Comparative Effectiveness Review
Number 241

Physical Activity and the Health of Wheelchair Users: A Systematic Review in Multiple Sclerosis, Cerebral Palsy, and Spinal Cord Injury

Evidence Summary

Main Points

- We found physical activity to be associated with improvements in walking ability, general function, balance (including fall risk), depression, sleep, activities of daily living, aerobic capacity, and female sexual function, depending on population and type of activity.
- No studies reported long-term cardiovascular or metabolic disease health outcomes.
- Evidence was also limited by heterogeneity in interventions and control groups and by small sample sizes; evidence in spinal cord injury was limited by the small number of trials.
- Evidence was lacking for many prioritized outcomes.
- Adverse effects of the interventions were inadequately reported in many studies.

Background and Purpose

The benefits of regular physical activity (movement using more energy than rest) for the general population include reduced risk of heart disease, stroke, type 2 diabetes, dementia, depression, falls with injuries among the elderly, and breast, colon, endometrial, esophageal, kidney, stomach, and lung cancer.[1] Although routine physical activity combining aerobic exercise with strength and balance training is recommended for people with physical disabilities,[2] less is known about the specific benefits and potential harms for this diverse population. In particular, the various populations using wheelchairs as a result of their physical disabilities is broad and poorly captured in the literature on physical activity. This review includes three diverse conditions commonly associated with wheelchair use: multiple sclerosis, cerebral palsy, and spinal cord injury. The three populations were chosen as representative of those using a wheelchair or those who

Agency for Healthcare Research and Quality

might benefit from using a wheelchair in the future. While there are differences in etiology and pathophysiology, a common denominator is the involvement of the corticospinal tracts of the central nervous system, which results in impaired central control and/or coordination of the peripheral muscles. This may lead to paralysis or reduced extremity muscle force and increased spasticity, which can greatly affect general mobility or coordinated movement such as posture and gait.

Methods

We employed methods consistent with those outlined in the Agency for Healthcare Research and Quality Evidence-based Practice Center Program Methods Guidance (https://effectivehealthcare.ahrq.gov/topics/cer-methods-guide/overview), and these are described in the full report. Our searches covered publication dates from 2008 to November 2020. (See Appendix A of the full report for search strategies.)

Results

We included 168 studies in 197 publications (n=7,511), comprising of 146 randomized controlled trials, 15 quasiexperimental nonrandomized trials, and 7 cohort studies. More studies enrolled participants with multiple sclerosis (44%) than other conditions, followed by cerebral palsy (38%) and spinal cord injury (18%).

Key Question 1: Prevention of Cardiovascular Conditions, Diabetes, and Obesity

No included study (n=168) or study excluded at the full-text level provided evidence on the prevention of cardiovascular conditions (e.g., myocardial infarction, stroke, development of hypertension) or the development of diabetes or obesity.

Key Question 2: Benefits and Harms

Compared with no physical activity or usual care, physical activity improved walking ability, function, balance, sleep, activities of daily living, cardiovascular fitness as measure with VO_2 peak, female sexual function (e.g., desire, lubrication, pain), and depression in participants with multiple sclerosis. Physical activity improved balance, function, and VO_2 peak in trials that enrolled participants with cerebral palsy. The evidence in spinal cord injury was sparse. Physical activity improved activities of daily living, function, and VO_2 peak in participants with spinal cord injury. All studies focused on benefits of physical activity, with inadequate reporting of adverse events in many studies. However, physical activity was associated with increased episodes of autonomic dysreflexia in spinal cord injury. Table A summarizes the strength of evidence on effects of physical activity interventions compared with usual care and general exercise effect across interventions compared with usual care.

Key Question 3: Patient Factors Affecting Benefits and Harms

In patients with incomplete spinal cord injury, having better function and more recent injury at baseline was associated with better response to aerobic interventions (2 randomized controlled trials). Other subgroup analyses (3 randomized controlled trials) did not find evidence of variation in effects based on baseline function or spasticity in children with cerebral palsy (total body vibration), or based on weight category in multiple sclerosis patients (cycling). There were no differences across cerebral palsy trials in walking outcomes when stratified by age group (children, adolescents, and adults).

Table A. Effects of physical activity interventions compared with usual care[a]

Intervention Category Intervention	Multiple Sclerosis Studies Strength of Evidence[b] (Direction of Finding)	Cerebral Palsy Studies Strength of Evidence[b] (Direction of Finding)	Spinal Cord Injury Studies Strength of Evidence[b] (Direction of Finding)
Aerobic Exercise Dance (1 RCT in MS and 1 RCT in CP)[a]	Low (function improvement)	Low (function improvement)	Insufficient
Aerobic Exercise Aerobics	Low (sleep improvement)	Insufficient	Insufficient
Aerobic Exercise Aquatics	Low (balance, ADL improvement, female sexual function)	Insufficient	Insufficient
Aerobic Exercise Cycling	Low (no clear benefit on walking)	Low (function improvement)	Insufficient
Aerobic Exercise Robot-Assisted Gait Training	Low (balance improvement) Low (no clear benefit in function)	Insufficient	Low (ADL improvement) Low (no clear benefit on function)
Aerobic Exercise Treadmill	Low (walking, function, and balance improvement)	Low (function improvement)	Insufficient

