

## Supplemental Online Content

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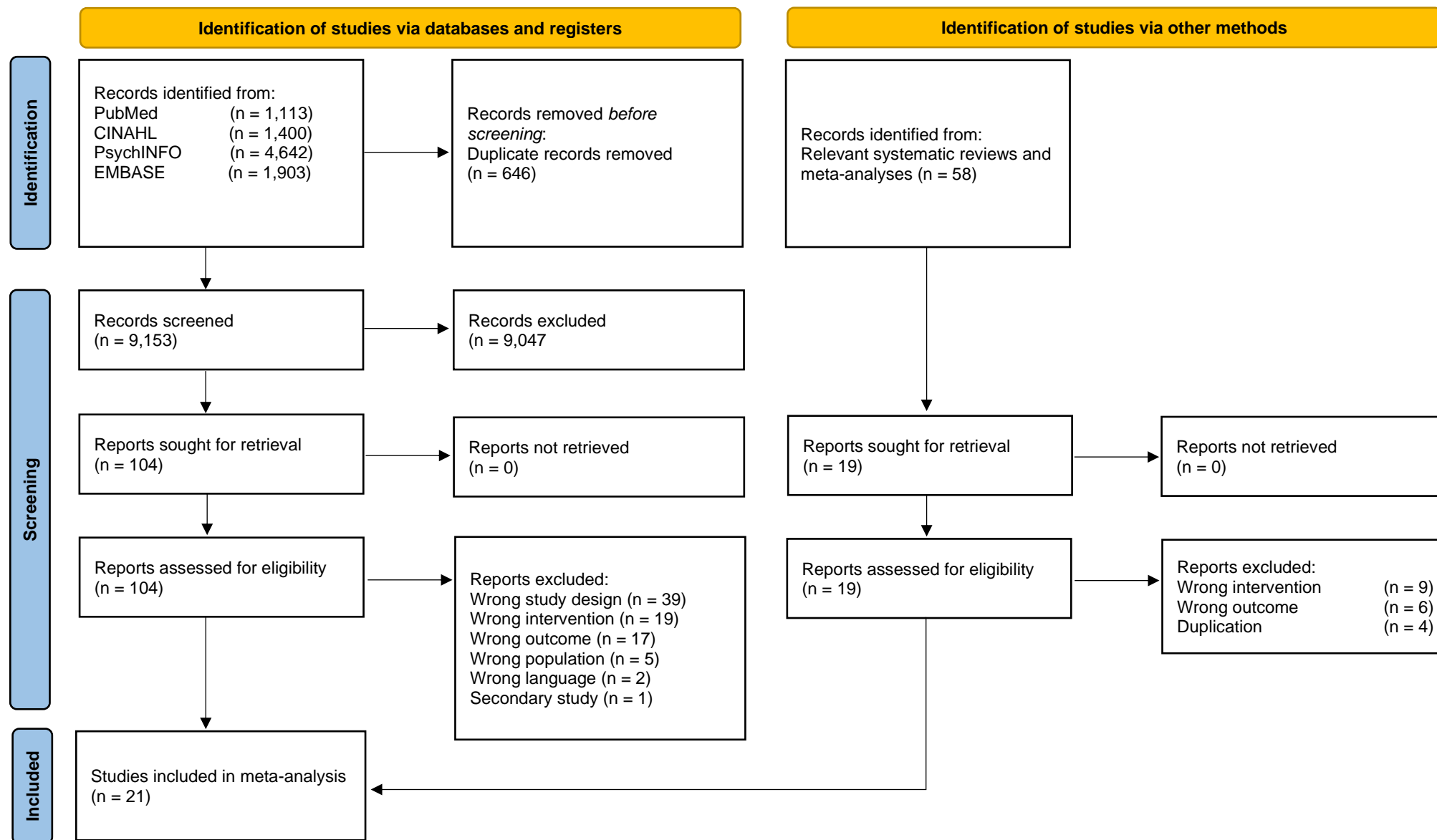
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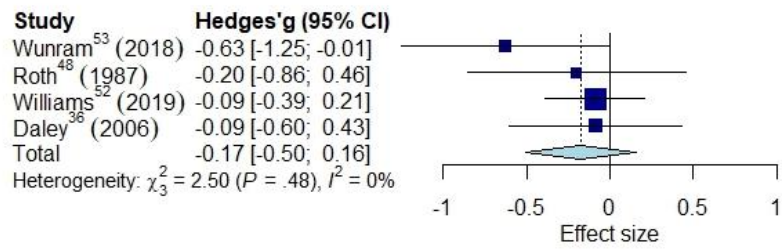
**eReference**

This supplemental material has been provided by the authors to give readers additional information about their work.

