb4CwyHOLZSUyYvYWRPmWhinkttA9iiMK6thG7mt~1bBMLJEVkoWprvbsxadnTntAFBWLbWQ

			fHEKuarO8Wl4hpFAC5li2vRxi7GoG TplaEeBxwL3EmpYibA &Key-Pair- Id=APKAJLOHF5GGSLRBV4ZA
Available virtual reality-based tools for executive functions: a systematic review	Borgnis, Francesca; Baglio, Francesca; Pedrolì, Elisa; Rossetto, Federica; Uccellatore, Lidia; Oliveira, Jorge Alexandre Gaspar; Riva, Giuseppe; Cipresso, Pietro	2022	https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2022.833136/full
Design and assessment of amblyopia, strabismus, and myopia treatment and vision training using virtual reality	Chan, Hoi Sze; Tang, Yuk Ming; Do, Chi Wai; Ho Yin Wong, Horace; Chan, Lily YL; To, Suet	2023	https://journals.sagepub.com/doi/pdf/10.1177/20552076231176638
Efficacy of virtual reality rehabilitation after spinal cord injury: a systematic review	De Araújo, Amanda Vitória Lacerda; Neiva, Jaqueline Freitas de Oliveira; Monteiro, Carlos Bandeira de Mello; Magalhães, Fernando Henrique	2019	https://onlinelibrary.wiley.com/doi/pdf/10.1155/2019/7106951
From movement to thought and back: A review on the role of cognitive factors influencing technological neurorehabilitation	De Bartolo, Daniela; Spitoni, Grazia Fernanda; Iosa, Marco; Morone, Giovanni; Ciancarelli, Irene; Paolucci, Stefano; Antonucci, Gabriella	2019	https://www.researchgate.net/profile/Daniela-De-Bartolo/publication/341680634_From_movement_to_thought_and_back_A_review_on_the_role_of_cognitive_factors_influencing_technological_neurorehabilitation/links/5ecea173458515294515e48e/From-movement-to-thought-and-back-A-review-on-the-role-of-cognitive-factors-influencing-technological-neurorehabilitation.pdf
Leveraging Technology for Vestibular Assessment and Rehabilitation in the Operational	Hoppes, Carrie W; Lambert, Karen H; Whitney, Susan L; Erbele, Isaac D; Esquivel, Carlos R; Yuan, Tony T	2024	https://www.mdpi.com/2306-5354/11/2/117

Environment: A Scoping Review			
Exploring the potential of immersive virtual reality in the treatment of unilateral spatial neglect due to stroke: a comprehensive systematic review	Martino Cinnera, Alex; Bisirri, Alessio; Chiocchia, Ilaria; Leone, Enza; Ciancarelli, Irene; Iosa, Marco; Morone, Giovanni; Verna, Valeria	2022	https://www.mdpi.com/2076-3425/12/11/1589
Augmentation and Rehabilitation with Active Orthotic Devices	Onose, Gelu; Morcov, Maria Veronica; Sporea, Corina; Mirea, Andrada; Ciobanu, Vlad	2021	https://d1wqtxts1xzle7.cloudfront.net/96219156/978-3-030-54564-2_24-libre.pdf?1671736584=&response-content-disposition=inline%3B+filename%3DAugmentation and Rehabilitation with Act.pdf&Expires=1731890926&Signature=dF7TEcfQ8x~OCotl1SiWlaI5UiP9~wp7PJZjrkYkvphVIGqbTwZChLI89dkR3BC58qzljnGZBhN3PoihUiP954R~3kDg~zYYD52NW-tT4geNRggLji2JoTpcovPreUavcjp uMUKiG-gtLAHsalGWxHERJ7pWkiQBDARrU2Vk5I05RW2csctZnmCW F0kJ1Eg5diTPIS85jBaxvNnU4OCTbjlx3xBrRkKhsCURkfmrVHum7GZcn3m-OiF6onIojmKfsj-jBWdLgffzXqUoXNG~d5cxeYnUAU9gDzTc68ABk5eFnrc4Y1tvStldDAhPOFjJtdUgwTTr93TaWmpQXnnYQ_&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA
What is the future for immersive virtual reality in memory rehabilitation? A systematic review	Plechata, Adela; Nekovářová, Tereza; Fajnerová, Iveta	2021	https://vrместо.cz/wp-content/uploads/2022/01/NRE201534.pdf
IoT-driven augmented reality and virtual reality systems in neurological sciences	Sahu, Mehar; Gupta, Rohan; Ambasta, Rashmi K; Kumar, Pravir	2024	https://www.sciencedirect.com/science/article/pii/S2542660524000404

