F1: Evidence on physical activity for children, adolescents and adults living with disability

Guiding Questions

F1. What is the association between **physical activity** and health-related outcomes?

Inclusion Criteria

Inclusion Criteria

Population: People living with impairments as a result of any of the following health conditions:

F1.a. Multiple sclerosis (MS)

F1.b Spinal cord injury (SCI)

F1.c Intellectual Disability (ID)

F1.d Parkinson's disease (PD)

F1.d Stroke (Str)

F1.e Major clinical depression (MCD)

F1.g Schizophrenia (Sch)

F1.h ADHD

Exposure: Greater volume, duration, frequency or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity

		Outcomes		
Population	1.1 Comorbidity	1.2 Physical functioning	1.3 Cognition	1.4 Quality of Life
F1.a Multiple sclerosis	X	X	X	X
F1.b Spinal cord injury	X	X		X
F1.c Intellectual disability	X	X		X
F1.d Parkinson's disease		X	X	
F1.e Stroke		X	X	
F1.f Major clinical depression				X
F1.g Schizophrenia			X	X
F1.h ADHD			X	

Included Evidence

Twenty-seven reviews were identified (published from 2016 to 2019) that examined the association between physical activity and health-related outcomes among people with impairments (**Table 7.1**) *(1-38)*. Each of the reviews focused on different subpopulations with impairments including four reviews that included people with multiple sclerosis, no reviews among people with a spinal cord injury, two reviews among children and adolescents with intellectual disabilities including Down syndrome, three reviews among older adults with Parkinson's disease, 12 reviews included people with a history of stroke, two reviews including people with major clinical depression, 3 reviews among adults with schizophrenia, and one among children with attention deficit hyperactivity disorder (**Table 7.1**).

The primary outcomes for each review varied according to the population of interest. For instance, measures of physical function were most commonly reported for reviews of exercise interventions among adults with a history of stroke whereas measures of cognition were most commonly reported for the reviews among children with ADHD. None of the reviews included evidence published in 2019; most reviews included evidence published through 2017. The included bodies of evidence for each review was relatively small ranging from 3 to 39 included studies. Three reviews were reviews-of-reviews and synthesized the evidence from existing systematic reviews and meta-analyses. Extracted data for each review is included in **Appendix A.** A summary of the U.S. Physical Activity Guidelines evidence for people with common chronic conditions is provided within each Evidence Profile.

In general, these reviews had many limitations in their design, execution, and reporting. None of the systematic reviews were rated as having high credibility based on the AMSTAR 2 instrument. Ten were rated as having moderate credibility, 14 were rated as having low credibility, and the remaining 12 were rated as having critically low credibility. Given concerns regarding the comprehensiveness and the validity of the results presented in reviews rated as having critically low credibility, they were not incorporated into the final Evidence Profiles. **Table 7.2** presents the ratings for each review according to all the AMSTAR 2 main domains. Two additional reviews were excluded given the scope or focus of the reviews *(7, 17)*. The paper by Christiansen 2019 *(7)* is not a systematic review and the review by Hendrey (2018) *(17)* was excluded given the research question (do resistance training interventions that have been studied among patients with a history of stroke adhere to American College of Sports Medicine guidelines?).

Table 7.1. Included Systematic Reviews

	Conditions								Outcomes						
Author, Year	**MS**	**SCI**	**ID**	**Park**	**Stroke**	**MCD**	**Schizo-phrenia**	**ADHD**	**Risk of co-morbid conditions**	**Physical function**	**Cognitive function**	**QOL**	**Last search date**	**# of included studies**	**AMSTAR 2**
People with multiple sclerosis															
Alphonsus, 2019 *(1)*	X											X	NR 2017	18	Low
Campbell, 2018 *(5)*	X									X			Sep 2017	7	Low
Charron, 2018 *(6)*	X									X			Nov 2016	12	Critically Low
Manca, 2018 *(24)*	X									X			May 2017	11	Moderate
Morrison, 2017 *(27)*	X										X		May 2016	19	Critically Low
Patterson, 2018 *(28)*	X	X			X					X			Aug 2017	9	Moderate
Veneri, 2018 *(34)*	X				X					X	X	X	May 2016	32	Critically Low
People with spinal cord injury															
Eitivipart, 2019[a] *(12)*		X								X			Aug 2018	16	Critically Low
Gaspar, 2019 *(14)*		X								X		X	Feb 2017	25	Critically Low
Melo, 2019 *(25)*		X								X			Nov 2015	7	Critically Low
Patterson, 2018 *(28)*	X	X			X					X			Aug 2017	9	Critically Low
People with intellectual disabilities															
Maïano, 2018 *(23)*			X							X			Mar 2018	15	Low
Maïano, 2019 *(22)*			X							X			Jun 2017	11	Moderate
People with Parkinson's disease															
Cugusi, 2017a *(8)*				X						X		X	Feb 2017	6	Low
Ćwiękała-Lewis, 2017 *(10)*				X						X		X	Apr 2015	11	Critically Low
Dos Santos Delabary, 2017 *(11)*				X						X		X	Aug 2017	5	Low
Kalyani, 2019 *(19)*				X						X	X		Sep 2017	12	Critically Low
Stuckenschneider, 2019 *(32)*				X							X		Mar 2018	11	Moderate

People with a history of stroke															
Bonini-Rocha, 2018 *(3)*					X					X			Mar 2017	11	Moderate
	Conditions								**Outcomes**						
Author, Year	**MS**	**SCI**	**ID**	**Park**	**Stroke**	**MCD**	**Schizo-phrenia**	**ADHD**	**Risk of co-morbid conditions**	**Physical function**	**Cognitive function**	**QOL**	**Last search date**	**# of included studies**	**AMSTAR 2**
Boyne, 2017 *(4)*					X					X			Nov 2015	20	Low
Cugusi, 2017b *(9)*					X					X			Oct 2016	15	Moderate
Ge, 2017 *(15)*					X					X			Feb 2017	32	Moderate
Hendrey, 2018[b] *(17)*					X					X			Oct 2016	39	N/A
Ilunga Tshiswaka, 2018 *(18)*					X					X			Oct 2016	29	Critically Low
Li, 2018 *(21)*					X					X			NR	5	Low
Miranda, 2018 *(26)*					X					X			Nov 2017	12	Low
Patterson, 2018 *(28)*	X	X			X					X			Aug 2017	9	Moderate
Pogrebnoy, 2019 *(29)*					X					X			Aug 2018	10	Low
Schröder, 2019 *(30)*					X					X			Apr 2018	7	Low
Veneri, 2018 *(34)*	X				X					X	X	X	NR	32	Critically Low
Wiener, 2019 *(35)*					X					X			Jan 2018	6	Low
Wu, 2018 *(36)*					X					X			May 2017	6	Critically Low
Zou, 2018a *(37)*					X					X			NR	20	Low
Zou, 2018b *(38)*					X				X	X			NR	16	Low
People with major clinical depression															
Ashdown-Franks, 2019[a] *(2)*						X	X	X	X		X		Jan 2018	27	Moderate
Krogh, 2017 *(20)*						X			X			X	Jun 2017	35	Moderate
Stubbs, 2018[a] *(31)*						X	X		X	X	X	X	Jan 2018	20	Moderate
People with schizophrenia															
Ashdown-Franks, 2019[a] *(2)*						X	X	X	X		X		Jan 2018	27	Moderate
Firth, 2016 *(13)*							X				X		Apr 2016	10	Low

Stubbs, 2018[a] *(31)*						X	X		X	X	X	X	Jan 2018	20	Critically Low
People with attention deficit hyperactivity disorder															
Ashdown-Franks, 2019[a] *(2)*						X	X	X	X		X		Jan 2018	27	Moderate
Christiansen, 2019[c] *(7)*								X			X		NR	18	N/A
	Conditions								**Outcomes**						
Author, Year	**MS**	**SCI**	**ID**	**Park**	**Stroke**	**MCD**	**Schizo-phrenia**	**ADHD**	**Risk of co-morbid conditions**	**Physical function**	**Cognitive function**	**QOL**	**Last search date**	**# of included studies**	**AMSTAR 2**
Grassmann, 2017 *(16)*								X			X		NR 2013	3	Critically Low
Suarez-Manzano, 2018 *(33)*								X			X		Jan 2017	16	Critically Low

Abbreviations: ADHD = attention deficit hyperactivity disorder; ID = intellectual disorder; MCD = major clinical depression; MS = multiple sclerosis; NR = month and/or year not reported; QOL = quality of life; SCI = spinal cord injury

[a] Review-of-reviews
[b] Review excluded given scope
[c] Not a systematic review

Table 7.2. Credibility Ratings (AMSTAR 2)

Author, Year	PICO[1]	Apriori Methods[2]	Study Design Selection[3]	Lit Search Strategy[4]	Study Selection[5]	Data Extraction[6]	Excluded Studies[7]	Included Studies[8]	RoB Assessment[9]	Funding Sources[10]	Statistical Methods[11]	Impact of RoB[12]	RoB Results[13]	Hetero-geneity[14]	Publication Bias[15]	COI[16]	Overall Rating[17]
Alphonsus, 2019	Y	N	N	PY	Y	N	PY	N	PY	N	Y	Y	Y	Y	Y	N	**Low**
Ashdown-Franks, 2019	Y	N	N	PY	Y	Y	PY	Y	Y	N	N/A	N/A	Y	Y	N/A	Y	**Moderate**
Bonini-Rocha, 2018	Y	N	N	PY	Y	N	PY	PY	Y	N	Y	N	Y	Y	Y	Y	**Moderate**
Boyne, 2017	Y	N	N	PY	N	N	PY	PY	PY	N	Y	N	N	Y	Y	N	**Low**
Campbell, 2018	Y	N	N	PY	N	N	PY	PY	PY	N	N/A	N/A	N	Y	N/A	Y	**Low**
Charron, 2018	Y	N	N	PY	N	N	PY	PY	N	N	N/A	N/A	N	N	N/A	Y	**Critically Low**
Cugusi, 2017a	Y	N	N	PY	Y	Y	Y	PY	PY	N	N/A	N/A	N	Y	N/A	Y	**Low**
Cugusi, 2017b	N	N	N	PY	Y	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	**Moderate**
Ćwiękała-Lewis, 2017	N	N	N	PY	N	N	PY	PY	N	N	N/A	N/A	N	N	N/A	Y	**Critically Low**
Dos Santos Delabary, 2017	Y	N	N	PY	Y	Y	PY	PY	Y	N	Y	N	N	Y	Y	Y	**Low**
Eitivipart, 2019[18]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Critically Low**
Firth, 2016	Y	N	N	PY	Y	N	PY	PY	Y	N	Y	Y	Y	Y	Y	Y	**Low**
Gaspar, 2019	N	N	N	PY	Y	Y	N	N	N	N	N/A	N/A	N	Y	N/A	N	**Critically Low**
Ge, 2017	Y	N	N	PY	Y	Y	PY	PY	Y	N	Y	N	Y	Y	Y	N	**Moderate**
Grassmann, 2017	Y	N	N	PY	N	N	N	PY	N	N	N/A	N/A	N	N	N/A	Y	**Critically Low**
Ilunga Tshiswaka, 2018	N	N	N	PY	Y	N	N	N	N	N	N/A	N/A	N	N	N/A	Y	**Critically Low**
Kalyani, 2019	Y	PY	N	PY	Y	Y	PY	PY	Y	N	N	N	Y	N	N	N	**Critically Low**
Krogh, 2017	Y	PY	N	PY	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	**Moderate**
Li, 2018	Y	N	N	PY	Y	Y	PY	PY	Y	N	Y	N	Y	Y	N	Y	**Low**
Maïano, 2018	Y	N	N	PY	Y	Y	N	Y	PY	N	Y	Y	Y	Y	Y	Y	**Low**
Maïano, 2019	Y	N	N	PY	Y	Y	PY	Y	Y	N	N/A	N/A	Y	N	N/A	Y	**Moderate**
Manca, 2018	Y	N	N	PY	Y	Y	Y	PY	Y	N	Y	N	Y	Y	Y	Y	**Moderate**
Melo, 2019	Y	N	N	PY	Y	Y	PY	PY	N	N	N/A	N/A	N	N	N/A	N	**Critically Low**
Miranda, 2018	N	N	N	PY	N	Y	Y	Y	PY	N	N/A	N/A	Y	Y	N/A	Y	**Low**
Morrison, 2017	N	N	N	PY	N	N	N	Y	PY	N	N/A	N/A	Y	N	N/A	Y	**Critically Low**
Patterson, 2018	Y	N	N	PY	Y	Y	PY	PY	Y	N	N/A	N/A	Y	Y	N/A	Y	**Moderate**
Pogrebnoy, 2019	Y	N	Y	PY	Y	N	PY	PY	PY	N	Y	N	N	Y	N	N	**Low**

Author, Year	PICO[1]	Apriori Methods[2]	Study Design Selection[3]	Lit Search Strategy[4]	Study Selection[5]	Data Extraction[6]	Excluded Studies[7]	Included Studies[8]	RoB Assessment[9]	Funding Sources[10]	Statistical Methods[11]	Impact of RoB[12]	RoB Results[13]	Hetero-geneity[14]	Publication Bias[15]	COI[16]	Overall Rating[17]
Schröder, 2018	Y	N	N	PY	Y	Y	N	PY	Y	N	N/A	N/A	Y	Y	N/A	Y	**Low**
Stubbs, 2018	Y	N	Y	PY	Y	Y	PY	PY	Y	N	N/A	N/A	Y	Y	N/A	Y	**Moderate**
Stuckenschneider, 2019	Y	N	N	PY	N	Y	PY	Y	PY	N	N/A	N/A	Y	Y	N/A	Y	**Moderate**
Suarez-Manzano, 2018	N	N	N	PY	Y	N	N	PY	N	N	N/A	N/A	N	N	N/A	Y	**Critically Low**
Veneri, 2018	N	N	N	PY	Y	N	N	PY	N	N	N	N	N	N	N	Y	**Critically Low**
Wiener, 2019	Y	N	N	PY	Y	N	N	PY	PY	N	N/A	N/A	N	Y	N/A	Y	**Low**
Wu, 2018	Y	N	N	PY	Y	Y	N	PY	N	N	N	N	Y	Y	N	N	**Critically Low**
Zou, 2018a	Y	N	N	PY	Y	Y	PY	PY	PY	N	Y	Y	Y	Y	Y	N	**Low**
Zou, 2018b	Y	N	N	PY	Y	Y	PY	PY	PY	N	N	N	Y	Y	N	Y	**Low**

Abbreviations: COI = conflict of interest; N = no; N/A = not applicable; PICO = population, intervention, comparator, outcome; PY = partial yes; RoB = risk of bias; Y = yes

[1] Did the research questions and inclusion criteria for the review include the components of PICO?

[2] Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?

[3] Did the review authors explain their selection of the study designs for inclusion in the review?

[4] Did the review authors use a comprehensive literature search strategy?

[5] Did the review authors perform study selection in duplicate?

[6] Did the review authors perform data extraction in duplicate?

[7] Did the review authors provide a list of excluded studies and justify the exclusions?

[8] Did the review authors describe the included studies in adequate detail?

[9] Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?

[10] Did the review authors report on the sources of funding for the studies included in the review?

[11] If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?

[12] If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?

[13] Did the review authors account for RoB in individual studies when interpreting/ discussing the results of the review?

[14] Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?

[15] If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?

[16] Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

[17] Shea et al. 2017. AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both.

[18] Eitivipart, 2019 is a review-of-reviews. All included reviews were rated as critically low by review authors and was therefore rated as critically low overall.

