Exercise and Quality of Life in Adults with ABI: A Systematic Review

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Abstract

Background: Adults with acquired brain injuries (ABI) often face long-term challenges with cognition, mood, and participation in daily life. This systematic review explored how exercise may improve quality of life for this population.

Importance: Exploring how exercise affects quality of life in adults with brain injuries is essential, considering this population may often face long-term challenges with cognition, mood, and social participation. Exercise has the potential to improve physical health, reduce symptoms of depression and anxiety, and enhance cognitive function. Understanding these benefits can help guide rehabilitation approaches to promote meaningful recovery and improved well-being in adults with brain injuries.

Objective: To identify, evaluate, and synthesize the current literature concerning exercise for adults with ABIs to determine its effectiveness on improved quality of life.

Data Sources: A literature search occurred between May 2024 and June 2024. Follow up searches were conducted in June 2024. Databases included EBSCOhost, MEDLINE, Academic Search Complete, CINAHL Complete using Hawai'i Pacific University's online library databases. Search terms included (TBI or traumatic brain injury or brain injury or ABI or acquired brain injury) AND (exercise or physical fitness or physical activity) AND (quality of life or well being or well-being or health-related quality of life) AND (memory or strength or emotion or emotional or mental health).

Study Selection and Data Collection: This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Published studies on exercise and how it could increase the quality of life for adults with ABIs were included in the systematic review. Data from presentations, non-peer reviewed literature, and dissertations were excluded.

Findings: Two level one studies, one level two study, one level three study, and one level five study were included according to the American Occupational Therapy Association's Levels of Evidence. The outcomes of these studies indicate exercise does improve cognitive abilities for adults with acquired brain injuries.

Conclusion and Relevance: Exercise is effective and improves quality of life for adults aged 18-45 with ABI.

What This Systematic Review Adds: There are limited high quality studies that evaluate exercise and how it impacts quality of life for adults with ABIs. This systematic review provides a starting point for evaluating the efficacy of exercise in OT practice. More research is needed to determine optimal programs and interventions that support improvement in quality of life. Establishing standardized assessments for quality-of-life measurement should also be considered with future research studies.

Key words: ABI, Adults, Cognition, Exercise, Quality of Life

Acquired brain injuries (ABIs) can have long-term effects on an individual's ability to think clearly, manage emotions, and participate in everyday life. Many adults with ABIs struggle with memory, attention, depression, and participation in work or social activities. These challenges can greatly reduce their overall quality of life. People with ABIs often have trouble accessing the services they need, which makes it even harder to stay engaged in meaningful tasks. Because these issues are so complex, it's important to find effective ways to help improve the lives of people living with ABI.

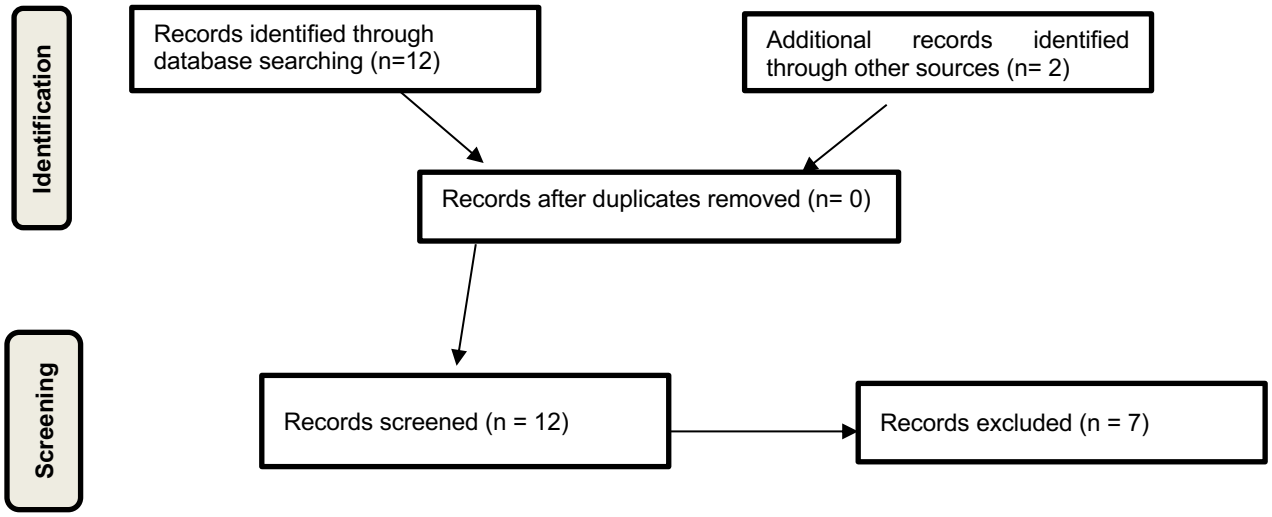
Exercise is one intervention that may help people with ABIs. Several studies have looked at how different types of physical activity can improve things like cognition, emotional health, and everyday functioning. For example, one study showed that combining exercise with mindfulness led to better cognitive performance (Lilliecreutz et al., 2017). Another found that people in a community-based exercise program reported better sleep and focus, although their mood didn't improve as much (Vargus et al., 2024). Other studies found that light exercise didn't make a huge difference in symptoms but it was still safe to try (Varner et al., 2021). Overall, there's a lot of evidence that show exercise could be a useful part of recovery for people with ABIs, and more research can help us understand how to use it effectively in occupational therapy.