A retrospective analysis and systematic review of the areas of entertainment computing and persuasive technologies for health	Silva, Paula Alexandra; Bermúdez i Badia, Sergi; Cameirão, Mónica S	2023	https://www.frontiersin.org/journals/computer-science/articles/10.3389/fc-omp.2023.1124183/full
Trends on the application of serious games to neuropsychological evaluation: A scoping review	Valladares-Rodríguez, Sonia; Pérez-Rodríguez, Roberto; Anido-Rifón, Luis; Fernández-Iglesias, Manuel	2016	https://www.sciencedirect.com/science/article/pii/S1532046416301563
Leveraging Emerging Technologies to Expand Accessibility and Improve Precision in Rehabilitation and Exercise for People with Disabilities	Willingham, T Bradley; Stowell, Julie; Collier, George; Backus, Deborah	2024	https://www.mdpi.com/1660-4601/21/1/79

Excluded Papers

The following table provides the papers excluded during title + abstract screening:

Title	Author(s)	Year	URL	Reason
Systematic review of motion capture in virtual reality: Enhancing the precision of sports training	Li, Xiaohui; Fan, Dongfang; Feng, Junjie; Lei, Yu; Cheng, Chao; Li, Xiangnan	2024	https://content.iospress.com/articles/journal-of-ambient	The paper focuses on using VR in sports training and does not mention cognitive/motor rehabilitation in TBI patients.

			-intelligence-and-smart-environments/ais230198	
Delivery of Allied Health Interventions Using Telehealth Modalities: A Rapid Systematic Review of Randomized Controlled Trials	Raymond, Melissa J; Christie, Lauren J; Kramer, Sharon; Malaguti, Carla; Mok, Zaneta; Gardner, Betina; Giummarra, Melita J; Alves-Stein, Serena; Hudson, Claire; Featherston, Jill	2024	https://www.mdpi.com/2227-9032/12/12/1217	The paper does not focus on VR.
Vision Evaluation Tools for Adults With Acquired Brain Injury: A Scoping Review	Dubé, Camille; Jin, Yu; Powers, Brienne G; Li, Ginny; Labelle, Amélie; Rivers, Meghan S; Gumboc, Ivy M; Bussi�eres, Andr�e E	2021	https://journals.sagepub.com/doi/full/10.1177/00084174211042955	The paper does not have any content related to VR.
Applications of functional magnetic resonance imaging to the study of functional connectivity and activation in neurological disease: a scoping review of the literature	Leskinen, Sandra; Singha, Souvik; Mehta, Neel H; Quelle, Mica; Shah, Harshal A; D'Amico, Randy S	2024	https://www.sciencedirect.com/science/article/abs/pii/S1878875024009501	The paper focuses on neurodegenerative conditions and does not focus on VR.