F.1. Physical Activity in children, adoslecents and adults living with disability

Table F.1.a. People with multiple sclerosis, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with multiple sclerosis
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Risk of co-morbid conditions (including disease progression and symptoms of disease), physical function, cognitive function, health-related QOL

Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Description of evidence Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness†	Imprecision	Other			
Risk of co-morbid conditions	No systematic review identified									No review evidence Insufficient evidence is available to determine the relationship between physical activity and risk of comorbid conditions in adults with multiple sclerosis. **PAGAC Grade: Not Assignable**.
Physical function[a]	Campbell 2018 *(5)* Low	5 RCTs 2 before-after N = 249	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Five studies included participants that were predominantly mildly disabled (EDSS < 4.0), one study recruited moderately disabled persons (EDSS 4.0-6.0), and one recruited those who were more severely disabled (EDSS 6.0-8.0). All studies conducted HIIT, in a supervised setting, on a cycle ergometer or upper limb ergometer. Four studies compared HIIT to a form of continuous training, one compared HIIT and in-patient rehabilitation to just in-patient rehabilitation, and two studies had no comparator. 6/7 studies found improvements in measures of cardiorespiratory fitness (VO_2peak or VO_2max,	HIGH[b]	12 ESRs Strong evidence demonstrates that physical activity—particularly aerobic and muscle-strengthening activities—improves physical function, including walking speed and endurance, in adults with multiple sclerosis. **PAGAC Grade: Strong.**

								HRMax, peak power) or muscle strength following 3-12 weeks of HIIT using cycle ergometry; however, minimal information on between-group differences for HIIT vs. control results.		.
	Manca 2019 *(24)* Moderate	11 RCTs N = 426	No serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	Possible publication bias	Median EDSS score was 3.9. Mean age ranged from 33.1 to 53.0 years. Strength training programs training whole lower limb (8 studies), knee extensor muscles (2 studies), or ankle plantar flexors (1 study). No study focused on upper limb strength. Average training duration was 13.2 weeks. All control groups received no intervention. Pooled analyses found increased strength by 23.1% (95% CI, 11.8 to 34.4) among those in strength training group compared with control groups (ES = 0.37 [95% CI, 0.16 to 0.57] (11 RCTs, n=366) as measured by isokinetic dynamometer and 1RM testing. No statistically significant differences in strength outcomes when limited dynamometer and 1RM measures separately.	LOW[c]	
	Patterson 2018 *(28)* Moderate	1 case reports 1 before-after N = 9	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	One case study reported improved functional mobility following a dance intervention and the other reported improved balance after the intervention.	VERY LOW[d]	
Cognitive function	No systematic review included[e]									1 ESR Moderate evidence indicates that moderate-to-vigorous physical activity can have beneficial effects on cognition in individuals with diseases or disorders that impair cognitive function, including attention deficit hyperactivity disorder, schizophrenia, multiple sclerosis, Parkinson's disease, and stroke.

										PAGAC Grade: Moderate. Results regarding the efficacy of interventions to improve cognitive function in individuals with MS are conflicting. However, interventions show the largest effects on executive function, learning, memory, and processing speed *(39)*.
Health-related QOL	Alphonsus 2019 *(1)* Low	12 RCTs 6 obs N = 725	No serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	None	Participant characteristics (age, disability status) NR. Seven studies tested aerobic exercise interventions, 4 tested anaerobic exercise studies, 3 tested a yoga intervention, 3 used physiotherapy, and 5 studies tested combinations of exercises. Aerobic exercise had small statistically significant effect on physical (ES = 0.35 [95% CI, 0.08 to 0.62], *p*=0.01), mental (ES = 0.42 [95% CI, 0.11 to 0.72], *p*=0.007), and social (ES = 0.42 [95% CI, 0.15 to 0.69], *p*=0.002) domains of QOL. Anaerobic exercise, combinations of exercise, and yoga did not have a significant effect on measures of QOL. Medium to large effects associated with physical and social domains of QOL were seen for physiotherapy, though few studies (3) measured this relationship.	LOW[f]	11 ESRs Limited evidence suggests that physical activity improves quality of life, including symptoms of fatigue and depressive symptoms, in adults with multiple sclerosis. **PAGAC grade: Limited.**

Abbreviations: 1RM = 1 repetition maximum; CI = confidence interval; EDSS = Expanded Disability Status Scale; ERS = existing systematic review; ES = effect size; HIIT = high-intensity interval training; NR = not reported; obs = observational study design; PAGAC = Physical Activity Guidelines Advisory Committee; QOL = quality-of-life; RCT = randomized clinical trial

[†] Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] One review *(6)* was identified by rated as very low credibility and was not included.
[b] Certainty of evidence not downgraded due to indirectness in outcome measures; the SOE indicates the certainty in measures of cardiorespiratory fitness or muscle strength
[c] Certainty of evidence downgraded due to substantial degree of heterogeneity (I^2=62%) in pooled analyses, serious imprecision given wide confidence intervals around estimates of effects, and possible publication bias serious inconsistency, indirectness, imprecision, and possible publication bias
[d] Certainty of evidence not upgraded
[e] Two reviews *(27, 34)* were identified but were rated as very low credibility and were not included.
[f] Certainty of evidence downgraded for serious unexplained inconsistency (moderate heterogeneity (I2>50%) in most pooled analyses; individual study effects include benefit and no benefit), serious indirectness (lack of detail regarding populations and interventions), and imprecision (wide confidence intervals around measures of effect)

Table F.1.b. People with spinal cord injury, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with spinal cord injury
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Risk of co-morbid conditions (including disease progression and symptoms of disease), physical function, health-related QOL

Outcome	Systematic review evidence Review credibility		Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
		No. of studies/ Study design No. of participants	Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Risk of co-morbid conditions	No systematic reviews identified									3 ESRs Limited evidence suggests that physical activity reduces shoulder pain and improves vascular function in paralyzed limbs in individuals with spinal cord injury. **PAGAC Grade: Limited.**
Physical function[a]	No systematic review included									8 ESRs Moderate evidence indicates that physical activity improves walking function, muscular strength, and upper extremity function for persons with spinal cord injury. **PAGAC Grade: Moderate.**
Health-related QOL	No systematic review included[b]									2 ESRs Limited evidence suggests physical activity improves health-related quality of life in individuals with spinal cord injury. **PAGAC Grade: Limited.**

Abbreviations: ESR = existing systematic review; PAGAC = Physical Activity Guidelines Advisory Committee; QOL = quality-of-life

† Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Three additional reviews were identified *(12, 14, 25)* but were rated as very low credibility and are not included. One additional review *(28)* included data from the abstracts of two studies among persons with spinal cord injury. Results are not presented here given no full-text article available.
[b] One systematic review was identified *(14)* but was rated as very low credibility and was not included.

Table F.1.c. People with intellectual disabilities, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with intellectual disabilities
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Risk of co-morbid conditions (including disease progression and symptoms of disease), physical function, health-related QOL

Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Risk of co-morbid conditions	No systematic review identified									1 ESR Insufficient evidence is available to determine the relationship of physical activity with risk of comorbid conditions in individuals with intellectual disabilities. **PAGAC Grade: Not assignable.**

Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Physical function	Maïano 2018 *(23)* Low	9 RCTs 6 before-after N=403	Serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	Possible publica-tion bias Effects higher for before-after studies than RCTs	Mean age was 13 years with most participants recruited from schools. Half had mild intellectual disabilities (53%) and most were males (71%). Seven studies used balance and/or strength exercises and remaining used computerized balance exercises, creative dance activities, hippotherapy exercises, rope-skipping exercise, swiss ball exercises, tai chi exercise, and trampoline with interventions lasting 6 to 16 weeks. Pooled analysis showed large and statistically significant improvement in static balance (ES = 0.98 [95% CI, 0.65 to 1.32], *p*<0.001, 11 studies) and dynamic balance (ES = 1.43 [95% CI, 0.71 to 1.97], *p*<0.001, 7 studies) among those in exercise groups vs. control groups.	VERY LOW[a]	3 ESRs Limited evidence suggests that physical activity improves physical function in children and adults with intellectual disabilities. **PAGAC Grade: Limited.**
	Maïano 2019 *(22)* Moderate	7 RCTs 4 NRSIs N=281	Serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	None	8/11 studies focused on children(mean age 12 years) with Down syndrome and 3/11 focused on adolescents (mean age 15 years) with Down syndrome. Interventions focused on balance and included walking backwards, hopscotch, computerized balance training using visual feedback, strengthening, vibration platforms, or combined exercise with interventions lasting 6 to 24 weeks. Among children, all studies showed that the exercise intervention groups had significant higher posttest static, dynamic, and static-dynamic balance than the control groups. None of the trials among adolescents found differences in any measures of balance between groups.	VERY LOW[b]	

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Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Health-related QOL	No systematic review identified									1 ESR Insufficient evidence is available to determine the relationship of physical activity with health-related quality of life in individuals with intellectual disabilities. **PAGAC Grade: Not assignable.**

Abbreviations: CI = confidence interval; ERS = existing systematic review; ES = effect size (Hedge's *g*); NR = not reported; NRSI = non-randomized study of an intervention; PAGAC = Physical Activity Guidelines Advisory Committee; QOL = quality-of-life; RCT = randomized clinical trial

† Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Certainty of evidence downgraded given serious risk of bias (12/15 studies were rated as having low quality), serious inconsistency (substantial statistical heterogeneity [I^2>70%] in all pooled analyses), serious indirectness (measures of static, dynamic , and static-dynamic balance of unclear clinical relevance), serious imprecision (wide CIs), and possible publication bias

[b] Certainty of evidence downgraded given serious risk of bias, inconsistency, serious indirectness (measures of static, dynamic , and static-dynamic balance of unclear clinical relevance), and serious imprecision (wide CIs)

Table F.1.d. People with Parkinson's disease, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with Parkinson's disease
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Physical function, cognitive function

Outcome	Systematic review evidence Review credibility		Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
		No. of studies/ Study design No. of participants	Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Physical function[a]	Dos Santos Delabary 2018 *(11)* Low	5 RCTs N=159	No serious risk of bias	No serious inconsistency	Serious indirectness	Serious imprecision	None	Mean age of participants ranged from 61 to 72 years; most participants were men. Studies represented older adults at all stage of Parkinson's disease (H&Y stage 0-4). Interventions consisted of any type of dance for at least 3 weeks of practice, with most consisting of Tango classes. Participants in dance groups were found to have more favorable outcomes related to motor symptoms (UPSDRS III scale), functional mobility (TUG test), endurance (6MWT), freezing of gait (FOG_Q), and velocity of forward and backward walking compared with no intervention or another form of exercise; although most differences between groups were not statistically significant.	MODERATE[b]	20 ESRs Strong evidence demonstrates that physical activity improves a number of physical function outcomes, including walking, balance, strength, and disease-specific motor scores in older adults with Parkinson's disease. **PAGAC Grade: Strong.**
	Cugusi 2017 *(8)* Low	6 RCTS N=221	No serious risk of bias	Serious inconsistency	Serious indirectness	No serious imprecision	None	Mean age of participants ranged from 40 to 80 years. Duration of Parkinson's ranged from 1.5 to 7 years since diagnosis at all stages (H&Y stage 1-4). Trials tested the differences between Nordic walking and other exercise protocols (5 studies) or no exercise (1 study) for 4-24 weeks. Mixed findings. 3/5 trials found greater improvements in motor symptoms (e.g.,	MODERATE[c]	

								UPSDRS III scale) and functional performance (e.g., 6MWT, TUG) in Nordic walking groups compared with other exercise groups and the remaining 2/5 found superior outcomes in the other exercise groups compared with the Nordic walking group.		
Outcome	**Systematic review evidence** **Review credibility**	**No. of studies/ Study design** **No. of participants**	**Quality Assessment** **Risk of bias**	**Inconsistency**	**Indirectness †**	**Imprecision**	**Other**	**Summary of findings**	**Certainty**	**US PAGAC evidence and conclusions *(39)***
Cognitive function[d]	Stucken-schneider 2019 *(32)* Moderate	11 RCTs N=508	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Mean age was 68 years and Parkinson's disease severity ranged from 1-4 on the H&Y. Five studies evaluated aerobic exercise, 1 studied resistance exercise, and 5 studied coordination exercise; intervention duration ranged from 4 and 26 weeks. Mixed evidence within and between studies on various measures of cognition. 1/7 studies found a statistically significant effect of an exercise intervention on global cognitive function vs. no exercise; 3/10 studies found an effect on executive function; 1/0 studies found an effect on memory. No studies found favorable effects of exercise vs. control on measures of attention or speed of processing.	HIGH[e]	1 ESR Moderate evidence indicates that moderate-to-vigorous physical activity can have beneficial effects on cognition in individuals with diseases or disorders that impair cognitive function, including attention deficit hyperactivity disorder, schizophrenia, multiple sclerosis, Parkinson's disease, and stroke. **PAGAC Grade: Moderate.**

Abbreviations: 6MWT = 6 min walk test; ESR = existing systematic review; FOG_Q = Freezing of Gait Questionnaire; H&Y = Hoehn and Yahr scale; PAGAC = Physical Activity Guidelines Advisory Committee; PDQ-39 = Quality of Life Parkinson's Disease Questionnare-39 items; QOL = quality of life; RCT = randomized clinical trial; TUG = timed up and go test; UPDRS III = Unified Parkinson's Diseases rating scale

† Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Two additional review *(10, 19)* identified, but were rated as critically low credibility and are not included
[b] Certainty of evidence downgraded due to serious indirectness (outcome measures), serious imprecision (small n's produced wide confidence intervals)
[c] Certainty of evidence downgraded due to serious inconsistency (mixed direction of effects), serious indirectness in outcome measures
[d] One additional review *(19)* identified, but was rated as critically low credibility and was not included
[e] Certainty of evidence not downgraded

[f] One additional review *(10)* identified, but was rated as critically low credibility and was not included

Table F.1.e. People with history of stroke, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with history of stroke
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Physical function, cognitive function

Outcome	Systematic review evidence Review credibility		Quality Assessment					Description of evidence Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
		No. of studies/ Study design No. of participants	Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Physical function[b]	Bonini-Rocha 2018 (23) Moderate	11 RCTs N = 750	Serious risk of bias	No serious inconsistency	Serious indirectness	Serious imprecision	None	Mean age was between 38 and 91 years old. Time of stroke diagnosis ranged from 1 to 157 months. Interventions included circuit-based exercises lasting from 4 to 19 weeks, with the frequency of exercise from 2 to 7 times per week for 30-90 minutes each session. Circuit-based training was associated with improvements in **gait speed** compared with other interventions (MD = 0.11 m/s [95% CI, 0.02 to 0.18; *p*=0.03; 7 trials; n=516). There was no effect of the intervention on **balance** or **functional mobility**.	LOW[c]	2 ESRs Moderate evidence indicates that that mobility-oriented physical activity improves walking function for individuals after a stroke. **PAGAC Grade: Moderate.**
	Boyne 2017 (24) Low	16 RCTs 4 NRSIs N=882	Serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	None	Participants ranged from 0.4 to 70 months post—stroke. Few other details provided regarding participants. Aerobic exercise was associated with greater change in **cardiorespiratory fitness** (VO_2Peak) than control groups (pooled MD = 2.2 mL/kg/min [95% CI 1.3 to 3.1], 16 trials, 598) and **walking speed** (MD = 0.06 m/s [95% CI, 0.01 to 0.11); 13 studies; n=415), but there was substantial heterogeneity present.	VERY LOW[d]	
Physical function[b]	Cugusi 2017b *(9)* Moderate	2 RCTs N = 50	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Mean age was 53 and 57 of two trial; stroke onset was >6 months in both studies. Both trials compared Nordic treadmill walking vs. standard treadmill training.	MODERATE[e]	