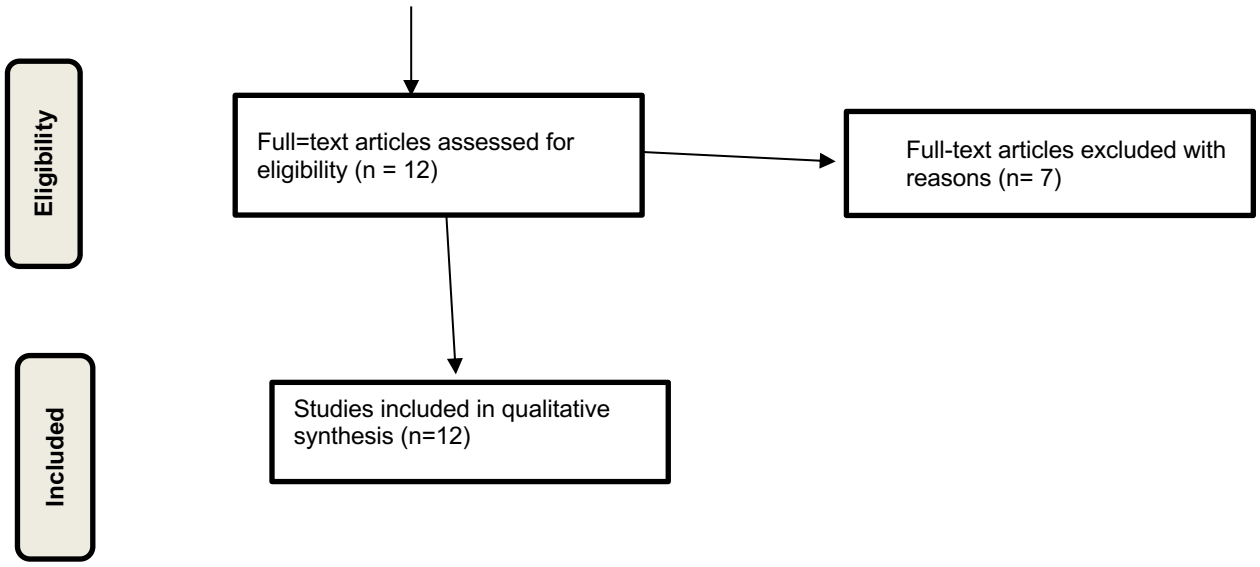
Method

The systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and incorporated recommended processes for conducting a systematic review. The guiding research question for this systematic review was: *Does exercise improve quality of life in adults with brain injuries?*

A broad search of the literature occurred between May 19, 2025, and June 6, 2025. An additional search was conducted June 24, 2025, to ensure all relevant research was included. The inclusion criteria for studies in this systematic review were as follows: peer-reviewed, published in English, and dated between 2015-2025. Exclusion criteria, in addition to those studies that did not meet the inclusion criteria, included articles that were systematic reviews, scoping reviews, dissertations, and presentations. A search for relevant literature was completed using electronic databases: EBSCOhost, MEDLINE, Academic Search Complete, CINAHL Complete through Hawai'i Pacific University's online library database. Search terms included TBI or traumatic brain injury or brain injury or ABI or acquired brain injury) AND (exercise or physical fitness or physical activity) AND (quality of life or well being or well-being or health-related quality of life) AND (memory or strength or emotion or emotional or mental health, as well as combinations of these terms. Appendix A provides an extensive list of all search terms used for this systematic review. The initial search included twenty-seven articles related to the research topic (Figure 1). Four independent reviewers completed the screening and selection of the studies, assessed their quality, and extracted the data.