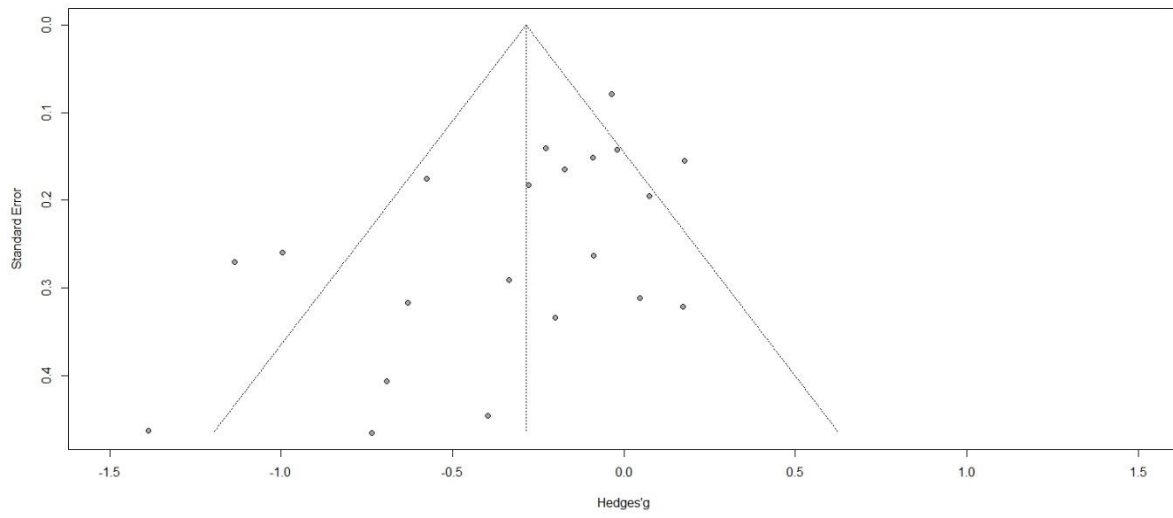
**eFigure 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analyses Flow Chart



**eFigure 2.** Forest Plot of the Distribution of Effect Sizes at Follow-up



**eFigure 3.** Funnel Plot of the Included Studies



**eFigure 4.** Risk of Bias of the Included Studies

<u>Study ID</u>	<u>D1</u>	<u>D2</u>	<u>D3</u>	<u>D4</u>	<u>D5</u>	<u>Overall</u>	
Bonhauer (2005)	!	+	+	!	+	!	Low risk
Daley (2006)	+	+	+	+	+	+	Some concerns
Goldfield (2015)	!	+	+	+	+	!	High risk
Hughes (2013)	+	+	+	+	+	+	
Mohammadi (2011)	!	+	+	!	!	!	D1 Randomisation process
Nabkasorn (2006)	!	!	+	!	+	!	D2 Deviations from the intended interventions
Norris (1992)	!	+	!	!	!	-	D3 Missing outcome data
Olive (2019)	+	+	!	+	+	!	D4 Measurement of the outcome
Peng (2015)	!	+	+	!	+	!	D5 Selection of the reported result
Petty (2009)	+	+	+	!	!	!	
Romero-Perez (2020)	!	+	+	!	+	!	
Roshan (2011)	!	+	+	!	+	!	
Roth (1987)	!	+	+	!	!	!	
Silva (2020)	!	+	!	!	!	-	
Talakoub (2012)	!	+	+	!	+	!	
Weintraub (2008)	+	+	+	+	+	+	
Williams (2019)	+	+	+	+	+	+	
Wunram (2018)	+	+	+	+	+	+	
Yu (2020)	+	+	+	+	+	+	
Zhang (2021)	!	+	+	+	+	!	
Lin (2020)	!	+	+	!	+	!	