								Both studies found improvement in measures of **walking distance** and **walking endurance** in both groups, with only one trial reporting these improvements to be statistically significantly greater among the Nordic walking group.		
	Ge 2017 (26) Moderate	31 RCTs N=2,349	Serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	No evidence of a dose-response relation-ship	Traditional Chinese exercise included Tai Chi (20 studies), Yijinjing (2 studies, Daoyin (3 studies), and Baduanjin (6 studies) ranging from 2 to 52 weeks duration. Traditional Chinese exercises compared with control groups were associated with **limb motor function** (SMD = 1.21 [95% CI, 0.66 to 1.77] *p*< 0.01), **balance function** (SMD = 2.07 [95% CI, 1.52 to 2.62, *p*< 0.01), **timed-up-and-go test** (MD = -1.77 [95%CI, -2.87 to -0.67], *p*< 0.01), and **ADLs** (MD = 15.60 [95% CI, 7.57 to 23.63, *p*< 0.01).	MODERATE[f]	
	Li 2018 (29) Low	5 RCTs N = 346	Serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Mean age ranged from 55 to 73 years old. All studies evaluated the effects of 6 to 12 weeks of tai chi on standing balance and gait ability. A significant association was found for participants of tai chi vs. control groups for **gait ability** (e.g., TUG) (SMD = -0.26 [95% CI, -0.50 to -0.03]; *p*=0.027; 5 trials), but not **standing balance** (SMD = 0.15 [95% CI, -0.26 TO==to -0.59]; *p*=0.475; 3 trials).	LOW[f]	
	Miranda 2018 (30) Low	2 RCTs N = 39	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Mean age was 63 and 68 years. One study reported greater improvement in **functional status** (TUG) and **cardiorespiratory fitness** (VO_2max) among those in a Pilates intervention group vs. control. The other study reported greater improvement in **balance** among those in the Pilates vs. control.	MODERATE[g]	
	Patterson 2018 *(28)* Moderate	2 case reports 1 before-after N = 11	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	All 3 studies reported improvements in balance (BBS) 1 to 8 weeks following a dance intervention.	VERY LOW[h]	
Physical function[b]	Pogrebnoy 2019 (31) Low	8 RCTs N = 499	No serious risk of bias	No serious inconsistency	Serious indirectness	Serious imprecision	None	Participants were mostly male with a mean age of 69 years. Range of 2.5 to 71 months post-stroke with most not reporting severity of stroke score. All trials evaluated outpatient exercise programs,	MODERATE[i]	

								including aerobic and resistance training from 12 weeks to 6 months in duration. Meta-analysis found that combined aerobic and resistance training was associated with improved **habitual walking speed** (MD 0.07 m/s [95% IC -0.01 to 0.16], 5 trials, n=248) and **walking enduran**ce (MD = 39.2 [95% CI 17.2 to 61.2], 6 trials, n=320) compared with usual care. There was no difference between groups for the TUG test and stair climb.		
	Schröder 2018 *(30)* Low	4 RCTs 2 case studies 1 case-control N = 120	Serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	None	Included stroke patients in the late sub-acute (3-6 months post-stroke) and chronic (>6 months post-stroke) phase. Most studies included persons at mild-to-moderate disability (BBS score>31). Interventions included tele-rehabilitation or virtual reality exercise interventions (e.g., Wii, PlayStation 2 EyeToy, Microsoft Kinect). All four RCTs found improvements in measures of **balance** (BBS), but there were no statistically significant differences between groups. Observational studies reported feasibility of interventions.	LOW[f]	
	Wiener 2019 (33) Low	3 RCTs 3 before-after N = 140	No serious risk of bias	No serious inconsistency	Serious indirectness	Serious impression	None	HIIT protocols (treadmill or bicycle training) ranged 20 to 30 minutes per session, 2 to 5 times a week, for 2 to 8 weeks total. Significant improvements in **cardiorespiratory fitness** were seen among HIIT participants but were not statistically significantly different than those in moderate-intensity exercise groups. There was no consistent effect of HIIT on measures of **balance** or **functional mobility.**	LOW[j]	
	Zou 2018a *(37)* Low	20 RCTs N = 1,286	Serious risk of bias	No serious inconsistency	Serious indirectness	Serious imprecision	None	Mean age ranged from 43 to 78 years old; course of disease varied from 14.5 days to 82 months; stroke type was often not reported. Interventions included qigong (4 study), yoga (2 studies), and tai chi (14 studies) for a duration of 4 to 12 weeks. Only 1 study included longer term follow-up at 12 months. Mind-body exercises were associated with greater **sensorimotor function of the lower limb** (SMD = 0.79 [95% CI, 0.43 to 1.15]; *p*<0.01; 8 trials;	LOW[k]	

								n=371), **upper limb function** (SMD = 0.7 [95% CI, 0.39 to 1.01]; *p*<0.001; 6 trials; n=276), and **gait speed** (SMD = 0.24 [95% CI, 0.01 to 0.48]; *p*=0.04; 5 trials; n=288). Mind-body exercises were not statistically significantly associated with **overall motor function** (SMD = 0.26 [95% CI, -0.06 to 0.57]; *p*=0.011; 3 trials; n=198).		
Physical function[b]	Zou 2018b (36) Low	16 RCTs N = 1,136	Serious risk of bias	Serious inconsistency	No serious indirectness	Serious imprecision	None	Course of stroke disease ranged from 2 weeks to 82 months. Interventions included qigong (1 study), toga (1 study), and tai chi (14 studies) for a duration of 4 to 12 weeks. Only 2 studies included longer term follow-up at 6 and 12 months. Mind-body exercises were associated with significantly improved **ADLs** (Hedge's g = 1.31 [95% CI, 0.85 to 1.77], *p*<0.001, 6 trials) and **mobility** (Hedge's g = 0.67 [95% CI, 0.25 to 1.09], *p*<0.001, 5 trials).	VERY LOW[l]	
Cognitive function	No systematic review identified[m]									1 ESR Moderate evidence indicates that moderate-to-vigorous physical activity can have beneficial effects on cognition in individuals with diseases or disorders that impair cognitive function, including attention deficit hyperactivity disorder, schizophrenia, multiple sclerosis, Parkinson's disease, and stroke. **PAGAC Grade: Moderate.**

Abbreviations: ADL = activities of daily living; BBS = Berg Balance Scale CI = confidence interval; ESR = existing systematic review; HIIT = high-intensity interval training; MD = mean difference; m/s = meters per second; NR = not reported; NRSI = non-randomized study of an intervention; PAGAC = Physical Activity Guidelines Advisory Committee; QOL = quality of life; RCT = randomized clinical trial; SMD = standardized mean difference; TUG = Timed Up and Go test

[†] Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Certainty of evidence downgraded given serious risk of bias (lack of blinding of outcome assessors, missing data), serious inconsistency (substantial statistical heterogeneity), and serious imprecision (very wide CIs)
[b] Three additional reviews were identified *(18, 34, 36)* but were rated as critically low credibility and are not included
[c] Certainty of evidence downgraded given serious risk of bias, serious indirectness (variable and distally measured outcomes), and serious imprecision (wide CIs, small n's)
[d] Certainty of evidence downgraded given serious risk of bias, serious inconsistency (substantial statistical heterogeneity, I^2>70%), and serious imprecision (wide CIs, small n's)
[e] Certainty of evidence downgraded given considerable indirectness in interventions and outcome measures
[f] Certainty of evidence downgraded given serious risk of bias and serious indirectness of measures
[g] Certainty of evidence downgraded given considerable indirectness in interventions and outcome measures
[h] Certainty of evidence not upgraded
[i] Certainty of evidence assigned by review authors as High for habitual walking speed and Low for walking endurance given serious imprecision. Further downgraded here given serious indirectness of outcome measures and comparators
[j] Certainty of evidence downgraded given serious indirectness (intervention protocols and outcome measures) and serious imprecision
[k] Certainty of evidence downgraded given serious risk of bias (lack of blinding of outcome assessors, missing data), serious indirectness (variable distal outcome measures), and serious imprecision (very wide CIs)
[l] Certainty of evidence downgraded given serious risk of bias (lack of blinding of outcome assessors, missing data), serious inconsistency (substantial statistical heterogeneity), and serious imprecision (very wide CIs)
[m] One additional review was identified *(18, 34, 36)* but was rated as critically low credibility and was not included

Table F.1.f. People with major clinical depression, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with major clinical depression
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Health-related QOL

Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Health-related QOL	Stubbs 2018[a] *(31)* Moderate	1 ESR (6 RCTs, N=198)	NA[c]					One high credibility review found exercise was associated with improved overall QOL (SMD = 0.39 [95% CI, 0.27 to 0.74], *p*=0.002, 5 trials) and physical and psychological QOL domains. There was no effect seen for social or environmental QOL domains.	MODERATE[g, h]	3 ESRs Limited evidence suggests that physical activity improves quality of life for adults with major clinical depression. **PAGAC Grade: Limited**
	Krogh 2017 *(20)* Moderate	9 RCTs N=827	Serious risk of bias	Serious inconsistency	Serious indirectness	Serious imprecision	NR	Mean age ranged from 21 to 75 years and 5 trials included participants with a mean age >60 years. Ten trials included inpatients. Comparisons were variable including exercise intervention vs. control group, comparison of various intensities of exercise, and comparison of one type of exercise vs. another. Pooled analysis found no statistically significant difference in QOL scores among exercise vs. control groups (SMD = 0.40 [95% CI, -0.03 to 0.83], 9 trials).	VERY LOW[ii]	

Abbreviations: CI = confidence interval; CRF = cardiorespiratory fitness; ESR = existing systematic review; NA = not applicable; NR = not reported; NRSI = non-randomized study of an intervention; PAGAC = Physical Activity Guidelines Advisory Committee; QOL = quality of life; RCT = randomized clinical trial; RR = risk ratio; SMD = standardized mean difference

[†] Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Both Stubbs et al. 2018 and Ashdown-Franks et al. 2019 were review-of-reviews and included the same existing systematic reviews for evidence related to adults with major depression
[b] Total N calculated by adding n's of each review; total number may be lower if reviews included overlapping studies
[c] Not able to assign given review-of-review methodology
[d] Certainty of evidence not downgraded
[e] Stubbs 2018 *(31)* rated as 1+ evidence (Well-conducted meta-analyses, systematic reviews or RCTs with a low risk of bias)
[f] As reported by review authors. Certainty of evidence downgraded due to serious risk of bias of included studies, serious inconsistency (I2>70%), serious indirectness (heterogeneity and applicability of populations and comparisons), and possible publication bias
[g] Certainty of evidence downgraded given limited number of RCTs with no long-term data
[h] Stubbs 2018 *(31)* rated as -1 evidence (Meta-analyses, systematic reviews or RCTs with a high risk of bias)
[i] As reported by review authors. Certainty of evidence downgraded given serious risk of bias, inconsistency, and imprecision

Table F.1.g. People with schizophrenia, relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with schizophrenia
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Cognitive function, health-related QOL

Outcome	Systematic review evidence Review credibility		Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
		No. of studies/ Study design No. of participants	Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Cognitive function	Firth 2017[f] *(13)* Low	10 RCTs N=455	No serious risk of bias	No serious inconsistency	Serious indirectness	No serious imprecision	Evidence of a dose-response relation-ship	Mean age of participants was 37.3 years (range 23-55 years). Ninety-two percent had schizophrenia/schizoaffective disorder and 7.9% had other nonaffective psychotic disorders and mean duration of illness was 13.4 years. About half (56%) of the total sample was male. Exercise programs were, on average, 12.2 weeks long and primarily focused on aerobic exercise. Exercise was statistically significant associated with improved global cognition (Hedge's g = 0.33 [95% CI, 0.13 to 0.53], *p*=0.001), working memory, social cognition, and attention/vigilance but there was no effect on processing speed, verbal memory, visual memory, reasoning, and problem solving.	HIGH[g]	1 ESR Moderate evidence indicates that moderate-to-vigorous physical activity can have beneficial effects on cognition in individuals with diseases or disorders that impair cognitive function, including attention deficit hyperactivity disorder, schizophrenia, multiple sclerosis, Parkinson's disease, and stroke. **PAGAC Grade: Moderate.**
Health-related QOL	Stubbs 2018[a] *(31)* Moderate	1 ESR (3 RCTs, N=NR)	NA[b]					Two RCTs, which both used 120 min of MVPA per week, reported significant improvements in QOL and disability, whilst 1 RCT of lower intensity did not lead to any significant results.	LOW[d, e]	3 ESRs Moderate evidence indicates that physical activity improves quality of

						life in individuals with schizophrenia. **PAGAC Grade: Moderate.**

Abbreviations: ESR = existing systematic review; MVPA = moderate-to-vigorous physical activity; NA = not applicable; NR = not reported; PAGAC = Physical Activity Guidelines Advisory Committee; SMD = standardized mean difference; QOL = quality of life; RCT = randomized clinical trial

[†] Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Both Stubbs et al. 2018 and Ashdown-Franks et al. 2019 were review-of-reviews and included the same existing systematic review
[b] Not able to assign given review-of-review methodology
[c] Certainty of evidence downgraded given small number of RCTs and low credibility of review
[d] Stubbs 2018 *(31)* rated as -1 evidence (Meta-analyses, systematic reviews or RCTs with a high risk of bias)
[e] Certainty of evidence downgraded given small number of studies and sample size
[f] Review also included in review-of-reviews by Stubbs et al. 2018 *(31)* and Ashdown-Franks et al. 2019 *(2)*
[g] Certainty of evidence not downgraded

Table F.1.h. People with attention deficit hyperactivity disorder (ADHD), relationship between physical activity and health-related outcomes

Questions: What is the association between **physical activity** and health-related outcomes?
Population: People with attention deficit hyperactivity disorder (ADHD)
Exposure: Greater volume, duration, frequency, or intensity of physical activity
Comparison: No physical activity or lesser volume, duration, frequency, or intensity of physical activity
Outcome: Cognitive function

Outcome	Systematic review evidence Review credibility	No. of studies/ Study design No. of participants	Quality Assessment					Summary of findings	Certainty	US PAGAC evidence and conclusions *(39)*
			Risk of bias	Inconsistency	Indirectness †	Imprecision	Other			
Cognitive function	Ashdown-Franks 2019[a, d] *(2)* Moderate	1 ESR (5 RCTs, N=NR)	NA[b]					One low credibility review of 5 RCTs found evidence to suggest that exercise is more effective than usual are or education in children (mean age 11 years) on measures of attention (SMD = 0.84 [95% CI, 0.48 to 1.20], trials NR) and executive function (SMD = 0.58 [95% CI, 0.15 to 1.00], 3 trials, n=102), and social disorders (SMD =0.59 [95% CI 0.03 to 1.16], 2 RCTs, n=53).	LOW[c]	2 ESRs Moderate evidence indicates that moderate-to-vigorous physical activity can have beneficial effects on cognition in individuals with diseases or disorders that impair cognitive function, including attention deficit hyperactivity disorder, schizophrenia, multiple sclerosis, Parkinson's disease, and stroke. **PAGAC Grade: Moderate.**

Abbreviations: ESR = existing systematic review; NR = not reported; PAGAC = Physical Activity Guidelines Advisory Committee; RCT = randomized clinical trial; QOL = quality of life

† Serious indirectness indicates measurement of intermediate/indirect outcomes or heterogeneity in exposures and comparisons assessed; certainty of evidence was not always downgraded for indirectness if it was not judged to impact the certainty in the findings for the outcome evaluated in the review

[a] Review-of-reviews

[b] Not able to assign given review-of-review methodology
[c] Certainty of evidence downgraded given small number of trials and unknown risk of bias, consistency, and precision
[d] Two additional reviews *(7 Suarez-Manzano, 2018 #113)* were identified but were rated as critically low credibility and are not included

APPENDIX A. DATA EXTRACTIONS

SCI 1. SYSTEMATIC REVIEW **Citation:** A. C. Eitivipart; C. Q. Oliveira; M. Arora; J. Middleton; G. M. Davis (2019) Overview of Systematic Reviews of Aerobic Fitness and Muscle Strength Training after Spinal Cord Injury	
Purpose: This overview was undertaken to assimilate evidence about the effectiveness of different types of physical activities, exercises, and therapeutic interventions for improving aerobic fitness and muscle strength in people with SCI. **Timeframe:** Variable start dates to 2018 **Total # studies included:** 16 **Other details (e.g. definitions used, exclusions etc)** Adults over the age of 16 **Outcomes addressed:** Aerobic fitness and muscle strength	**Abstract:** The number of systematic reviews on the effects of exercise on aerobic fitness and muscle strength in people with spinal cord injury (SCI) has recently increased. However, the results of some of these reviews are inconclusive or inconsistent. To strengthen recommendations, this overview was undertaken to assimilate evidence about the effectiveness of different types of physical activities, exercises, and therapeutic interventions for improving aerobic fitness and muscle strength in people with SCI. Cochrane Overview of reviews methods were adopted to undertake this overview. An online search was conducted in August 2018 on eight databases based on predefined search criteria. Potential systematic reviews were screened, selected, and assessed on methodological quality by two independent authors, and discussed and resolved with a third author, when necessary. Only systematic reviews published in the English language were included. The protocol was registered on PROSPERO. Overall, 16 systematic reviews were included (aerobic fitness, n = 10; muscle strength, n = 15). For all 16 reviews, the quality of evidence was rated as critically low." Despite low evidence, this overview strengthens the existing guidelines for people with SCI, providing specific advice on exercise domains (types, intensities, frequency, and duration) for improving aerobic fitness and muscle strength. The evidence from this overview suggests that ergometry training with/without additional therapeutic interventions (20 min, moderate to vigorous intensity, twice weekly for 6 weeks) may improve aerobic fitness; similarly, resistance training with/without additional therapeutic interventions (three sets of 8-10 repetitions, moderate to vigorous intensity, twice weekly for 6 weeks) may improve muscle strength."