A review of virtual reality technologies in the field of communication disability: implications for practice and research	Bryant, Lucy; Brunner, Melissa; Hemsley, Bronwyn	2020	https://www.tandfonline.com/doi/full/10.1080/17483107.2018.1549276#abstract	The paper does not focus on traumatic brain injuries and instead focuses on improving existing functioning.
Scoping review of outcome measures used in telerehabilitation and virtual reality for post-stroke rehabilitation	Veras, Mirella; Kairy, Dahlia; Rogante, Marco; Giacomozzi, Claudia; Saraiva, Silvia	2017	https://journals.sagepub.com/doi/abs/10.1177/1357633X16656235	The paper does not focus on TBI or patients and instead focuses on stroke patients.
Effectiveness of somatosensory interventions on somatosensory, motor and functional outcomes in the upper limb post-stroke: A systematic review and meta-analysis	Yilmazer, Cigdem; Boccuni, Leonardo; Thijs, Liselot; Verheyden, Geert	2019	https://content.iospress.com/articles/neurorehabilitation/nre192687	The paper does not focus on VR or how it relates to TBI.
Extended Reality in Revolutionizing Neurological Disease: A New Era for Chronic Condition Treatment	Hariharan, V; Pk, Malini Prithiva Kumari; Rajanandh, MG	2024	https://pmc.ncbi.nlm.nih.gov/articles/PMC11419588/	The paper does not focus on how VR can help treat TBI.

Use of virtual reality in patients with acquired brain injury: A systematic review	Calderone, Andrea; Carta, Diamante; Cardile, Davide; Quartarone, Angelo; Rifici, Carmela; Calabrò, Rocco Salvatore; Corallo, Francesco	2023	https://www.mdpi.com/2077-0383/12/24/7680	The paper does not focus on how VR can help treat TBI and instead focuses on ABI rehabilitation.
Cognitive rehabilitation for pediatric neurological disorders	Locascio, Gianna; Slomine, Beth S	2018	https://books.google.ca/books?hl=en&lr=&id=Cp1dDwAAQBAJ&oi=fnd&pg=PR9&dq=Cognitive+rehabilitation+for+pediatric+neurological+disorders&ots=gl-L_SFiBH&sig=bSAQvg05XMh1AzFEPKOYX9FU8Ic#v=onepage&q=Cognitive%20rehabilitation%20for%20pediatric%20neurological	The paper does not focus on VR.

			%20disorders&f=false	
Therapy and rehabilitation of mild brain injury/concussion: Systematic review	Thomas, Roger E; Alves, Jorge; Vaska Mlis, Marcus M; Magalhaes, Rosana	2017	https://content.iospress.com/articles/restorative-neurology-and-neuroscience/rnn170761	The paper does not focus on VR.
Advanced visualization engineering for vision disorders: a clinically focused guide to current technology and future applications	Zaman, Nasif; Ong, Joshua; Waisberg, Ethan; Masalkhi, Mouayad; Lee, Andrew G; Tavakkoli, Alireza; Zuckerbrod, Stewart	2024	https://link.springer.com/article/10.1007/s10439-023-03379-8	The paper does not focus on how VR can be used to help TBI patients and instead focuses on vision disorders.
Technology and mental health: state of the art for assessment and treatment	Harvey, Philip D; Depp, Colin A; Rizzo, Albert A; Strauss, Gregory P; Spelber, David; Carpenter, Linda L; Kalin, Ned H; Krystal, John H; McDonald, William M; Nemeroff, Charles B	2022	https://psychiatryonline.org/doi/full/10.1176/appi.ajp.211.21254	The paper does not mention VR in depth and does not mention TBI.

Effectiveness of teleneuropsychological rehabilitation: Systematic review of randomized controlled trials	Naamanka, Elina; Salakka, Ilja; Parkkila, Minna; Hotti, Joona; Poutiainen, Erja	2024	https://www.cambridge.org/core/journals/journal-of-the-international-neuropsychological-society/article/effectiveness-of-teleneuropsychological-rehabilitation-systematic-review-of-randomized-controlled-trials/08ED8875463338F83F282E4533E0D084	The paper does not specifically mention virtual reality.
Challenges and promises of mixed-reality interventions in acquired brain injury rehabilitation: A scoping review	Figeys, Mathieu; Koubasi, Farnaz; Hwang, Doyeon; Hunder, Allison; Miguel-Cruz, Antonio; Rincon, Adriana Rios	2023	https://www.sciencedirect.com/science/article/abs/pii/S1386505623002538	The paper does not focus on how VR is related to TBI and instead focuses on ABI.
Vestibulo-ocular dysfunction in mTBI: Utility of the VOMS for evaluation and management—A review	Kaae, Cristen; Cadigan, Kristin; Lai, Katherine; Theis, Jacqueline	2022	https://content.iospress.com/articles/neurorehabilitation/nre2280	The paper does not focus on how cognitive and motor improvements through VR in TBI patients.