Figure 1 PRISMA Flow Diagram





Results

Six studies met the inclusion criteria. The articles were assessed according to their risk of bias, level of evidence, and quality. This systematic review included six studies that contained relevant information regarding beneficial outcomes resulting from exercise following an acquired brain injury (ABI). The information from these articles was divided into two themes related to cognitive health and activity participation. An evidence table is provided in Appendix B. The Cochrane risk-of-bias guidelines were used to assess each article and are provided in appendix C.

Cognitive Health

Three of the studies on the topic discussed the efficacy of exercise. One was Level II, one was Level III, and one was Level V study (see Appendix B). All studies provided evidence that exercise is effective and potentially beneficial.

Vargus et al. (2024) explored how technology can help individuals with acquired brain injury (ABI) engage in meaningful activities. Participants included adults with ABI and family

members of those with ABI. Interviews were conducted and a thematic analysis based on the grounded theory approach concluded that participants had difficulty with accessing services, but technology positively influenced cognitive skills and motivation. Researchers emphasized that cognitive impairments that result from head injuries can lead to unique accessibility needs when using assistive technologies. (Jamieson et al., 2020). Ultimately, technology was found to be beneficial for people with ABI, especially if the materials and services are client-centered and tailored specifically for the needs of each individual.

Vargus et al. (2024) examined how a community-based exercise training program improved self-reported cognitive function, sleep, depression, and quality of life (QOL). Add a sentence here describing the community-based exercise program and what it entailed. Results indicated that cognitive health and sleep improved after the intervention. However, there were no significant changes in depression, emotional, and social health.

Lilliecreutz et al. (2017) examined the impact of aerobic exercises combined with mindfulness programs for individuals with mild or moderate ABIs. Participants had improvements in self–reported outcomes, occupational performance, and satisfaction with how well they executed tasks. The study also showed that the participants experienced higher levels of cognitive functioning, especially when it came to attention and processing information. Overall, this study suggested that integrating mindfulness practices with physical activity offers some improvements to cognitive functioning for individuals with ABI (Lilliecreutz et al., 2017).

Limitations of the studies on cognitive health include small sample sizes across all articles under this theme that limit the generalizability of the outcomes. There was no psychological and neurocognitive testing done in the post-hoc analysis to determine the states of

each participant, and self-reported measures may cause bias and prevent objectivity (Vargas et al., 2024). In one of the studies, there was attrition (9.5%) due to physical inability to perform the PASAT test, which could have skewed the results (Lilliecreutz et al., 2017).

Activity Participation

Three of the studies on the topic discussed the efficacy of exercise interventions with ABI populations. Two of these studies were Level I studies, and one study was a Level V study (see Appendix B). Both studies provided evidence that exercise is effective to improve cognition for individuals with ABIs and potentially beneficial.

Varner et al. (2021) examined exercise as an intervention to improve cognition for individuals that suffered from a mild traumatic brain injury (mTBI). Participants' symptoms were observed before and after 30 days of treatment. Additional behaviors that contribute to participation, including work/school absence and doctor visit frequencies, were also monitored as a means of activity participation. Following the 30-day study, no significant differences were found following exercise interventions. Although exercise is deemed a safe intervention, there were no significant results to demonstrate improvements in cognition. Overall, light exercise might be recommended upon discharge from the emergency department after a mild traumatic brain injury mTBI, this advice is not enough to prevent post-concussion symptoms (Varner et al,.2021).

Guiterrez-Suarez et al. (2025) utilized sports-based interventions such as races, o-courses, and circuits as a means of improving health and well-being. Games were modified to be appropriate for participants, comparing those findings with a control group focused only on

mobility, balance, and strength individually. Findings suggest sport-related interventions improve cognition for adults that acquired an ABI.