SCI 2 SYSTEMATIC REVIEW

Citation: R. Gaspar; N. Padula; T. B. Freitas; J. P. J. de Oliveira; C. Torriani-Pasin (2019) Physical Exercise for Individuals With Spinal Cord Injury: Systematic Review Based on the International Classification of Functioning, Disability, and Health

Purpose: To review and evaluate the literature on physical exercise interventions for individuals with SCI, based on the International Classification of Functioning, Disability and Health, as well as physiological parameters for exercise prescription

Timeframe:
August 2016 – February 2017

Total # studies included: 25

Other details (e.g. definitions used, exclusions etc)

Outcomes addressed:
Gait performance
Quality of life
Depression

Abstract:
Introduction: Considering the reduction of physical activity performed daily in people with spinal cord injury, it is necessary to analyze the interventions based on physical exercises in order to provide recommendations based on evidence. Objectives: To review and evaluate the literature on physical exercise interventions for individuals with SCI, based on the International Classification of Functioning, Disability and Health, as well as physiological parameters for exercise prescription. Method: A systematic review of the literature produced from August 2016 to February 2017 within the PubMed, Embase, Cochrane Library, and MEDLINE databases. Results: Two independent examiners conducted a search in which 223 articles were initially found. A third evaluator verified possible divergences and generated a final list of 25 articles that strictly met the inclusion criteria, 5 of which investigated the effects of aerobic exercise, 2 of resistance training, 2 of balance training, 12 of gait training, and 4 evaluating the combined effect of 2 or more forms of training. Conclusion: Considering studies classified as of high and moderate quality of evidence, positive effects were observed in the domains of structures and functions, in aerobic, resistance training and combined exercises, and in some studies with gait training. In the domain of activities and participation, positive effects were observed in the studies with gait training, balance training, and combined interventions.

SCI 3 SYSTEMATIC REVIEW

Citation: F. C. M. Melo; K. K. F. de Lima; A. Silveira; K. P. M. de Azevedo; I. K. Dos Santos; H. J. de Medeiros; J. C. Leitao; M. I. Knackfuss (2019) Physical Training and Upper-Limb Strength of People With Paraplegia: A Systematic Review

Purpose: To investigate the scientific implications of the impact of physical training on the strength of the upper limbs of people with paraplegias	**Abstract:** CONTEXT: Physical training improves the strength of upper limbs, contributing directly to the performance of activities of daily life, confirming one more time that the strengthened muscle is imperative for a rapid rehabilitation. OBJECTIVE: To investigate the scientific implications of the impact of physical training on the strength of the upper limbs of people with paraplegias. EVIDENCE ACQUISITION: The search strategy with truncations and Boolean operator was defined as: (spinal cord inju* OR traumatic myelopat* OR paraplegi*) AND (physical exercise OR strength training OR resisted training) AND (upper limb* OR arm OR armrest), for all of the databases. There were included experimental and quasi-experimental studies, published in the English language and with the complete text available, with at least 1 physical exercise that worked with the strength of the upper limbs. Two independent evaluators extracted from each article data on study characteristics (publishing year, country of origin, and study design), of the subjects (gender and age), and of the disability (level of lesion and cause). EVIDENCE SYNTHESIS: Seven articles were included in the systematic revision. The procedure used the most for measuring the maximum strength was the 1-repetition maximum test, followed by the isokinetic dynamometer and Quantitative Muscle Testing System. Furthermore, the most commonly associated variables in the included studies were pain in the shoulder, cardiorespiratory capacity, and functionality, respectively. The results showed that all of the variables improved because of the training. CONCLUSIONS: The training improved the strength, the functionality, and reduced the pain in the shoulder of the people with paraplegia.
Timeframe: Inception – November 2015	
Total # studies included: 7	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Upper limb strength	

ID 1: Systematic Review & Meta-Analysis

Citation: C. Maiano; O. Hue; G. Lepage; A. J. S. Morin; D. Tracey; G. Moullec 2019 Do Exercise Interventions Improve Balance for Children and Adolescents With Down Syndrome? A Systematic Review 10.1093/ptj/pzz012

Purpose:
To investigate the effects of exercise interventions designed to improve balance in young people with intellectual disabilities.

Timeframe: 1991-2017 search conducted March 17th, 2018

Total # studies included: 15

Other details (e.g. definitions used, exclusions etc) In English/ school-aged (from 5–22y) with intellectual disabilities or mixed samples.
Subpopulation excluded.
Exercise intervention to improve balance.
Quasi-experimental or experimental design.

Outcomes addressed: Static and dynamic Balance

Abstract: AIM To conduct a systematic review and meta-analysis of the effects of exercise interventions designed to improve balance in young people with intellectual disabilities. **METHOD** A systematic literature search was performed on 10 databases. Studies in press or published in English in a peer-reviewed journal were included if: (1) participants were young people with intellectual disabilities; (2) exercise interventions were designed to improve balance; and (3) they used quasi-experimental or experimental designs. Studies focusing only on a specific subpopulation of young people with intellectual disabilities or having a specific physical characteristic were excluded. Risk of bias was assessed for randomization, allocation sequence concealment, blinding, incomplete outcome data, selective outcome reporting, and other biases. **RESULTS** The search strategy identified 937 articles and 15 studies, published between 1991 and 2017, that met the inclusion criteria. Exercise intervention groups showed a significant and larger improvement in static (pooled effect size, Hedges' g=0.98) and dynamic (g=1.34) balance compared with the control groups. However, although the pooled improvement of static–dynamic balance was large (g=2.80), the result was non-significant. None of the subgroup analyses were significant, except for the improvement in: (1) static balance (higher in quasi-experimental than in experimental studies); and (2) dynamic balance (higher in young people with a mild vs a mild–moderate intellectual disability). **INTERPRETATION** The reviewed exercise interventions seem to represent an effective means for improving the static and dynamic balance of young people with intellectual disabilities. However, the present findings should be considered as preliminary given the small number of studies and their limitations.

ID2: Systematic Review and Meta-Analysis **Citation:** C. Maiano; O. Hue; A. J. S. Morin; G. Lepage; D. Tracey; G. Moullec 2019 Exercise interventions to improve balance for young people with intellectual disabilities: a systematic review and meta-analysis 10.1111/dmcn.14023	
Purpose: to summarize the findings from studies examining the effects of exercise interventions designed to improve balance in youths with Down syndrome. **Timeframe:** 2010-2017 **Total # studies included:** 11 **Other details (e.g. definitions used, exclusions etc) Exclusion criteria:** Case study. Mean age < 18. Not Balance intervention. Not intervenion study. No control. Sample of infants. **Outcomes addressed:** static and dynamic balance/ postural stability	**Abstract: Background.** Youths with Down syndrome are characterized by deficits in balance/postural stability. One way to palliate balance deficits among this population is through exercise interventions. However, to the authors' knowledge, the effects of exercise interventions designed to improve the balance of youths with Down syndrome have never been systematically reviewed. **Purpose.** The purpose of this review was to summarize the findings from studies examining the effects of exercise interventions designed to improve balance in youths with Down syndrome. **Data Sources.** A systematic literature search was performed in 10 databases (Academic Search Complete, CINAHL Plus With Full-Text, Education Source, ERIC, Medline With FullText, PsycARTICLES, Psychology and Behavioral Sciences Collection, Scopus, SocINDEX, and SPORTDiscus With Full-Text) on June 12, 2017. Study Selection. Randomized controlled trials and controlled trials examining the effects of exercise interventions designed to improve balance in youths with Down syndrome were included. **Data Extraction.** Two authors selected the studies and extracted their characteristics and results. Three authors assessed the risk of bias in the studies using the Cochrane Collaboration tool. Data Synthesis. Eleven studies, published between 2010 and 2017, met the inclusion criteria. The findings showed that exercise interventions were more effective than control conditions for improving the static balance of children with Down syndrome and the static-dynamic balance (ie, global balance score obtained with a scale measuring both static and dynamic balance) of children and adolescents with Down syndrome. Nevertheless, the findings on dynamic balance in children and static balance in adolescents were inconclusive. **Limitations.** With a small number of studies and their high risk of bias, the present findings must be interpreted with caution. **Conclusions.** The reviewed exercise interventions were successful in improving the static balance of children with Down syndrome and the static-dynamic balance of children and adolescents with Down syndrome.

MS 1. Systematic review with Meta-analysis **Citation:** K. B. Alphonsus; Y. Su; C. D'Arcy 2019. The effect of exercise, yoga and physiotherapy on the quality of life of people with multiple sclerosis: Systematic review and meta-analysis 10.1016/j.ctim.2019.02.010	
Purpose: examine the effect of exercise, yoga and physiotherapy on the physical, mental and social QOL among individuals living with MS **Timeframe:** 1990-2017 **Total # studies included:** 18 **Other details (e.g. definitions used, exclusions etc)** Quality of life (QOL) was categorized into three	**Abstract: Introduction:** Multiple sclerosis (MS) is a chronic autoimmune disease affecting the myelinated axons of the central nervous system causing neurological deterioration. People living with MS have a poor quality of life (QOL) because of the symptoms caused by the disease and there are various types of treatments to manage the symptoms aside from medication. **Objective:** This meta-analysis examines the effect of exercise, yoga and physiotherapy on the physical, mental and social QOL among individuals living with MS. **Setting:** A systematic review with meta-analysis was conducted using PubMed, Medline, and Scopus from 1990 to 2017. The standard mean difference scores were computed in each study for the domains of physical, mental and social functioning. **Results:** Eighteen studies met the inclusion criteria for this meta-analysis. Aerobic exercise was effective in improving satisfaction with physical functioning,d = 0.35 (95% CI = 0.08 to 0.62), mental functioning d = 0.42 (95% CI = 0.11 to 0.72), and social functioning d = 0.42 (95% CI = 0.15 to 0.69). Physiotherapy was also found to be effective for physical functioning d = 0.50 (95% CI 0.19 to 0.80), mental functioning d = 0.44 (95% CI 0.14 to 0.75) and social functioning d = 0.60 (95% CI 0.21 to 0.90). However yoga and combination of exercises did not have a significant effect on any of the QOL domains. **Conclusion:** These findings suggest that aerobic exercise and physiotherapy improves the satisfaction of MS

domains: a) physical, b) mental and c) social health.	patients with their physical, mental and social functioning and may be included as normal practice in the treatment of MS.
Outcomes addressed: QoL	

MS 2. Systematic Review **Citation:** E. Campbell; E. H. Coulter; L. Paul 2018 High intensity interval training for people with multiple sclerosis: A systematic review 10.1016/j.msard.2018.06.005	
Purpose: investigate the efficacy and safety of HIIT in people with MS	**Abstract: Background:** Aerobic high intensity interval training (HIIT) is safe in the general population and more efficient in improving fitness than continuous moderate intensity training. The body of literature examining HIIT in multiple sclerosis (MS) is expanding but to date a systematic review has not been conducted. The aim of this review was to investigate the efficacy and safety of HIIT in people with MS. **Methods:** A systematic search was carried out in September 2017 in EMBASE, MEDline, PEDro, CENTRAL and Web of Science Core collections using appropriate keywords and MeSH descriptors. Reference lists of relevant articles were also searched. Articles were eligible for inclusion if they were published in English, used HIIT, and included participants with MS. Quality was assessed using the PEDro scale. The following data were extracted using a standardised form: study design and characteristics, outcome measures, significant results, drop-outs, and adverse events. **Results:** Seven studies (described by 11 articles) were identified: four randomised controlled trials, one randomised cross-over trial and two cohort studies. PEDro scores ranged from 3 to 8. Included participants (n = 249) were predominantly mildly disabled; one study included only people with progressive MS. Six studies used cycle ergometry and one used arm ergometry to deliver HIIT. One study reported six adverse events, four which could be attributed to the intervention. The other six reported that there were no adverse events. Six studies reported improvements in at least one outcome measure, however there were 60 different outcome measures in the seven studies. The most commonly measured domain was fitness, which improved in five of the six studies measuring aspects of fitness. The only trial not to report positive results included people with progressive and a more severe level of disability (Extended Disability Status Scale 6.0–8.0). **Conclusion:** HIIT appears to be safe and effective in increasing fitness in people with MS and low levels of disability. Further research is required to explore the effectiveness of HIIT in people with progressive MS and in those with higher levels of disability.
Timeframe: inception - 2017	
Total # studies included: 7	
Other details (e.g. definitions used, exclusions etc) included if Human subjects, English, used HIIT, and included participants with MS or mixed with separate reporting for MS. Included clinical trials using HIIT or combination.	
Outcomes addressed: cardiovascular fitness and muscle strength	

MS 3: Systematic Review **Citation:** S. Charron; K. A. McKay; H. Tremlett 2018 Physical activity and disability outcomes in multiple sclerosis: A systematic review (2011-2016) 10.1016/j.msard.2018.01.021	
Purpose: examining the relationship between physical activity and physical ability outcomes in persons with MS	**Abstract: Background:** Physical activity may be neuroprotective in multiple sclerosis (MS). One review (2011) of exercise and MS disability was inconclusive, but highlighted the need for more studies. **Objective:** To perform an updated systematic literature review examining the relationship between physical activity and physical ability outcomes in persons with MS. **Methods:** EMBASE and MEDLINE were searched for original interventional studies (2011–2016) evaluating exercise on quantitative outcomes of physical disability in MS. We also assessed any reported adverse outcomes. **Results:** Of the 153 articles identified, 12 were included; 3 examined endurance training; 6 resistance training; and 3 explored less conventional exercises, specifically, tai chi, kickboxing, and vestibular rehabilitation, each lasting 5–24 weeks. In total, 568 unique individuals were included, and > 10 different scales used to assess outcomes. Endurance training provided benefits in walking ability, while mindfulness exercises (tai chi and vestibular rehabilitation), and dynamic workouts (kickboxing) led to improvements in balance and coordination. Resistance training alone did not improve walking ability, but improved lower limb muscular strength and endurance. When resistance and endurance training were combined, improvements were seen in mobility, balance and coordination. Four studies assessed discontinuation; most reported a return to pre-intervention function. Adverse outcomes were reported in 6 studies, and appeared generally mild, ranging from mild muscle soreness to exacerbation of MS symptoms. **Conclusions:** Physical activity was associated with measurable benefits on ability outcomes, but continuation is likely required to maintain benefits. While adverse events were generally mild, approximately half of studies actually reported safety outcomes.
Timeframe: 2011-2016	
Total # studies included: 12	
Other details (e.g. definitions used, exclusions etc) Studies were in English. Populations with MS. Impact of a physical activity- intervention /quantitative measure of ability/ disability as an outcome	
Outcomes addressed: physical ability outcomes	

MS 4 Meta-Analysis and Scoping Study **Citation:** A. Manca; Z. Dvir; F. Deriu 2019 Meta-analytic and Scoping Study on Strength Training in People With Multiple Sclerosis 10.1519/jsc.0000000000002381	
Purpose: determine a pooled estimate of effect on muscle strength and functional capacity induced by strength training in people with multiple sclerosis	**Abstract:** Aim of the study was to determine a pooled estimate of effect on muscle strength and functional capacity induced by strength training in people with multiple sclerosis (PwMS). Five databases and 2 public registries were searched from inception to May 2017. Indexing terms used were: "multiple sclerosis," "resistance training," and "strength training." After title/abstract screening, 2 independent reviewers evaluated the studies' eligibility, which were retained if PwMS were randomly assigned to strength training or to a no intervention group. Of the 1,467 items retrieved, 30 randomized controlled trials formed the initial database with 11 trials (426 subjects) entering the final meta-analysis. The quality of the included studies was assessed by the PEDro scale and the risk of bias using the Cochrane Risk-of-Bias tool. All meta-analyses were conducted using a random effects model. After interventions, PwMS increased strength by 23.1% (confidence interval [CI] 11.8–34.4; +12.1 N; CI 4.5–19.8; p = 0.002; n = 366 subjects) at a small-to moderate effect size (0.37; CI 0.2–0.6). Walking speed increased by 16.3 6 10.7% (p = 0.0002; effect size 0.54; n = 275 subjects), distance covered in the 2-minute walking test by 6.7 6 6.4% (p = 0.04; effect size 0.50; n = 111 subjects). People with MS respond to resistance training with consistent strength gains. Methodological inconsistencies among studies and inadequate reporting of the findings limited a comprehensive determination of the impact of strength improvements on patient functioning, except for walking performance which seemed significantly improved. Methodological steps and scoping lines are provided to establish a common platform for future trials.
Timeframe: inception to May 2017	
Total # studies included: 11	
Other details (e.g. definitions used, exclusions etc) Exclusions - absence of control, healthy controls, combined training, unconventional protocols/ same dataset as other study	
Outcomes addressed: muscle strength and functional capacity	