			12	
A systematic review of virtual reality therapeutics for acute pain management	Dreesmann, Nathan J; Su, Han; Thompson, Hilaire J	2022	https://www.sciencedirect.com/science/article/abs/pii/S1524904222001229	The paper does not focus on brain injuries and instead focuses on pain management.
Clinical virtual reality tools to advance the prevention, assessment, and treatment of PTSD	Rizzo, Albert 'Skip'; Shilling, Russell	2017	https://www.tandfonline.com/doi/full/10.1080/20008198.2017.1414560	The paper does not focus rehabilitation of TBI patients and instead focuses on rehabilitation of PTSD patients.
A systematic review of the effect of physical exercise on cognition in stroke and traumatic brain injury patients	Vanderbeken, Ines; Kerckhofs, Eric	2017	https://content.iospress.com/articles/neurorehabilitation/nre1388	The paper does not focus on VR and instead focuses on physical exercise.
The role of sensory augmentation for people with vestibular deficits: Real-time balance aid and/or rehabilitation device?	Sienko, KH; Whitney, SL; Carender, WJ; Wall III, C	2017	https://content.iospress.com/articles/journal-of-vestibular-research/ves606	The paper does not focus on cognitive rehabilitation and instead focuses on improving balance and gait.
Technology and concussion: A scoping review	Reneker, Jennifer C; Slaughter, Janet; Scruggs, Anna; Pannell, W Cody	2021	https://journals.sagepub.com/doi/full/10.1177/20597002219929	The paper does not focus on rehabilitation through VR.

			52	
Virtual reality during gait training: does it improve gait function in persons with central nervous system movement disorders? A systematic review and meta-analysis	De Keersmaecker, Emma; Lefeber, Nina; Geys, Marion; Jespers, Elise; Kerckhofs, Eric; Swinnen, Eva	2019	https://content.iospress.com/articles/neurorehabilitation/nre182551	The paper does not focus on cognitive/motor rehabilitation in TBI patients and instead focuses on gait training.
Efficacy and moderators of virtual reality for cognitive training in people with dementia and mild cognitive impairment: A systematic review and meta-analysis	Papaioannou, Themis; Voinescu, Alexandra; Petrini, Karin; Stanton Fraser, Danaë	2022	https://content.iospress.com/articles/journal-of-alzheimers-disease/jad210672	The paper focuses on degenerative conditions instead of TBI patients.
The use of extended reality in rehabilitation for patients with acquired brain injury: A scoping review	Bulle-Smid, Loes; van den Heuvel, Renée; Keuning, Wouter; Hakvoort, Gido; Daniëls, Ramon; Verhoeven, Fenne	2023	https://journals.sagepub.com/doi/full/10.1177/10554181241290963	The paper focuses on ABI and does not focus on VR's impact on TBI rehabilitation.
Concussion rehabilitation and the application of ten movement training principles	McLoughlin, James	2023	https://pubmed.ncbi.nlm.nih.gov/articles/PMC10625311/	The paper does not focus on VR.