Jamieson et al. (2018) explored the use of assistive equipment and "just-in-time" interventions with ABI patients on activity participation. "Just-in-time" interventions are defined as adaptations to current demands considering current contexts. Difficulties participating in activities resulted from physical disability, social stigma, or lack of necessary and accessible resources or services. The study concluded that assistive devices have the potential to assist ABI populations with undertaking more activities. Technology can be social bringing groups of people together to connect. It can be persuasive by guiding and motivating, helping people form the habit of its use. Also, technology should allow for collaborative opportunities, being related to the client, as well as being modifiable to better support current demands (Jamieson et al., 2018).

Limitations of the studies on activity participation include small sample sizes across all articles under this theme and the use of self-reported data in one that limit the generalizability of the outcomes (Varner et al., 2021). In another study, lack of follow-up assessments is a limitation (Gutierrez-Suarez et al., 2025).

Discussion

The results of this systematic review suggest that exercise and interventions involving technology are effective in improving cognitive health outcomes for individuals post acquired brain injury. Across the studies, interventions focused on physical activities that can support participation and engagement in meaningful occupations, including guided aerobic exercise, sport-integrated exercises, and assistive technology.

These studies all looked at self-reported cognitive functioning, especially in areas that address attention, information processing, and occupational performance. Assistive technology was found to help people with ABI by offering reminders, planning tools, and motivational support. While its effectiveness can be co-designed with users to truly support daily engagement and recovery (Jamieson et al., 2018). Benefits of combining mindfulness programs and exercise are inferred to be an effective intervention strategy as well. Vargus et al. (2024) showed the potential of community-based programs to enhance cognitive functioning.

As sport-based interventions program showed significant improvements in physical and mental health, upper limb motor control, functional mobility, balance, and physical activity levels compared to those receiving usual care. These results suggest that incorporating structured, sports-oriented exercise into rehabilitation can enhance both function and quality of life(Gutierrez-Suarez et al., 2025). Whereas a combined program of guided aerobic exercise and mindfulness was found to improve cognitive function, physical capacity, and perceived well-being in individuals with ABI according to Lilliecreutz et al. (2017).

Overall, these articles provide supportive evidence that exercise is an effective and beneficial intervention to promote cognitive function and health for individuals that have acquired brain injuries. Future research should expand on the existing evidence with more rigorous study designs.

Strengths and Limitations

The systematic review demonstrated several strengths, including adherence to PRISMA guidelines and the use of a PRISMA flow diagram, which enhanced transparency of the methodology. A collaborative team approach, including occupational students driven to learn

about the effects of exercise for individuals with ABI allowed for consensus in article selection, reducing individual bias and increasing reliability. However, the review also faced limitations, such as a low number of eligible articles, which restricts the generalizability of findings. Some potentially relevant studies could not be obtained, and there is a possibility that additional relevant literature was missed due to search limitations.

Implications for Occupational Therapy Practice

Exercise, especially when combined with mindfulness or delivered through community-based training programs, is linked to better attention, information processing, and quality of life. The use of assistive technology after acquiring a brain injury also supported engagement in meaningful activities when tailored to individual needs. However, limitations to these studies may influence the quality of such results. Overall, these findings support the potential benefits of exercise for ABI recovery, but further high-quality research is needed.

- Occupational therapists should consider integrating structured physical activity, like aerobic or sport-based programs, into treatment plans for individuals with ABI to support cognitive recovery and improve participation in daily activities.
- Rehabilitation programs may benefit from combining mindfulness practices with exercise, as this approach has been proven to enhance cognitive functioning.
- Community-based exercise programs can be valuable for long-term engagement, social participation, and motivation.

- Assistive and adaptive technologies should be tailored to the unique cognitive and physical needs of individuals with ABI to promote engagement, independence, and motivation.