<table>
<tr><td colspan="2">MS 5 Integrative Review (SysRev)
Citation: J. D. Morrison; L. Mayer 2017 Physical activity and cognitive function in adults with multiple sclerosis: an integrative review 10.1080/09638288.2016.1213900</td></tr>
<tr><td>Purpose: To identify and synthesize the research evidence concerning (1) the relationship between physical activity and cognitive performance in persons with multiple sclerosis (MS) and (2) to review the reported effects of physical activity interventions on neurocognitive performance conducted in this population</td><td rowspan="5">Abstract: Purpose: To identify and synthesize the research evidence concerning (1) the relationship between physical activity and cognitive performance in persons with multiple sclerosis (MS) and (2) to review the reported effects of physical activity interventions on neurocognitive performance conducted in this population. Methods: Relevant peer-reviewed journal articles were identified by searching PubMed, PsychINFO, and SPORTDiscus through May 2016. Full-text articles meeting the inclusion criteria were evaluated for quality using tools developed by the National Institutes of Health. Studies deemed to be of poor quality were excluded from the review. Results: Nineteen studies meeting the inclusion/exclusion criteria were analyzed. Nine studies reported significant relationships between higher levels of physical activity or cardiorespiratory fitness and measures of cognitive function. Data extracted from 10 physical activity intervention studies reported mixed results on the effectiveness of physical activity to improve selected domains of cognitive function in persons with MS. Conclusion: Although correlational studies provide evidence to support a linkage between physical activity and cognitive function in persons with MS, this linkage is confounded by factors that may have influenced the studies' results. Evidence derived from intervention studies that could support a positive effect of physical activity on cognition in persons with MS is equivocal.</td></tr>
<tr><td>Timeframe: inception to May 2016</td></tr>
<tr><td>Total # studies included: 19</td></tr>
<tr><td>Other details (e.g. definitions used, exclusions etc) MS age 18 or older and that addressed both physical activity and cognitive function. In English. Self-report of cognitive impairment excluded.</td></tr>
<tr><td>Outcomes addressed: cognition</td></tr>
</table>

MS 6 Meta-Analysis

Citation: D. Veneri; M. Gannotti; M. Bertucco; S. E. Fournier Hillman 2018 Using the International Classification of Functioning, Disability, and Health Model to Gain Perspective of the Benefits of Yoga in Stroke, Multiple Sclerosis, and Children to Inform Practice for Children with Cerebral Palsy: A Meta-Analysis
10.1089/acm.2017.0030

Purpose: to determine the domains of the International Classification of Functioning, Disability, and Health (ICF) model and levels of evidence for yoga and adults with stroke and multiple sclerosis (MS), and children	**Abstract: Objective**: Research pertaining to yoga and children with cerebral palsy (CP) is negligible. The primary purpose of this study was to determine the domains of the International Classification of Functioning, Disability, and Health (ICF) model and levels of evidence for yoga and adults with stroke and multiple sclerosis (MS), and children. A secondary purpose was to decide whether any inferences could be made for children with CP. **Design:** This study included a meta-analysis. Interventions: A systematic review was performed of yoga and said populations. Outcome measures were categorized according to the ICF model domains of body structures and function, activity, and quality of life. Effect sizes (ESs) were calculated by using Cohen's d. Since there were few commonalities among outcome measures and reporting of outcomes within and among diagnostic groups, direct comparisons of ESs were difficult. Hence, we chose to evaluate the impact of yoga as compared with the control group or other physical exercise by using a General Linear Mixed Model. **Results:** There were 5 yoga studies with stroke, 15 with MS, and 12 with children. Studies with children used outcomes related to body structure and function, whereas those with stroke and MS used outcomes across all three domains of the ICF. ESs varied from negligible to medium for stroke, from negligible to large for MS and children. **Conclusions:** The findings of this meta-analysis indicate that yoga is no better or worse than other exercise modalities as a treatment intervention for adults with stroke and MS, and children. Group yoga classes are typically social environments that can contribute to increased physical progress and feelings that contribute to quality of life, which may benefit individuals with CP. More research on yoga and particularly in children and adults with CP would yield valuable information for creating effective and safe yoga programs with a rich array of benefits.
Timeframe: to May 2016	
Total # studies included: 32	
Other details (e.g. definitions used, exclusions etc) yoga as an intervention and OM examining body structures and function, physical capacity or performance, and/or quality of life. Exclusion criteria included SRs.	
Outcomes addressed: body structures and function, activity, quality of life	

PFn 1 SYSTEMATIC REVIEW Citation: L. Cugusi; A. Manca; D. Dragone; F. Deriu; P. Solla; C. Secci; M. Monticone; G. Mercuro. Nordic Walking for the Management of People With Parkinson Disease: A Systematic Review. PM R 9 (2017) 1157-1166	
Purpose: to bring together current knowledge on the effects of NW compared with other exercise interventions on motor and nonmotor symptoms, functional performance, and QOL in people with PD. Second, we sought to appraise the clinical relevance of the findings arising from the studies and, finally, to propose a sharable design for upcoming research that might allow the uniformity and usefulness of future trials on this field	Abstract: BACKGROUND: It is well known that physical exercise is the main therapeutic element of rehabilitation programs for people with Parkinson disease (PD). As traditional forms of exercise can guarantee significant health benefits, the emergence of nonconventional physical activities, such as Nordic walking (NW), may add positive effects. OBJECTIVE: To appraise the available evidence on the main effects of NW in the rehabilitation programs for people with PD and to propose a design for upcoming research that might improve the uniformity of future trials. STUDY DESIGN: Systematic review. LITERATURE SURVEY: A literature search of 5 established databases (PubMed, MEDLINE, Scopus, Web of Science, and Cochrane) was conducted. METHODOLOGY: Any relevant randomized controlled trials pertinent to NW in PD published in English from inception to February 2017 were included. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were followed, and the methodologic quality of each study was assessed by the Physiotherapy Evidence Database scale. DATA SYNTHESIS: Sixty-six studies were retrieved, and 6 randomized controlled trials (221 subjects) were entered into the qualitative synthesis. Overall, these studies portrayed NW as feasible and likely to be effective in improving the functional and clinical outcomes of people with PD. When we compared NW with other exercise-based interventions, such as treadmill training, free walking, a program of standardized whole-body movements with maximal amplitude (Lee Silverman Voice Treatment BIG training), or a home-based exercise program, the findings proved controversial. CONCLUSIONS: High heterogeneity and methodologic discrepancies among the studies prevent us from drawing firm conclusions on the effectiveness of NW in comparison with other exercise-based interventions currently used by people with PD. Further investigations with a common design are necessary to verify whether NW may be included within conventional rehabilitation programs commonly recommended to people with PD. LEVEL OF EVIDENCE: II.
Timeframe: from inception to February 2017	
Total # studies included: 6	
Other details (e.g. definitions used, exclusions etc) Inclusion criteria: (1) people with PD; (2) an analysis of the main outcomes arising from a mid- to long-term (defined as ≥2 weeks) NW program; (3) only RCTs were included	
Outcomes addressed: Motor and nonmotor symptoms Functional performance Quality of life	

PFn 2. SYSTEMATIC REVIEW Citation: K. J. Ćwiękała-Lewis; M. Gallek; R. E. Taylor-Piliae. The effects of Tai Chi on physical function and well-being among persons with Parkinson's Disease: A systematic review. Journal of Bodywork & Movement Therapies (2017) 21, 414e421	
Purpose: to evaluate the effects of Tai Chi on physical function and well-being among persons with Parkinson's disease	Abstract: Current medical treatments for Parkinson's disease (PD) are mainly palliative, though research indicates Tai Chi exercise improves physical function and well-being. An electronic database search of PubMed, CINAHL, Web of Science, Cochrane Library, PsycINFO and Embase was conducted, to examine current scientific literature for potential benefits of Tai Chi on physical function and well-being among persons with PD. A total of 11 studies met the inclusion criteria: 7 randomized clinical trials and 4 quasi-experimental studies. PD participants (n = 548) were on average age 68 years old and 50% women. Overall, participants enrolled in Tai Chi had better balance and one or more aspect of well-being, though mixed results were reported. Further research is needed with more rigorous study designs, larger sample sizes, adequate Tai Chi exercise doses, and carefully chosen outcome measures that assess the mechanisms as well as the effects of Tai Chi, before widespread recommendations can be made.
Timeframe: January 2000 through April 2015	
Total # studies included: 12	
Other details (e.g. definitions used, exclusions etc) PD participants were assigned to a Tai Chi exercise intervention and if physical function or well-being outcomes were assessed	
Outcomes addressed: Physical function outcomes Well-being outcomes	

PFn 3. SYSTEMATIC REVIEW

Citation: M. Dos Santos Delabary; I. G. Komeroski; E. P. Monteiro; R. R. Costa; A. N. Haas. Effects of dance practice on functional mobility, motor symptoms and quality of life in people with Parkinson's disease: a systematic review with meta-analysis. Aging Clin Exp Res (2018) 30:727–735.

Purpose: to conduct a systematic review with meta-analysis in the aim to analyze the effects of dance classes when compared to other interventions or to the absence of intervention, in randomized clinical trials on functional mobility, motor symptoms and Quality of life of patients with Parkinson's disease	Abstract: BACKGROUND: Patients with Parkinson's Disease (PD) undergo motor injuries, which decrease their quality of life (QL). Dance, added to drug therapy, can help treating these patients AIMS: To conduct a systematic review with meta-analysis with the aim to analyze the effects of dance classes in comparison to other interventions or to the absence of intervention, in randomized clinical trials (RCTs), on functional mobility, motor symptoms and QL of PD patients METHODS: The search was conducted in MEDLINE, LILACS, SciELO, Cochrane and PsycINFO (last searched in August 2017). RCTs analyzing dance effects in comparison to other physical training types or to no intervention, on functional mobility, motor symptoms and QL of PD patients were selected. The outcomes assessed were motor symptoms with Unified PD Rating Scale III (UPDRSIII), functional mobility with Timed Up and Go Test (TUG), endurance with 6 min walking test (6MWT), freezing of gait with Freezing of Gait Questionnaire (FOG_Q), walking velocity with GAITRite and QL with PD Questionnaire (PDQ39). Two reviewers independently extracted methodological quality and studies data. Results are presented as weighted mean differences. RESULTS: Five RCTs were included, totaling 159 patients. Dance promoted significant improvements on UPDRSIII, and a decrease in TUG time when compared to other types of exercise. In comparison to the absence of intervention, dance practice also showed significant improvements in motor scores. CONCLUSION: Dance can improve motor parameters of the disease and patients' functional mobility.
Timeframe: up to August 2017	
Total # studies included: 5	
Other details (e.g. definitions used, exclusions etc) RCTs that compared an intervention group undergoing any type of dance for at least 3 weeks of practice, with Parkinson's disease patients at any stage of the disease, of both sexes and at any age, which analyzed functional and biomechanical parameters of the gait and/or quality of life of the participants were included	
Outcomes addressed: Functional and biomechanical parameters of the gait Quality of life	

PFn 4. SYSTEMATIC REVIEW

Citation: H. H. N. Kalyani; K. Sullivan; G. Moyle; S. Brauer; E. R. Jeffrey; L. Roeder; S. Berndt; G. Kerr. Effects of Dance on Gait, Cognition, and Dual-Tasking in Parkinson's Disease: A Systematic Review and Meta-Analysis. Journal of Parkinson's Disease 2019.

Purpose: to 1) appraise the literature evaluating dance as an intervention to improve gait, cognition and dual-tasking in people with Parkinson's disease; and 2) identify strengths and limitations of this evidence through a formal risk of bias analysis, in order to inform future researchers and practitioners.

Timeframe: up to 28th September 2017

Total # studies included: 12

Other details (e.g. definitions used, exclusions etc)
Inclusion criteria: 1) study participants had PD (any stage of the disease, any age, and gender); 2) at least one study group underwent a type of dance intervention lasting for at least two weeks (changed from 3 weeks in PROSPERO registration to 2 weeks which allowed inclusion of two more studies); 3) the study reported on at least one outcome measure for gait or cognition or dual-tasking; 4) randomised and quasi-randomised (studies where participants were not strictly randomised to intervention arms) controlled trials and observational studies (case-control, cohort and crossover studies). Only fully peer-reviewed articles with full text available in English were included without a date limitation.

Outcomes addressed:
Gait
Cognition
Dual-tasking

Abstract:
Dance-based interventions have been proposed for the management of Parkinson's disease (PD) symptoms. This review critically appraises and synthesises the research on the effects of dance interventions on gait, cognition and dual-tasking in PD, through a meta-analysis of peer-reviewed literature from seven databases. Eligible studies included people with PD, used a parallel-group or cohort design with a dance-based intervention, reported outcome measures of gait, cognition or dual-tasking, and were published in English up until September 2017. Of the initial 1079 articles, 677 articles were reviewed for eligibility, and 25 articles were retained. Only 12 articles had sufficient common assessment items for meta-analysis. Two independent reviewers extracted the data and assessed the risk of bias of each study using the Cochrane risk-of-bias tool. Based on pre-post change scores, gait speed, Timed Up and Go (TUG) test performance, freezing of gait questionnaire, and six-minute walk test times significantly improved after a dance intervention compared to controls. Global cognition assessed with Montreal Cognitive Assessment, and cognitive dual-tasking measured using dual-task TUG, also exhibited greater improvement in dance groups. There was limited evidence to determine the most effective intensity, frequency, duration of dance interventions or the most beneficial music. Findings must be interpreted cautiously because of the lack of randomised control trials, and the moderate to high risk of bias of studies. However, the results of papers with level-I and level-II.1 evidence suggest that dance may have the potential to ameliorate PD symptoms, particularly gait, global cognition and cognitive dual-tasking.

<table>
<tr><td colspan="2">PCog 1. SYSTEMATIC REVIEW
Citation: T. Stuckenschneider; C. D. Askew; A. L. Meneses; R. Baake; J. Weber; S. Schneider. The Effect of Different Exercise Modes on Domain-Specific Cognitive Function in Patients Suffering from Parkinson's Disease: A Systematic Review of Randomized Controlled Trials. Journal of Parkinson’s Disease 9 (2019) 73–95.</td></tr>
<tr><td>Purpose: to compare the effects of different exercise modes on various measures of cognitive function in individuals with Parkinson’s disease by systematically reviewing previous randomized controlled trials</td><td rowspan="4">Abstract:
BACKGROUND: Supervised exercise training alleviates motor symptoms in people with Parkinson's disease (PD). However, the efficacy of exercise to improve nonmotor symptoms such as cognitive function is less well known. OBJECTIVE: To systematically review evidence on the efficacy of different exercise modes (coordination exercise, resistance exercise, aerobic exercise) on domain-specific cognitive function in patients with PD. METHODS: Parallel-group randomized controlled trials published before March 2018 were included. Primary outcome measures included global cognitive function and its subdomains, and the Unified Parkinson's Disease Rating Scale was included as a secondary outcome. Methodological quality was assessed using the Physiotherapy Evidence Database scale. RESULTS: The literature search yielded 2,000 articles, of which 11 met inclusion criteria. 508 patients (mean age 68+/-4 years) were included with a disease severity from 1 to 4 on the Hoehn & Yahr stage scale. Overall study quality was modest (mean 6+/-2, range 3-8/10). In 5 trials a significant between-group effect size (ES) was identified for tests of specific cognitive domains, including a positive effect of aerobic exercise on memory (ES = 2.42) and executive function (ES = 1.54), and of combined resistance and coordination exercise on global cognitive function (ES = 1.54). Two trials found a significant ES for coordination exercise (ES = 0.84-1.88), which led to improved executive function compared with that of non-exercising control subjects. CONCLUSION: All modes of exercise are associated with improved cognitive function in individuals with PD. Aerobic exercise tended to best improve memory; however, a clear effect of exercise mode was not identified.</td></tr>
<tr><td>Timeframe: not specified</td></tr>
<tr><td>Total # studies included: 11</td></tr>
<tr><td>Other details (e.g. definitions used, exclusions etc)
Only randomized controlled trials were included. Study populations consisted of individuals with idiopathic PD without any restriction placed on the stage of the disease or its severity. Trials targeting secondary or acquired PD were excluded. Exercise programs lasting at least 4 weeks with at least one supervised exercise session per week were considered eligible. Exercise interventions included aerobic training, resistance training, coordination training or a combination of any of these exercise modes. Studies that evaluated the combination of an exercise intervention with other treatments (e.g., drug therapy, education programs) were excluded.</td></tr>
<tr><td>Outcomes addressed:
Cognitive function</td><td></td></tr>
</table>

PCog 2. SYSTEMATIC REVIEW

Citation: H. H. N. Kalyani; K. Sullivan; G. Moyle; S. Brauer; E. R. Jeffrey; L. Roeder; S. Berndt; G. Kerr. Effects of Dance on Gait, Cognition, and Dual-Tasking in Parkinson's Disease: A Systematic Review and Meta-Analysis. Journal of Parkinson's Disease 2019.