Intervention Category Intervention	Multiple Sclerosis Studies Strength of Evidence[b] (Direction of Finding)	Cerebral Palsy Studies Strength of Evidence[b] (Direction of Finding)	Spinal Cord Injury Studies Strength of Evidence[b] (Direction of Finding)
Postural Control Balance Exercises	Moderate (balance improvement)	Insufficient	Insufficient
Postural Control Balance Exercises	Low (fall risk improvement)	Insufficient	Insufficient
Postural Control Balance Exercises	Low (function improvement)	Insufficient	Insufficient
Postural Control Hippotherapy	Insufficient	Low (balance and function improvement)	Insufficient
Postural Control Tai Chi	Insufficient	Insufficient	Insufficient
Postural Control Motion Gaming	Low (function, balance improvement)	Low (balance improvement)	Insufficient
Postural Control Whole Body Vibration	Insufficient	Insufficient	Insufficient
Postural Control Yoga	Low (no clear benefit on function)	Insufficient	Insufficient
Strength Interventions Muscle Strength Exercise	Low (no clear benefit on walking, function, balance, quality of life, spasticity)	Low (no clear benefit on walking and function)	Insufficient

Intervention Category Intervention	Multiple Sclerosis Studies Strength of Evidence[b] (Direction of Finding)	Cerebral Palsy Studies Strength of Evidence[b] (Direction of Finding)	Spinal Cord Injury Studies Strength of Evidence[b] (Direction of Finding)
Multimodal Exercise Progressive Resistance or Strength Exercise Plus Aerobic and/or Balance Exercise	Low (walking, balance, VO_2 improvement)	Low (no clear benefit on function, quality of life)	Insufficient
All Types of Exercise	High (walking improvement)	Low (function)	Low (function)
	Moderate (balance, depression improvement, no clear benefit on function)	Low (VO_2 improvement)	Low (VO_2 improvement, increased episodes of autonomic dysreflexia[c], no clear benefit on depression)

Abbreviations: ADL = activities of daily living; CP = cerebral palsy; MS = multiple sclerosis; RCT = randomized controlled trial

[a] Strength of evidence color shading: blue=high strength of evidence, green=moderate, yellow=low, white=insufficient

[b] Strength of evidence based on combining the two populations, multiple sclerosis and cerebral palsy.

[c] Whole-body exercise versus exercise limited to upper body

Limitations

Key Question 4: Methodological Weaknesses or Gaps

Conclusions that can be drawn from the evidence on physical activity in patients with multiple sclerosis, cerebral palsy, and spinal cord injury are limited by small sample sizes; few trials (in spinal cord injury); inadequate descriptions of population characteristics, control group activities, and intensity of physical activity; incomplete data analysis; inadequate reporting of adverse events; and relatively few trials considered to be high quality (low risk of bias). The addition of larger, well-conducted randomized controlled trials of longer duration and including all disability levels would greatly strengthen the evidence base and may alter the current conclusions.

Implications and Conclusions

Physical activity was associated with improvements in walking ability, general function, balance (including fall risk), depression, aerobic capacity, activities of daily living, female sexual function, and sleep, depending on population and type of physical activity. No studies reported long-term cardiovascular or metabolic disease health outcomes. Future trials could alter these findings, and further research is needed to

examine health outcomes to understand the magnitude and clinical importance of benefits seen in intermediate outcomes.

References

1. U.S. Department of Health and Human Services. Physical Activity Guidelines for Americans, 2nd edition. Washington, D.C.: U.S. Department of Health and Human Services; 2018. https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf Accessed Sept. 15, 2019.
2. UK Chief Medical Officers' Physical Activity Guidelines Care UKDoHS; Sept. 7, 2019. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/829841/uk-chief-medical-officers-physical-activity-guidelines.pdf Accessed Sept. 15, 2019.

Full Report

Selph SS, Skelly AC, Wasson N, Dettori JR, Brodt ED, Ensrud E, Elliot D, Dissinger KM, Hart E, Kantner S, Graham E, Junge M, Dana T, McDonagh M. Comparative Effectiveness Review No. 241. Physical Activity and the Health of Wheelchair Users: A Systematic Review of Evidence in Multiple Sclerosis, Cerebral Palsy, and Spinal Cord Injury. (Prepared by the Pacific Northwest Evidence-based Practice Center under Contract No. 290-2015-00009-I.) AHRQ Publication No. 21(22)-EHC017. Rockville, MD: Agency for Healthcare Research and Quality; October 2021.
DOI: https://doi.org/10.23970/AHRQEPCCER241. Posted final reports are located on the Effective Health Care Program search page.