Conclusion

Studies included within this systematic review provide evidence on the effectiveness of exercise for adults with ABI and its effects on quality of life. Additional research is necessary to better understand how exercise can support recovery and guide occupational therapy practice. This systematic review shows that exercise can play an important role in improving quality of life for adults with acquired brain injuries

References

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Appendix A

Search Terms

Hawai'i Pacific University database/library

TBI or traumatic brain injury or brain injury or acquired brain injury

AND

Exercise or physical fitness or physical activity

AND

Quality of life or well being or well-being or health-related quality of life

AND

Memory or strength or emotion or emotional or mental health

Appendix B

Evidence Table

Research Question: Does exercise improve quality of life in adults with brain injuries?

Author/Year	Level of Evidence Study Design Risk of Bias	Participants Inclusion Criteria Study Setting	Intervention and Control Groups	Outcome Measures	Results
Gutiérrez-Suárez et al., 2024 Level I	This study was a RCT with a small sample size. It was a single-blind, parallel-group RCT. Overall, in terms of bias risks, the small sample size (23), lack of data to follow up, and the therapy time for the participants were unequal. Also, the participants and the therapists were not	23 participants randomly assignment to 1 of 2 groups, Sport-based Exercise Therapy + Usual Care: 11 participants Usual Care (UC) Only: 12 participants. Participants 18 years or older with TBI or stroke (6>months post-injury).	The **Intervention group** utilized team sports for sports-based exercise therapy. This included soccer, basketball, hockey, and Modified Games; Group-based relay races, Obstacle courses for balance and coordination, and Circuit training incorporating sport skills. The **Control Group** Focused on mobility, balance, and strength. targeting daily living skills and upper limb function.	- Higher QOL for health related issues - Better upper limb control Overall, the outcomes that are covered are about physical, functional, and participation for the individuals.	This study concludes by stating that the sET+UC group had significant improvements in regards to health related QOL, motor control, and balance, mobility, and physical activity.

	blinded, so that could cause some bias with performance.				
Jamieson et al., 2020 Level V	This study was a collaborative thematic analysis with the approach of Grounded Theory.	24 participants (12 former caregivers, 3 current caregivers without clinical training, 3 families with someone with ABI, 9 males, 15 females). All over the age of 18 (ranged 26-62). Participants were White, British, Scottish.	Interventions included utilization of assistive equipment with consideration of *Just-In-Time Interventions*. 6 experimenters who had experience with working with ABI patients to participate in the qualitative analyses.	***Access***: Physical disability services, accessing activities, accessing solutions. ***Cognition***: memory, executive function / planning, social cognition. ***Anticipation of Difficulties***: Due to physical disability. ***Motivation***: Due to cognitive difficulties, mental health, pre-morbid lifestyles, losing momentum	The study concludes highlighting how assistive tech that is social, persuasive, and adaptive to the individual can assist with people planning activities, particularly useful for neurophysical rehabilitation. External prompting, maintaining momentum, and being planful can all assist adults with ABIs in undertaking more meaningful activities.
Lilliecreutz et, al 2017 Level II	This study was a quasi-experimental, prospective study with a before and after design.	21 participants aged 24-75 with mild to moderate ABI's > 6 months	Intervention was a combination of outdoor walking and mindfulness sessions three times a week for 12 weeks.	1.Individual occupational performance problems as a result of cognitive impairments were identified and scored using the Canadian Occupational Performance	Improvements in cognitive functions were related to attention and information processing speed; in addition, self-reported mental fatigue was

				Measure (COPM). 2. Self-reported health-related quality of life (HRQoL (EQ-5D) is defined by having a person answer a 5-dimensional questionnaire. 3. tests were chosen to measure main- taining attention and information processing speed: D-KEFS Trail Making Test TMT DLS reading speed test ; Wechsler Adult Intelligence Scale (WAIS) IV-Coding stepwise; Paced Auditory Serial Attention Test 4. Mental fatigue and related symptoms after neurological disorders were measured with the Mental Fatigue Scale (MFS)	reduced after the intervention. Cognitive function related to working memory and health-related quality of life were not affected.