Purpose: to 1) appraise the literature evaluating dance as an intervention to improve gait, cognition and dual-tasking in people with Parkinson's disease; and 2) identify strengths and limitations of this evidence through a formal risk of bias analysis, in order to inform future researchers and practitioners.	Abstract: Dance-based interventions have been proposed for the management of Parkinson's disease (PD) symptoms. This review critically appraises and synthesises the research on the effects of dance interventions on gait, cognition and dual-tasking in PD, through a meta-analysis of peer-reviewed literature from seven databases. Eligible studies included people with PD, used a parallel-group or cohort design with a dance-based intervention, reported outcome measures of gait, cognition or dual-tasking, and were published in English up until September 2017. Of the initial 1079 articles, 677 articles were reviewed for eligibility, and 25 articles were retained. Only 12 articles had sufficient common assessment items for meta-analysis. Two independent reviewers extracted the data and assessed the risk of bias of each study using the Cochrane risk-of-bias tool. Based on pre-post change scores, gait speed, Timed Up and Go (TUG) test performance, freezing of gait questionnaire, and six-minute walk test times significantly improved after a dance intervention compared to controls. Global cognition assessed with Montreal Cognitive Assessment, and cognitive dual-tasking measured using dual-task TUG, also exhibited greater improvement in dance groups. There was limited evidence to determine the most effective intensity, frequency, duration of dance interventions or the most beneficial music. Findings must be interpreted cautiously because of the lack of randomised control trials, and the moderate to high risk of bias of studies. However, the results of papers with level-I and level-II.1 evidence suggest that dance may have the potential to ameliorate PD symptoms, particularly gait, global cognition and cognitive dual-tasking.
Timeframe: up to 28th September 2017	
Total # studies included: 12	
Other details (e.g. definitions used, exclusions etc) Inclusion criteria: 1) study participants had PD (any stage of the disease, any age, and gender); 2) at least one study group underwent a type of dance intervention lasting for at least two weeks (changed from 3 weeks in PROSPERO registration to 2 weeks which allowed inclusion of two more studies); 3) the study reported on at least one outcome measure for gait or cognition or dual-tasking; 4) randomised and quasi-randomised (studies where participants were not strictly randomised to intervention arms) controlled trials and observational studies (case-control, cohort and crossover studies). Only fully peer-reviewed articles with full text available in English were included without a date limitation.	
Outcomes addressed: Gait Cognition Dual-tasking	

SFn 1 META-ANALYSIS

Citation: A. C. Bonini-Rocha; A. L. S. de Andrade; A. M. Moraes; L. B. Gomide Matheus; L. R. Diniz; W. R. Martins. (2018) Effectiveness of Circuit-Based Exercises on Gait Speed, Balance, and Functional Mobility in People Affected by Stroke: A Meta-Analysis

Purpose: To examine the effectiveness of circuit-based exercise in the treatment of people affected by stroke.	**Abstract:** BACKGROUND: Several interventions have been proposed to rehabilitate patients with neurologic dysfunctions due to stroke. However, the effectiveness of circuit-based exercises according to its actual definition, ie, an overall program to improve strength, stamina, balance or functioning, was not provided. OBJECTIVE: To examine the effectiveness of circuit-based exercise in the treatment of people affected by stroke. METHODS: A search through PubMed, Embase, Cochrane Library, and Physiotherapy Evidence Database databases was performed to identify controlled clinical trials without language or date restriction. The overall mean difference with 95% confidence interval was calculated for all outcomes. Two independent reviewers assessed the risk of bias. RESULTS: Eleven studies met the inclusion criteria, and 8 presented suitable data to perform a meta-analysis. Quantitative analysis showed that circuit-based exercise was more effective than conventional intervention on gait speed (mean difference of 0.11 m/s) and circuit-based exercise was not significantly more effective than conventional intervention on balance and functional mobility. CONCLUSION: Our results demonstrated that circuit-based exercise presents better effects on gait when compared with conventional intervention and that its effects on balance and functional mobility were not better than conventional interventions. LEVEL OF EVIDENCE: I.
Timeframe: November 2016 - March 2017	
Total # studies included: 11	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Gait speed, balance, functional mobility	

SFn 2 META-ANALYSIS

Citation: P. Boyne; J. Welge; B. Kissela; K. Dunning. (2017) Factors Influencing the Efficacy of Aerobic Exercise for Improving Fitness and Walking Capacity After Stroke: A Meta-Analysis With Meta-Regression

Purpose: To assess the influence of dosing parameters and patient characteristics on the efficacy of aerobic exercise (AEX) poststroke	**Abstract:** OBJECTIVE: To assess the influence of dosing parameters and patient characteristics on the efficacy of aerobic exercise (AEX) poststroke. DATA SOURCES: A systematic review was conducted using PubMed, MEDLINE, Cumulative Index of Nursing and Allied Health Literature, Physiotherapy Evidence Database, and Academic Search Complete. STUDY SELECTION: Studies were selected that compared an AEX group with a nonaerobic control group among ambulatory persons with stroke. DATA EXTRACTION: Extracted outcome data included peak oxygen consumption (V o2peak) during exercise testing, walking speed, and walking endurance (6-min walk test). Independent variables of interest were AEX mode (seated or walking), AEX intensity (moderate or vigorous), AEX volume (total hours), stroke chronicity, and baseline outcome scores. DATA SYNTHESIS: Significant between-study heterogeneity was confirmed for all outcomes. Pooled AEX effect size estimates (AEX group change minus control group change) from random effects models were V o2peak, 2.2mLkg(-1)min(-1) (95% confidence interval [CI], 1.3-3.1mLkg(-1)min(-1)); walking speed, .06m/s (95% CI, .01-.11m/s); and 6-minute walk test distance, 29m (95% CI, 15-42m). In meta-regression, larger V o2peak effect sizes were significantly associated with higher AEX intensity and higher baseline V o2peak. Larger effect sizes for walking speed and the 6-minute walk test were significantly associated with a walking AEX mode. In contrast, seated AEX did not have a significant effect on walking outcomes. CONCLUSIONS: AEX significantly improves aerobic capacity poststroke, but may need to be task specific to affect walking speed and endurance. Higher AEX intensity is associated with better outcomes. Future randomized studies are needed to confirm these results.
Timeframe: No publication date restrictions were imposed	
Total # studies included: 20	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: VO2peak from graded exercise testing Comfortable or fastest walking speed over a short distance (eg, 10-m walk test) Timed walking distance test (eg, 6-min walk test)	

SFn 3 META-ANALYSIS **Citation:** L. Cugusi; A. Manca; T. J. Yeo; P. P. Bassareo; G. Mercuro; J. C. Kaski (2017) Nordic walking for individuals with cardiovascular disease: A systematic review and meta-analysis of randomized controlled trials	
Purpose: to appraise research evidence on the effects of Nordic walking for individuals with cardiovascular disease	**Abstract:** Background Exercise is the cornerstone of rehabilitation programmes for individuals with cardiovascular disease (IwCVD). Although conventional cardiovascular rehabilitation (CCVR) programmes have significant advantages, non-conventional activities such as Nordic walking (NW) may offer additional health benefits. Our aim was to appraise research evidence on the effects of Nordic walking for individuals with cardiovascular disease. Design Systematic review and meta-analysis. Methods A literature search of clinical databases (PubMed, MEDLINE, Scopus, Web of Science, Cochrane) was conducted to identify any randomized controlled trials, including: (i) individuals with cardiovascular disease, (ii) analyses of the main outcomes arising from Nordic walking (NW) programmes. Data from the common outcomes were extracted and pooled in the meta-analysis. Standardized mean differences (SMDs) were calculated and pooled by random effects models. Results Fifteen randomized controlled trials were included and eight trials entered this meta-analysis. Studies focused on coronary artery disease, peripheral arterial disease, heart failure and stroke. In coronary artery disease, significant differences between NW+CCVR and CCVR were found in exercise capacity (SMD: 0.49; $p = 0.03$) and dynamic balance (SMD: 0.55; $p = 0.01$) favouring NW+CCVR. In peripheral artery disease, larger changes in exercise duration (SMD: 0.93; $p < 0.0001$) and oxygen uptake (SMD: 0.64; $p = 0.002$) were observed following NW compared with controls. In heart failure, no significant differences were found between NW and CCVR or usual care for peak VO2 and functional mobility. In post-stroke survivors, functional mobility was significantly higher following treadmill programmes with poles rather than without (SMD: 0.80; $p = 0.03$). Conclusions These data portray NW as a feasible and promising activity for individuals with cardiovascular disease. Further studies are necessary to verify whether NW may be incorporated within CCVR for individuals with cardiovascular disease.
Timeframe: from inception to November 2016	
Total # studies included: 15 IN TOTAL, ONLY 2 WITH STROKE	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: functional mobility	

SFn 4 META-ANALYSIS

Citation: L. Ge; Q. X. Zheng; Y. T. Liao; J. Y. Tan; Q. L. Xie; M. Rask (2017) Effects of traditional Chinese exercises on the rehabilitation of limb function among stroke patients: A systematic review and meta-analysis

Purpose: To determine the rehabilitative effects of traditional Chinese exercises on limb function among patients with stroke	**Abstract:** OBJECTIVE: To systematically review literature about the rehabilitative effects of traditional Chinese exercises (TCEs) on limb function among patients with stroke. METHODS: Systematic review and meta-analysis of randomized controlled trials (RCTs). Twelve electronic databases were searched from their inceptions to February 2017, including PudMed, The Cochrane Library, Web of Science, EMBase, Science Direct, PsycINFO, Cumulative Index to Nursing and Allied Health Literature, Allied and Complementary Medicine, Chinese Scientific Journal Database, China National Knowledge Infrastructure, Chinese Biomedical Literature Database and WanFang Data. RCTs were located to examine the rehabilitative effects of TCEs on limb function among stroke patients. Two authors independently screened the literature, extracted data and assessed the risk bias of the included studies. Methodological quality evaluation and meta-analysis of included studies was performed by using Cochrane Collaboration's tool (RevMan 5.3). RESULTS: A total of 31 RCTs with 2349 participants were included. Results of meta-analysis showed that TCEs produced positive effects on limb motor function (random effects model, standardized mean difference [SMD] = 1.21, 95% confidence interval [CI] = 0.66 to 1.77, P < 0.01), balance function (Berg balance scale: (random effects model, SMD = 2.07, 95%CI = 1.52 to 2.62, P < 0.01), timed-up-and-go test: (fixed effects model, mean difference [MD] = -1.77, 95%CI = -2.87 to -0.67, P < 0.01)) activities of daily living (ADL) ability {Barthel Index scale: (random effects model, MD = 15.60, 95%CI = 7.57 to 23.63, P < 0.01), Modified Barthel Index scale: (random effects model, MD = 12.30, 95%CI = 7.48 to 17.12, P < 0.01), and neurological impairment (fixed effects model, MD = -2.57, 95%CI = -3.14 to -2.00, P < 0.01). After subgroup analysis and sensitivity analysis, the positive effects did not be affected by different types of TCEs and different lengths of intervention time. However, TCEs were no benefit to physical function on Short Physical Performance Battery and 2-min Step Test among stroke patients. CONCLUSION: Current evidence showed that TCEs produced positive effects on limb motor function, balance function, ADL ability and neurological impairment among stroke patients. More large-scale, high-quality, multiple center RCTs are required to further verify above conclusions in the future.
Timeframe: Inception – Feb 2017	
Total # studies included: 31	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Limb motor function Balance	

SFn 5 SYSTEMATIC REVIEW **Citation:** G. Hendrey; A. E. Holland; B. F. Mentiplay; R. A. Clark; G. Williams (2018) Do Trials of Resistance Training to Improve Mobility After Stroke Adhere to the American College of Sports Medicine Guidelines? A Systematic Review	
Purpose: To determine whether adherence to the American College of Sports Medicine (ACSM) guidelines on resistance training is associated with better mobility outcomes after stroke	**Abstract:** OBJECTIVE: To determine whether resistance training to improve mobility outcomes after stroke adheres to the American College of Sports Medicine (ACSM) guidelines, and whether adherence was associated with better outcomes. DATA SOURCES: Online databases searched from 1975 to October 30, 2016. STUDY SELECTION: Randomized controlled trials examining the effectiveness of lower limb strength training on mobility outcomes in adult participants with stroke. DATA EXTRACTION: Two independent reviewers completed data extraction. Quality of trials was determined using the Cochrane Risk of Bias Tool. Trials were scored based on their protocol's adherence to 8 ACSM recommendations. To determine if a relation existed between total adherence score and effect size, Spearman rho was calculated, and between individual recommendations and effect size, Mann-Whitney U or Kruskal-Wallis tests were used. DATA SYNTHESIS: Thirty-nine trials met the inclusion criteria, and 34 were scored on their adherence to the guidelines. Adherence was high for frequency of training (100% of studies), but few trials adhered to the guidelines for intensity (32%), specificity (24%), and training pattern (3%). Based on the small number of studies that could be included in pooled analysis (n=12), there was no relation between overall adherence and effect size (Spearman rho=-.39, P=.21). CONCLUSIONS: Adherence to the ACSM guidelines for resistance training after stroke varied widely. Future trials should ensure strength training protocols adhere more closely to the guidelines, to ensure their effectiveness in stroke can be accurately determined.
Timeframe: trials published after 1975 – 30 October 2016	
Total # studies included:	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: walking outcome (eg, gait velocity, 6-minute walk test, or timed up and go test)	

SFn 6 SYSTEMATIC REVIEW **Citation:** D. Ilunga Tshiswaka; C. Bennett; C. Franklin (2018) Effects of walking trainings on walking function among stroke survivors: a systematic review	
Purpose: to assess the impact of walking training on enhancing walking for stroke survivors	**Abstract:** Physical function is often compromised as a result of stroke event. Although interventions propose different strategies that seek to improve stroke survivors' physical function, a need remains to evaluate walking training studies aimed at improving such physical function. The aim of this review was to assess the available literature that highlights the impact of walking training on enhancing walking for stroke survivors. We performed a systematic literature review of online databases - Google Scholar, PubMed, CINHAL, Cochrane Library, Scopus, and EBSCO - with the following inclusion criteria: manuscript published from 2005 to 2016, written in English, with treatment and control groups, for walking training studies aimed at improving physical function among stroke survivors. Findings indicated that walking speed, walking distance, and gait speed were the most used outcome variables for measuring improved physical function among stroke survivors. Importantly, proposed interventions involved either overground or treadmill walking trainings, if not both. Preserved locomotor improvements were not noted in all interventions at follow-up. Some interventions that used walking treadmill training augmented by auditory stimulations reported significant improvements in physical function compared with overground walking training augmented by auditory stimulations. The imperative to improve physical function among stroke survivors with physical impairment is paramount, as it allows survivors to be socially, emotionally, and physically more independent. In general, we note an insufficiency of research on the interaction between physical function and socialization among stroke survivors.
Timeframe: from 2005 to 2016	
Total # studies included: 29	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Walking function	