The following table provides the papers excluded during full-text screening:

Title	Author	Year	URLs/Hyperlink	Reason
Is clinical virtual reality ready for primetime?	Rizzo, Albert; Koenig, Sebastian Thomas	2017	https://psycnet.apa.org/record/2018-03502-004	The paper discusses the application of VR in clinical settings but does not focus on TBI or rehabilitation.
Use of virtual technology as an intervention for wheelchair skills training: a systematic review	Lam, Jean-François; Gosselin, Laurent; Rushton, Paula W	2018	https://www.sciencedirect.com/science/article/abs/pii/S000399931830159X	The paper does not focus on TBI patients and instead focuses on developing wheelchair skills.
Technological Features of Immersive Virtual Reality Systems for Upper Limb Stroke Rehabilitation: A Systematic Review	Diriba Kenea, Chala; Gemechu Abessa, Teklu; Lamba, Dheeraj;	2024	https://www.mdpi.com/1424-8220/24/11/3546	The paper does not focus on TBI patients and instead focuses on rehabilitation for upper limbs post stroke.
Art as therapy in virtual reality: A scoping review	Hadjipanayi, Christos; Banakou, Domna; Michael-Grigoriou, Despina	2023	https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/frvir.2023.1065863/full	The paper does not focus on TBI patients.
Survey of movement reproduction in immersive virtual rehabilitation	Wang, Liu; Huang, Mengjie; Yang, Rui; Liang, Hai-Ning; Han, Ji; Sun, Ying	2022	https://ieeexplore.ieee.org/abstract/document/9677963	The paper does not focus on TBI patients.

A systematic review of the use of virtual reality and its effects on cognition in individuals with neurocognitive disorders	Moreno, Alexander; Wall, Kylie Janine; Thangavelu, Karthick; Craven, Lucas; Ward, Emma; Dissanayaka, Nadeeka N	2019	https://www.sciencedirect.com/science/article/pii/S2352873719300770	The paper does not focus on TBI patients and instead focuses on neurodegenerative disorders.
The ultimate display for physical rehabilitation: A bridging review on immersive virtual reality	Elor, Aviv; Kurniawan, Sri	2020	https://www.frontiersin.org/journals/virtual-reality/articles/10.3389/fvri.2020.585993/full	The paper does not focus on TBI patients and instead focuses on physical rehabilitation.
A systematic review of the long-term effects of using smartphone-and tablet-based rehabilitation technology for balance and gait training and exercise programs	Lee, Chihyeong; Ahn, Jooeun; Lee, Beom-Chan	2023	https://www.mdpi.com/2306-5354/10/10/1142	The paper does not focus on TBI patients and is outside of the required time frame.
A survey of research trends in assistive technologies using information modelling techniques	Modi, Nandini; Singh, Jaiteg	2022	https://www.tandfonline.com/doi/abs/10.1080/17483107.2020.1817992	The paper does not focus on TBI patients.

Discussion/conclusion

To ensure the research question was accurately addressed, a sophisticated search process was developed to identify only relevant studies. Various Boolean search queries were generated based on inclusion criteria, and tested on the Google Scholar database until an optimal iteration was identified. The final query incorporated relevant keywords such as "rehabilitation," "VR," and "traumatic brain injury," along with filters for publication date (2016-present) and document-type (review articles). This search process ultimately yielded 99 articles for further screening by the team.

From these 99 search results, a methodical process was followed using Covidence, a systematic review tool, to narrow down the articles until only the most relevant would remain. The team began with an initial title and abstract screening to quickly remove any articles that clearly violated the inclusion criteria. With the remaining 24 articles, a comprehensive full text review was conducted. In the end, 15 studies were deemed valid, with specific justifications on the 9 articles that were excluded (such as "study condition violation", refer to the PRISMA diagram for more specifics).

With these results, the research team will extract, synthesize, and analyze data from an assigned 3 papers each. Data will be extracted to an excel spreadsheet, where it will then be analyzed for themes, patterns, and other key statistics to methodically prepare a summary of findings report.

References

- [1] B. Garrett, T. Taverner, D. Gromala, G. Tao, E. Cordingley, and C. Sun, "Virtual Reality Clinical Research: Promises and Challenges," *JMIR Serious Games*, vol. 6, no. 4, p. e10839, Oct. 2018, doi: <https://doi.org/10.2196/10839>.