				5.Calculated maximal oxygen uptake was measured using Åstrand 's test to evaluate aerobic exercise as an outcome of the intervention	
Vargas et al., 2024 Level III	This study is a post-hoc analysis. There is no mention of how randomization was conducted, which could indicate a risk of bias. The researchers discuss the negatives about small sample sizes that could	Inclusion criteria: age 45-80yrs, history of msTBI, ongoing cognitive symptoms, and at least 1 year from injury, walking as a primary means of locomotion with no physical assistance, fluent in English	10 adults were randomized to the aerobic exercise treatment (AET) and another 10 adults to the stretching and toning (SAT) control group. Over 12 weeks, Participants in both groups were advised to exercise (personal choice) for 60 minutes total for week 1 and gradually increase to a total of 150 minutes per week by the end of week 4, continuing	The outcome measures were performed at baseline and post-interventions. Researchers analyzed the participants' self-reported questionnaires: Traumatic Brain Injury Quality of Life questionnaire (TBI-QOL), Patient Health Questionnaire-9 (PHQ-9), and Pittsburgh Sleep Quality Index (PSQI). Participants were instructed to fill out questionnaires through a	The most common cause of injury was MVAs, followed by assaults and falls. At the end of the intervention, participants in the AET group reported significantly improved cognitive health, especially in communication skills, executive function, and sleep symptoms. Emotional and social

	lead to random error and fail to represent the entire msTBI population.		at 150 minutes per week for the remaining 8 weeks in the program. (Popular exercises included fast walking, jogging, bicycling, and treadmill running in the AET group and yoga, stretching, or slow-paced walking in the SAT group.)	website link either during or after study visits.	health was also improved.
Varner, et al., 2021 Level I	This study is a randomized control trial.	Inclusion criteria: Adults 18-64-years-old, Pts who presented with mTBI within 24 hours. Study Setting: RCT, study conducted in the different emergency departments in Canada.	Intervention: 30 minutes of light exercise daily. Started intervention 48 hours after injury. Participants were told to stop exercising if they showed signs of severe symptoms. Control Group: Gradual return to physical activities. avoidance of exercise.	The main outcome measures were how many individuals still had symptoms after 30 days of injury. Researchers also look out how the symptoms changed over time, how many absences they had at work/school, how much exercise they did, and how often they went back to the doctor.	No significant difference in persistent TBI symptoms after 30 days between the groups. Light exercise was deemed safe, but ineffective.

Note. Acronyms used

ABI - acquired brain injury; AET - aerobic exercise treatment; SAT - stretching and toning; TBI-QOL - Traumatic Brain Injury Quality of Life; PHQ-9 - patient health questionnaire 9; PSQI - Pittsburgh Sleep Quality Index; COPM - Canadian Occupational Performance Measure; TUGT - Timed Up and Go Test; RCT - Randomized Control Trial; TBI - Traumatic Brain Injury; sET+UC - Sport-based exercise therapy program combined with usual care.

Appendix C

Risk-of-Bias Table: Randomized Controlled Trial (RCT) and Non-RCT

	Selection Bias (Risk of bias arising from randomization process)			Performance Bias (effect of assignment to intervention)		Detection Bias		Attrition Bias	Reporting Bias	Overall risk-of-bias (low, moderate, high
Citation	Random Sequence Generation	Allocation Concealment (until participants enrolled and assigned)	Baseline difference between intervention groups	Blinding of Participants During the Trial	Blinding of Study Personnel During the Trial	Blinding of Outcome Assessment: Self-reported outcomes	Blinding of Outcome Assessment: Objective Outcomes (assessors aware of intervention received?)	Incomplete Outcome Data (data for all or nearly all participants	Selective Reporting (results being reported selected on basis of the results?)	
Vargas, G. et al. (2024).	+	?	+	-	-	+	+	?	?	M RISK
Gutiérrez-Suárez et al. (2023)	+	+	-	-	-	+	-	+	+	L RISK
Varner et al. (2021)	+	+	?	-	?	-	?	+	+	L RISK

Note. Categories for risk of bias are as follows: Low risk of bias (+), unclear risk of bias (?), high risk of bias (–). Scoring for overall risk of bias assessment is as follows: 0–3 minuses, low risk of bias (L); 4–6 minuses, moderate risk of bias (M); 7–9 minuses, high risk of bias (H).

Citation. Table format adapted from Higgins, J. P. T., Sterne, J. A. C., Savović, J., Page, M. J., Hróbjartsson, A., Boutron, I., . . . Eldridge, S. (2016). A revised tool for assessing risk of bias in randomized trials. *Cochrane Database of Systematic Reviews 2016, 10* (Suppl. 1), 29–31. https://doi.org//10.1002/14651858.CD201601