SFn 7 META-ANALYSIS **Citation:** G. Y. Li; W. Wang; G. L. Liu; Y. Zhang (2018) Effects of Tai Chi on balance and gait in stroke survivors: A systematic meta-analysis of randomized controlled trials	
Purpose: To investigate the effects of tai chi on balance and gait in stroke survivors	**Abstract:** OBJECTIVE: To investigate the effects of tai chi on balance and gait in stroke survivors. METHODS: A systematic meta-analysis of randomized controlled trials on the effects of tai chi on balance and gait in stroke survivors. RESULTS: Five randomized controlled trials, with a total of 346 patients, were included in the meta-analysis. All of these studies had a high bias based on the Cochrane Collaboration recommendation, and a relatively small sample size. In the pooled analysis, the tai chi group exhibited a significantly better gait ability than the control group, as evaluated with the Timed Up and Go (TUG) test and Short Physical Performance Battery (SPPB) (-0.26 [-0.50 to -0.03], p = 0.027; I2=0%, p = 0.682), but no significant difference in dynamic standing balance scores was found between tai chi and control groups (0.154 [-0.269 to 0.578], p = 0.475; I2=26.6%, p = 0.256). CONCLUSION: Tai chi may be beneficial for stroke survivors with respect to gait ability in the short term, but further large, long-term randomized controlled trials with standard evaluation indicators are needed to confirm this conclusion.
Timeframe: No limitation on publication year	
Total # studies included: 5	
Other details (e.g. definitions used, exclusions etc.)	
Outcomes addressed: Balance Gait	

SFn 8 SYSTEMATIC REVIEW **Citation:** S. Miranda; A. Marques (2018) Pilates in noncommunicable diseases: A systematic review of its effects	
Purpose: To investigate the effects of Pilates in the four major groups of NCD	**Abstract:** OBJECTIVES: Chronic cardiovascular diseases, cancer, chronic respiratory diseases and diabetes are the four major groups of non-communicable diseases (NCDs) and the main cause of mortality worldwide. Pilates has been described as an effective intervention to promote healthy behaviors and physical activity in people with chronic diseases. However, the evidence of its effects in NCDs have not been systematized. We investigated the effects of Pilates in the four major groups of NCDs. DESIGN: A systematic review was performed. Searches were conducted on Cochrane Library, EBSCO, PubMed, Science Direct, Scopus and Web of Science databases. Studies were rated with the quality assessment tool for quantitative studies. As a meta-analysis was not possible to conduct, a best-evidence synthesis was used. RESULTS: Twelve studies, mostly of moderate quality, were included with 491 participants (78.6% females; age range 13-70 years old) with breast cancer (n=3), diabetes (n=3), chronic stroke (2 years post stroke) (n=2), chronic obstructive pulmonary disease (n=1), cystic fibrosis (n=1), heart failure (n=1) and arterial hypertension (n=1). The best-evidence synthesis revealed strong evidence for improving exercise tolerance; moderate evidence for improving symptoms, muscle strength and health-related quality of life and limited or conflicting evidence on vital signs, metabolic parameters, body composition, respiratory function, functional status, balance, flexibility and social support. CONCLUSIONS: Pilates should be considered for patients with NCDs, as it improves exercise tolerance. Future studies with robust methodologies are still needed to clarify its effectiveness on outcomes with moderate, limited or conflicting evidence and to establish the most suitable intervention protocol.
Timeframe: Variable start dates up to 2017	
Total # studies included: 12 IN TOTAL, ONLY 2 IN STROKE	
Other details (e.g. definitions used, exclusions etc.)	
Outcomes addressed: Functional status Peak VO2 consumption	

SFn 9 SYSTEMATIC REVIEW

Citation: K. K. Patterson; J. S. Wong; E. C. Prout; D. Brooks (2018) Dance for the rehabilitation of balance and gait in adults with neurological conditions other than Parkinson's disease: A systematic review

Purpose: To examine the effect of dance interventions on balance, gait and functional mobility outcomes in adults with neurological conditions other than Parkinson's disease	**Abstract:** Purpose: To conduct a systematic review that examined the effect of dance interventions on balance, gait and functional mobility outcomes in adults with neurological conditions other than Parkinson's disease. Methods: A systematic search of relevant databases was conducted. Data extraction and methodological appraisal were performed by two independent authors. Results: Nine studies were included (4 pre-post studies with no control group, 3 case reports, and 2 controlled studies) and results of the methodological quality assessment ranged from poor to good. Study groups included stroke, multiple sclerosis, spinal cord injury, and Huntington's disease. Dance interventions varied in frequency, type and duration, and only 1 study reported intensity. Study dropout rates ranged from 20-44%, and 88-100% of dance classes were attended. Only 3 studies mentioned adverse events, of which there were none. A summary of results revealed significant changes in spatiotemporal gait parameters, Berg Balance Scale scores, Timed Up and Go test and six-minute walk test that were similar to or greater than those previously reported in a review of dance for individuals with Parkinson's disease. Conclusions: There is emerging evidence to support the use of dance as a feasible intervention for adults with neurological conditions. Further investigation of the effects of dance with randomized controlled trials using larger sample sizes and better reporting of the intervention, participant tolerance, and adverse events is warranted.
Timeframe: 1946 - 21 December 2016	
Total # studies included: 9 IN TOTAL, 3 WITH STROKE	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Balance Gait Functional mobility	

SFn 10 META-ANALYSIS

Citation: D. Pogrebnoy; A. Dennett (2019) Exercise programs delivered according to guidelines improve mobility in people with stroke: A Systematic Review and meta-analysis

Purpose: To determine if prescribing a combined aerobic and resistance training exercise program in accordance with American Stroke Association physical activity guidelines improves mobility and physical activity levels of people after stroke.

Timeframe: Online database search from earliest available date to 27 August 2018.

Total # studies included: 10 Papers from 8 trials

Other details (e.g. definitions used, exclusions etc)

Outcomes addressed:
Function e.g. sit to stand, walking speed
Physical activity

Abstract:
OBJECTIVE: To determine if prescribing a combined aerobic and resistance training exercise program in accordance with American Stroke Association physical activity guidelines improves mobility and physical activity levels of people after stroke. DATA SOURCES: Online database search from earliest available date to August 27, 2018. STUDY SELECTION: Randomized controlled trials evaluating the effectiveness of exercise programs prescribed in accordance with guidelines for improving mobility and physical activity levels in adults with sub-acute or chronic stroke. DATA EXTRACTION: Two independent reviewers completed data extraction. Risk of bias was assessed using the Physiotherapy Evidence Database Scale and overall quality of evidence was assessed using the Grades of Research, Assessment, Development and Evaluation approach. DATA SYNTHESIS: Data was pulled from a total of 499 participants for meta-analysis. There was high-level evidence that exercise programs adhering to guidelines improve habitual walking speed (Mean Difference 0.07m/s, 95% CI -0.01 to 0.16) and walking endurance (Mean Difference 39.2 meters, 95% CI 17.2 to 61.2). A sensitivity analysis demonstrated high level evidence of improvements in walking endurance (Mean Difference 51.1 meters, 95% CI 19.96 to 82.24) and moderate-level evidence of improvements on the timed up and go test (Standardized Mean Difference 0.57, 95% CI 0.16 to 0.99). No differences were detected for other mobility outcome measures or physical activity levels. Adherence was high and few adverse events were reported. CONCLUSION: A combined exercise program comprising aerobic and resistance training that adheres to the American Stroke Association guidelines, is safe, and should be prescribed in addition to usual care to improve mobility. Further research is needed to understand the relationship between exercise programs and behavior change requirements to improve long term physical activity levels.

SFn 11 SYSTEMATIC REVIEW

Citation: J. Schroder; T. van Criekinge; E. Embrechts; X. Celis; J. Van Schuppen; S. Truijen; W. Saeys (2019) Combining the benefits of tele-rehabilitation and virtual reality-based balance training: a systematic review on feasibility and effectiveness

Purpose: To investigate whether it is feasible to combine virtual reality (VR) which allows exercising in game-like environments with tele-rehabilitation in a community-dwelling stroke population.	**Abstract:** PURPOSE: A motivational surrounding is desirable in stroke rehabilitation considering the need to train repetitively to improve balance, even after discharge from rehabilitation facilities. This review aims to investigate whether it is feasible to combine virtual reality (VR) which allows exercising in game-like environments with tele-rehabilitation in a community-dwelling stroke population. METHODS: Literature searches were conducted in five databases, for example, PubMed and the Cochrane Library. Randomized controlled trial (RCT) and non-RCT investigating feasibility and effectiveness of VR-based tele-rehabilitation were included. Based on the risk of bias and study design, methodological quality is ranked according to the GRADE guidelines. RESULTS: Seven studies (n = 120) were included, of which four are RCTs. Evidence regarding therapy adherence and perceived enjoyment of VR, as well as a cost-benefit of tele-rehabilitation emphasizes feasibility. Equal effects are reported comparing this approach to a therapist-supervised intervention in the clinical setting on balance and functional mobility. CONCLUSIONS: Tele-rehabilitation could be a promising tool to overcome burdens that restrict accessibility to rehabilitation in the future. VR can increase motivation allowing longer and more training sessions in community-dwelling stroke survivors. Therefore, combining the benefits of both approaches seems convenient. Although evidence is still sparse, functional improvements seem to be equal compared to a similar intervention with therapist-supervision in the clinic, suggesting that for cost-efficient rehabilitation parts of therapy can be transferred to the homes. Implications for rehabilitation The use of tele-rehabilitation could be a promising tool to overcome burdens that restrict the access of stroke survivors to long-term rehabilitative care. VR-based interventions are game-like and therefore seem to provide a motivational environment which allows longer exercise sessions and greater adherence to therapy.
Timeframe: up to 04/01/2018	
Total # studies included: 7	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Balance Functional mobility	

SFn 12 SYSTEMATIC REVIEW

Citation: J. Wiener; A. McIntyre; S. Janssen; J. T. Chow; C. Batey; R. Teasell (2019) Effectiveness of High-Intensity Interval Training for Fitness and Mobility Post Stroke: A Systematic Review

Purpose: To evaluate the evidence on the effectiveness of high-intensity interval training (HIIT) in improving fitness and mobility post stroke.	**Abstract:** OBJECTIVE: To evaluate the evidence on the effectiveness of high-intensity interval training (HIIT) in improving fitness and mobility post stroke. TYPE: Systematic review. LITERATURE SURVEY: Medline, Embase, CINAHL, PsycINFO, and Scopus were searched for articles published in English up to January 2018. METHODOLOGY: Studies were included if the sample was adult human participants with stroke, the sample size was >/=3, and participants received >1 session of HIIT. Study and participant characteristics, treatment protocols, and results were extracted. SYNTHESIS: Six studies with a total of 140 participants met inclusion criteria: three randomized controlled trials and three pre-post studies. HIIT protocols ranged 20 to 30 minutes per session, 2 to 5 times per week, and 2 to 8 weeks in total. HIIT was delivered on a treadmill in five studies and a stationary bicycle in one study. Regarding fitness measures, HIIT produced significant improvements in peak oxygen consumption compared to baseline, but the effect was not significant compared to moderate intensity continuous exercise (MICE). Regarding mobility measures, HIIT produced significant improvements on the 10-Meter Walk Test (10MWT), 6-Minute Walk Test (6MWT), Berg Balance Scale (BBS), Functional Ambulation Categories (FAC), Timed Up and Go Test, and Rivermead Motor Assessment compared to baseline. The effect of HIIT was significant compared to MICE on the 10MWT and FAC but not on the 6MWT or BBS. CONCLUSIONS: There is preliminary evidence that HIIT may be an effective rehabilitation intervention for improving some aspects of cardiorespiratory fitness and mobility post stroke. LEVEL OF EVIDENCE: I.
Timeframe: up to January 2018.	
Total # studies included: 6	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Fitness Mobility	

SFn 13 META-ANALYSIS **Citation:** S. Wu; J. Chen; S. Wang; M. Jiang; X. Wang; Y. Wen (2018) Effect of Tai Chi Exercise on Balance Function of Stroke Patients: A Meta-Analysis	
Purpose: To evaluate the effect of Tai Chi exercise on balance function in stroke patients	**Abstract:** BACKGROUND Tai Chi is an ancient form of physical activity that has been shown to improve cardiovascular function, but to date there had been no comprehensive systematic review on the effect of Tai Chi exercise on balance function of patients with stroke. This study evaluated the effect of Tai Chi exercise on balance function in stroke patients. MATERIAL AND METHODS PubMed, Cochrane library, and China National Knowledge Information databases and the Wan Fang medical network were searched to collect the articles. The random-effects model was used to assess the effect of Tai Chi exercise on balance function of stroke patients. RESULTS Six studies were chosen to perform the meta-analysis according to the inclusion and exclusion criteria. There were significant improvements of balance on Berg Balance Scale score (MD=4.823, 95% CI: 2.138-7.508), the standing balance with fall rates (RR=0.300, 95%CI: 0.120-0.770), functional reach test and dynamic gait index in Tai Chi intervention group compared to the control intervention group. However, the short physical performance battery for balance (SPBB) showed Tai Chi did not significantly improve the ability of balance for stroke patients (MD=0.293, 95%CI: -0.099~0.685). CONCLUSIONS Tai Chi exercise might have a significant impact in improving balance efficiency by increasing BBS score and reducing fall rate.
Timeframe: up to May 2017	
Total # studies included: 6	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Balance	

SFn 14 META-ANALYSIS

Citation: L. Zou; J. E. Sasaki; N. Zeng; C. Wang; L. Sun (2018) A Systematic Review With Meta-Analysis of Mindful Exercises on Rehabilitative Outcomes Among Poststroke Patients

Purpose: To critically evaluate the rehabilitative effects of mindful exercises for poststroke patients.	**Abstract:** OBJECTIVE: To critically evaluate the rehabilitative effects of mindful exercises for poststroke patients. DATA SOURCES: Six databases (PubMed, Physiotherapy Evidence Database, Cochrane Library, Web of Science, Wanfang, Chinese National Knowledge Infrastructure) and reference lists of relevant articles were searched. STUDY SELECTION: Randomized controlled trials on the effects of mindful exercises on rehabilitative outcomes such as sensorimotor function, gait speed, leg strength, aerobic endurance, cognitive function, and overall motor function. DATA EXTRACTION: Two investigators independently screened eligible studies according to the eligible criteria, extracted data, and assessed risk of bias. DATA SYNTHESIS: A total of 20 studies that satisfied the eligibility criteria were finally included. The sum scores of 5-9 points in the adapted Physiotherapy Evidence Database scale indicates low-to-medium risk of bias. The study results of meta-analysis indicate that mindful exercise intervention was significantly associated with improved sensorimotor function on both lower limb (standardized mean difference=0.79; 95% confidence interval, 0.43-1.15; P<.001; I(2)=62.67%) and upper limb (standardized mean difference=0.7; 95% confidence interval, 0.39-1.01; P<.001; I(2)=32.36%). CONCLUSIONS: This review suggests that mindful exercises are effective in improving sensorimotor function of lower and upper limbs in poststroke patients. The effects on gait speed, leg strength, aerobic endurance, overall motor function, and other outcomes (eg, cognitive function, gait parameters) require further investigation for allowing evidence-based conclusions.
Timeframe: publication date was not limited	
Total # studies included: 20	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Sensorimotor function Gait speed Leg strength Aerobic endurance Cognitive function Overall motor function	

SFn 15 META-ANALYSIS

Citation: L. Zou; A. Yeung; N. Zeng; C. Wang; L. Sun; G. A. Thomas; H. Wang (2018) Effects of Mind-Body Exercises for Mood and Functional Capabilities in Patients with Stroke: An Analytical Review of Randomized Controlled Trials

Purpose: to critically evaluate and statistically synthesize the existing literature regarding the effects of mind-body exercises on mood and functional capabilities in patients with stroke.	**Abstract:** Objective: The effects of stroke are both physical and mental in nature and may have serious implications on the overall well-being of stroke survivors. This analytical review aims to critically evaluate and statistically synthesize the existing literature regarding the effects of mind-body (MB) exercises on mood and functional capabilities in patients with stroke. Methods: A structured literature review was performed in both English (PubMed, PEDro, and Cochrane Library) and Chinese (Wanfang and CNKI (Chinese National Knowledge Information Database)) databases. Sixteen randomized controlled trials were considered eligible for meta-analysis. Based on the random effects model, we used the pooled effect size to determine the magnitude of rehabilitative effect of MB exercise intervention on depression, anxiety, activities of daily living, and functional mobility among stroke survivors. The sum PEDro score ranged from five to nine points (fair-to-good methodological quality), but the absence of concealed allocation and blinded assessors were reported in most studies. Results: The aggregated results showed that MB exercise intervention is associated with significantly improved ADL (Hedges' g = 1.31, 95% CI 0.85 to 1.77, p < 0.001, I(2) = 79.82%) and mobility (Hedges' g = 0.67, 95% CI 0.25 to 1.09, p < 0.001, I(2) = 69.65%), and reduced depression (Hedges' g = -0.76, 95% CI -1.16 to -0.35, p < 0.001, I(2) = 74.84%). Conclusions: as add-on treatments, the MB exercises may potentially improve depression, activities of daily living, and mobility of these post-stroke patients. Future studies with more robust methodology will be needed to provide a more definitive conclusion.
Timeframe: no restriction on publication date	
Total # studies included: 16	
Other details (e.g. definitions used, exclusions etc)	
Outcomes addressed: Depression Anxiety Activities of daily living Functional mobility	

ADHD 1 SYSTEMATIC REVIEW OF REVIEWS

Citation: G. Ashdown-Franks; J. Firth; R. Carney; A. F. Carvalho; M. Hallgren; A. Koyanagi; S. Rosenbaum; F. B. Schuch; L. Smith; M. Solmi; D. Vancampfort; B. Stubbs (2019) Exercise as Medicine for Mental and Substance Use Disorders: A Meta-review of the Benefits for Neuropsychiatric and Cognitive Outcomes

Purpose: To review the evidence on the impact of exercise on neuropsychiatric and cognitive symptoms in people with mental disorders	**Abstract:** BACKGROUND: Exercise may improve neuropsychiatric and cognitive symptoms in people with mental disorders, but the totality of the evidence is unclear. We conducted a meta-review of exercise in (1) serious mental illness (schizophrenia spectrum, bipolar disorder and major depression (MDD)); (2) anxiety and stress disorders; (3) alcohol and substance use disorders; (4) eating disorders (anorexia nervosa bulimia nervosa, binge eating disorders, and (5) other mental disorders (including ADHD, pre/post-natal depression). METHODS: Systematic searches of major databases from inception until 1/10/2018 were undertaken to identify meta-analyses of randomised controlled trials (RCTs) of exercise in people with clinically diagnosed mental disorders. In the absence of available meta-analyses for a mental disorder, we identified systematic reviews of exercise interventions in people with elevated mental health symptoms that included non-RCTs. Meta-analysis quality was assessed with the AMSTAR/+. RESULTS: Overall, we identified 27 systematic reviews (including 16 meta-analyses representing 152 RCTs). Among those with MDD, we found consistent evidence (meta-analyses = 8) that exercise reduced depression in children, adults and older adults. Evidence also indicates that exercise was more effective than control conditions in reducing anxiety symptoms (meta-analyses = 3), and as an adjunctive treatment for reducing positive and negative symptoms of schizophrenia (meta-analyses = 2). Regarding neurocognitive effects, exercise improved global cognition in schizophrenia (meta-analyses = 1), children with ADHD (meta-analyses = 1), but not in MDD (meta-analyses = 1). Among those with elevated symptoms, positive mental health benefits were observed for exercise in people with pre/post-natal depression, anorexia nervosa/bulimia nervosa, binge eating disorder, post-traumatic stress disorder and alcohol use disorders/substance use disorders. Adverse events were sparsely reported. CONCLUSION: Our panoramic meta-overview suggests that exercise can be an effective adjunctive treatment for improving symptoms across a broad range of mental disorders.
Timeframe: from inception until 1/10/2018	
Total # studies included: 27 systematic reviews (including 16 meta-analyses representing 152 RCTs)	
Other details (e.g. definitions used, exclusions etc) Did not include adults Review of reviews	
Outcomes addressed: Attention Hyperactivity Impulsivity Anxiety symptoms Executive function Social disorders	

ADHD 2. (SYSTEMATIC) REVIEW OF REVIEWS AND META-ANALYSES

Citation: L. Christiansen; M. M. Beck; N. Bilenberg; J. Wienecke; A. Astrup; J. Lundbye-Jensen (2019) Effects of Exercise on Cognitive Performance in Children and Adolescents with ADHD: Potential Mechanisms and Evidence-based Recommendations

Purpose: To review existing evidence that exercise affects cognitive functions in children with and without ADHD and present likely neurophysiological mechanisms of action	**Abstract:** Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder with a complex symptomatology, and core symptoms as well as functional impairment often persist into adulthood. Recent investigations estimate the worldwide prevalence of ADHD in children and adolescents to be ~7%, which is a substantial increase compared to a decade ago. Conventional treatment most often includes pharmacotherapy with central nervous stimulants, but the number of non-responders and adverse effects call for treatment alternatives. Exercise has been suggested as a safe and low-cost adjunctive therapy for ADHD and is reported to be accompanied by positive effects on several aspects of cognitive functions in the general child population. Here we review existing evidence that exercise affects cognitive functions in children with and without ADHD and present likely neurophysiological mechanisms of action. We find well-described associations between physical activity and ADHD, as well as causal evidence in the form of small to moderate beneficial effects following acute aerobic exercise on executive functions in children with ADHD. Despite large heterogeneity, meta-analyses find small positive effects of exercise in population-based control (PBC) children, and our extracted effect sizes from long-term interventions suggest consistent positive effects in children and adolescents with ADHD. Paucity of studies probing the effect of different exercise parameters impedes finite conclusions in this regard. Large-scale clinical trials with appropriately timed exercise are needed. In summary, the existing preliminary evidence suggests that exercise can improve cognitive performance intimately linked to ADHD presentations in children with and without an ADHD diagnosis. Based on the findings from both PBC and ADHD children, we cautiously provide recommendations for parameters of exercise.
Timeframe: not specified – study is very narrative, with no methods section	
Total # studies included: unclear	
Other details (e.g. definitions used, exclusions etc) Review of reviews Unclear if it was 'systematic' Did not include adults	
Outcomes addressed: Cognitive function	

ADHD 3. SYSTEMATIC REVIEW **Citation:** V. Grassmann; M. V. Alves; R. F. Santos-Galduroz; J. C. Galduroz (2017) Possible Cognitive Benefits of Acute Physical Exercise in Children With ADHD	
Purpose: To review the acute effects of exercise in executive function in children with ADHD	**Abstract:** OBJECTIVE: Studies have suggested that even a single session of physical exercise enhances executive functions. ADHD is among the most common developmental disorders in childhood, but little is known about alternative treatments for this disorder. Therefore, we performed a systematic review of the literature to analyze articles that evaluated the executive functions of children with ADHD after an acute exercise session. METHOD: We reviewed articles indexed in the PubMed, American Psychiatric Association (APA) psychNET, Scopus, and Web of Knowledge databases between 1980 and 2013. RESULTS: Of 231 articles selected, only three met the inclusion criteria. CONCLUSION: Based on these 3 articles, we concluded that 30 min of physical exercise reportedly improved the executive functions of children with ADHD. Due to the small number of articles selected, further studies are needed to confirm these benefits.
Timeframe: 1980 - 2013	
Total # studies included: 3	
Other details (e.g. definitions used, exclusions etc) Did not include adults	
Outcomes addressed: Executive function	

ADHD 4. SYSTEMATIC REVIEW

Citation: S. Suarez-Manzano; A. Ruiz-Ariza; M. De La Torre-Cruz; E. J. Martinez-Lopez (2018) Acute and chronic effect of physical activity on cognition and behaviour in young people with ADHD: A systematic review of intervention studies

Purpose: To analyse the acute and chronic effect of physical activity on the cognition and behaviour of children and adolescents with ADHD	**Abstract:** BACKGROUND: Young people with attention deficit hyperactivity disorder (ADHD) often have learning and behavioral control difficulties. AIM: The aim of this review is analyse the acute and chronic effect of physical activity (PA) on the cognition and behaviour of children and adolescents with ADHD. METHODS: Studies were identified in five databases (PubMed, SPORTDiscus, ProQuest, Web of Science, and SCOPUS), from January 2000 through to January 2017. A total of 16 interventional studies met the inclusion criteria. RESULTS/CONCLUSIONS: PA practice of 20-30min (intensity 40-75%) produces a positive acute effect on processing speed, working memory, planning and problem solving in young people with ADHD. However, these effects on behaviour are contradictory and vary depending on age. Chronic PA practice (>/=30min per day, >/=40% intensity, >/=three days per week, >/=five weeks) further improves attention, inhibition, emotional control, behaviour and motor control. The results must be treated with caution, because only 25% of the studies used confounders. IMPLICATION: More research is needed to justify the causes of these effects. It is necessary to establish programs with regard to the duration, intensity, kind of exercise, and time of PA to improve cognition and behaviour in young people with ADHD taking into account potential confounders.
Timeframe: from January 2000 through to January 2017	
Total # studies included: 16	
Other details (e.g. definitions used, exclusions etc) Did not include adults	
Outcomes addressed: Cognitive function	

Systematic Review and Meta-Analysis

Citation: J. Firth; B. Stubbs; S. Rosenbaum; D. Vancampfort; B. Malchow; F. Schuch; R. Elliott; K. H. Nuechterlein; A. R. Yung 2017 Aerobic Exercise Improves Cognitive Functioning in People With Schizophrenia: A Systematic Review and Meta-Analysis 10.1093/schbul/sbw115

Purpose: investigating the cognitive outcomes of exercise interventions in schizophrenia	**Abstract:** Cognitive deficits are pervasive among people with schizophrenia and treatment options are limited. There has been an increased interest in the neurocognitive benefits of exercise, but a comprehensive evaluation of studies to date is lacking. We therefore conducted a meta-analysis of all controlled trials investigating the cognitive outcomes of exercise interventions in schizophrenia. Studies were identified from a systematic search across major electronic databases from inception to April 2016. Meta-analyses were used to calculate pooled effect sizes (Hedges g) and 95% CIs. We identified 10 eligible trials with cognitive outcome data for 385 patients with schizophrenia. Exercise significantly improved global cognition (g = 0.33, 95% CI = 0.13–0.53, P = .001) with no statistical heterogeneity (I2 = 0%). The effect size in the 7 studies which were randomized controlled trials was g = 0.43 (P < .001). Meta-regression analyses indicated that greater amounts of exercise are associated with larger improvements in global cognition (β = .005, P = .065). Interventions which were supervised by physical activity professionals were also more effective (g = 0.47, P < .001). Exercise significantly improved the cognitive domains of working memory (g = 0.39, P = .024, N = 7, n = 282), social cognition (g = 0.71, P = .002, N = 3, n = 81), and attention/vigilance (g = 0.66, P = .005, N = 3, n = 104). Effects on processing speed, verbal memory, visual memory and reasoning and problem solving were not significant. This meta-analysis provides evidence that exercise can improve cognitive functioning among people with schizophrenia, particularly from interventions using higher dosages of exercise. Given the challenges in improving cognition, and the wider health benefits of exercise, a greater focus on providing supervised exercise to people with schizophrenia is needed.
Timeframe: inception to April 2016	
Total # studies included: 10	
Other details (e.g. definitions used, exclusions etc) Exclusion: review or abstract, ineligible population, study protocol only, no neurocognitive outcomes, no exercise interventions, no control conditions. Interventions using only yoga or tai-chi were excluded as these theoretically confer benefits for cognition which are distinct from the physical activity itself.	
Outcomes addressed: Global Cognition/ Cognitive Functioning: (significant) working memory, social cognition, attention/ vigilance (Not significant) processing speed, verbal memory, visual memory and reasoning and problem solving.	

MCL 1 Systematic Review

Citation: J. Krogh; C. Hjorthoj; H. Speyer; C. Gluud; M. Nordentoft 2017 Exercise for patients with major depression: a systematic review with meta-analysis and trial sequential analysis 10.1136/bmjopen-2016-014820

Purpose: assess the effect of exercise in participants diagnosed with depression	**Abstract: Objectives** To assess the benefits and harms of exercise in patients with depression. **Design:** Systematic review **Data sources:** Bibliographical databases were searched until 20 June 2017. **Eligibility criteria and outcomes:** Eligible trials were randomised clinical trials assessing the effect of exercise in participants diagnosed with depression. Primary outcomes were depression severity, lack of remission and serious adverse events (eg, suicide) assessed at the end of the intervention. Secondary outcomes were quality of life and adverse events such as injuries, as well as assessment of depression severity and lack of remission during follow-up after the intervention. **Results** Thirty-five trials enrolling 2498 participants were included. The effect of exercise versus control on depression severity was −0.66 standardised mean difference (SMD) (95% CI −0.86 to −0.46; p<0.001; grading of recommendations assessment, development and evaluation (GRADE): very low quality). Restricting this analysis to the four trials that seemed less affected of bias, the effect vanished into −0.11 SMD (−0.41 to 0.18; p=0.45; GRADE: low quality). Exercise decreased the relative risk of no remission to 0.78 (0.68 to 0.90; p<0.001; GRADE: very low quality). Restricting this analysis to the two trials that seemed less affected of bias, the effect vanished into 0.95 (0.74 to 1.23; p=0.78). Trial sequential analysis excluded random error when all trials were analysed, but not if focusing on trials less affected of bias. Subgroup analyses found that trial size and intervention duration were inversely associated with effect size for both depression severity and lack of remission. There was no significant effect of exercise on secondary outcomes. **Conclusions** Trials with less risk of bias suggested no antidepressant effects of exercise and there were no significant effects of exercise on quality of life, depression severity or lack of remission during follow-up. Data for serious adverse events and adverse events were scarce not allowing conclusions for these outcomes.
Timeframe: inception to July 2017	
Total # studies included: 35	
Other details (e.g. definitions used, exclusions etc.)	
Outcomes addressed: depression severity, lack of remission and serious adverse events (eg, suicide). Secondary outcomes QoL and adverse events such as injuries, as well as assessment of depression severity and lack of remission during follow-up after the intervention.	

MCD 2 Meta Review of Systematic Reviews with or without Meta-Analysis.

Citation: B. Stubbs; D. Vancampfort; M. Hallgren; J. Firth; N. Veronese; M. Solmi; S. Brand; J. Cordes; B. Malchow; M. Gerber; A. Schmitt; C. U. Correll; M. De Hert; F. Gaughran; F. Schneider; F. Kinnafick; P. Falkai; H. J. Moller; K. G. Kahl 2018 EPA guidance on physical activity as a treatment for severe mental illness: a meta-review of the evidence and Position Statement from the European Psychiatric Association (EPA), supported by the International Organization of Physical Therapists in Mental Health (IOPTMH) 10.1016/j.eurpsy.2018.07.004

Purpose: 1. establish the benefits of physical activity / exercise across all categories of severe mental illness (SMI), 2. examine how the benefits of physical activity may differ across specific SMIs, including schizophrenia- pectrum disorders, BD and MDD. 3. Use findings to provide guidance for clinical practice, policy and future research.

Timeframe: inception to Jan 2018

Total # studies included: 20

Other details (e.g. definitions used, exclusions etc) :Included 1) SRs 2) physical activity/ exercise interventions, including aerobic, high intensity and resistance exercise as monotherapy or in conjunction with other treatment options, 3) systematic reviews of PA, which included people with pooled SMI or schizophrenia-spectrum disorders, BD or MDD, confirmed through validated assessment measures 4) systematic reviews, which included a non-active/ non-exercise control group (e.g., does not include physical activity). We excluded mind-body physical activity interventions, such as yoga and tai-chi.

Outcomes addressed: incl. Cognitive functioning, e.g. performance in neuropsychological tests

Abstract: Physical activity (PA) may be therapeutic for people with severe mental illness (SMI) who generally have low PA and experience numerous lifestyle-related medical complications. We conducted a metareview of PA interventions and their impact on health outcomes for people with SMI, including schizophrenia-spectrum disorders, major depressive disorder (MDD) and bipolar disorder. We searched major electronic databases until January 2018 for systematic reviews with/without metaanalysis that investigated PA for any SMI. We rated the quality of studies with the AMSTAR tool, grading the quality of evidence, and identifying gaps, future research needs and clinical practice recommendations. For MDD, consistent evidence indicated that PA can improve depressive symptoms versus control conditions, with effects comparable to those of antidepressants and psychotherapy. PA can also improve cardiorespiratory fitness and quality of life in people with MDD, although the impact on physical health outcomes was limited. There were no differences in adverse events versus control conditions. For MDD, larger effect sizes were seen when PA was delivered at moderate-vigorous intensity and supervised by an exercise specialist. For schizophrenia-spectrum disorders, evidence indicates that aerobic PA can reduce psychiatric symptoms, improves cognition and various subdomains, cardiorespiratory fitness, whilst evidence for the impact on anthropometric measures was inconsistent. There was a paucity of studies investigating PA in bipolar disorder, precluding any definitive recommendations. No cost effectiveness analyses in any SMI condition were identified. We make multiple recommendations to fill existing research gaps and increase the use of PA in routine clinical care aimed at improving psychiatric and medical outcomes.

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