**eTable 1.** Definitions and Codes for Primary and Secondary Moderators

<b>Primary moderators</b>	<b>Definition</b>
<b>Health status</b>	
Healthy	Participants did not present any primary physical or mental condition
Ill	Participants had at least one physical or mental condition
<b>Total physical activity volume</b>	Session duration x intervention duration x frequency
<b>Allocation and/or assessment concealment</b>	
Yes	Participant randomization and/or outcome assessments were reported as blinded
No	Neither participant randomization nor outcome assessments were reported as blinded
<b>Study design</b>	
RCT	The study was a randomized controlled trial
QRCT	The study was a quasi-randomized controlled trial
<b>Secondary moderators</b>	<b>Definition</b>
<b>Sex</b>	
Mixed	Participants randomized were both male and female
Female	Participants randomized were all female
<b>Age</b>	
< 14	Participants were younger than 14 years old
≥ 14	Participants were 14 years old or older
<b>Health</b>	
Healthy	Participants were healthy
Physical illness	Participants presented a primary physical illness
Mental illness	Participants presented a primary mental illness
<b>Depression diagnosis</b>	
Yes	Participants had a clinical diagnosis of depression
No	Participants did not have a clinical diagnosis of depression
<b>Monotherapy</b>	
Yes	The physical activity intervention was administered as a monotherapy
No	The physical activity intervention was administered in combination with another intervention
<b>Supervision</b>	
Fully supervised	The physical activity intervention was fully supervised
Partially supervised	The physical activity intervention was partially supervised
Not supervised	The physical activity intervention was not supervised
<b>Control</b>	
Usual care	The control condition involved the continuation of the treatment that participants were undergoing prior to joining the study (e.g., pharmacotherapy)
Attention	The control condition involved some activities of lower intensity, time and/or contacts than the intervention activities (e.g., health education)
Wait-list	

	Participants did not receive the intervention, but were put on a waiting list to receive the intervention after the active treatment group
No intervention	Participants did not receive any intervention
<b>ITT</b>	
Yes	Intention-to-treat analyses were used
No	No intention-to-treat analyses were used
<b>Frequency</b>	
2 days/week	The physical activity intervention was conducted two times per week
3 days/week	The physical activity intervention was conducted three times per week
≥ 4 days/week	The physical activity intervention was conducted four or more times per week
<b>Session duration</b>	
< 45 minutes	Each physical activity session lasted less than 45 minutes
≥ 45 minutes	Each physical activity session lasted 45 minutes or more
<b>Duration</b>	
< 12 weeks	The physical activity intervention lasted less than 12 weeks
≥ 12 weeks	The physical activity intervention lasted 12 weeks or more
<b>Intensity</b>	
Low-Moderate	Physical activity intensity was reported as low or moderate
Vigorous	Physical activity intensity was reported as vigorous
Not reported	Physical activity intensity was not reported

**eTable 2.** Intervention Characteristics

Study	Intervention	1. Session duration 2. Frequency 3. Intervention duration 4. Intensity	Delivered by	Control	Delivered by	Setting
Bonhauser (2005)	Four units of 30 sessions each. Sessions in each unit included: 1) No weight transfer activities: stretching and arm, leg, and trunk movements 2) Weight transfer activities: fast walking, running and jumping 3) Sports practice: Dance, aerobics, track practice and volleyball for females AND soccer, basketball, track practice and volleyball for males (sports varied depending on current unit)	1. 90 minutes 2. 3 sessions/week 3. 40 weeks (10 weeks x 4 units) 4. Moderate-Vigorous	Teachers	90-min standard exercise class performed once/week  Mixed activities, including general training (running, jumping), playing games and practicing sports that changed from session to session	Teachers	Urban public school located in a low socioeconomic area in Santiago, Chile  Interventions delivered as part of the school curriculum
Daley (2006)	Short bouts of intermittent aerobic activities e.g., (stepping, cycling, rowing, dance mat, and walking) and mini games  Exercise counselling for behavior change was also an integral part of the exercise sessions	1. 30 minutes 2. 3 sessions/week 3. 8 weeks 4. 40%-59% of HR reserve	One researcher	Usual care – participants were asked to continue with their lives as normal	NA	Exercise therapy room housed at an English University
Goldfield (2015)	Aerobic exercise on treadmills, elliptical machines, and/or bicycle ergometers + 5-10 minutes of warm-up and cool-down (light exercise and stretching)  Participants gradually increased the duration and intensity of exercise in each session  All participants attended an initial visit with a dietitian to set dietary goals and received individually-tailored dietary advice	1. 20-45 minutes 2. 4 sessions/week 3. 22 weeks 4. 65%-85% of HR max	Certified fitness trainers and dietitian	Participants followed the same eating plan as those in the exercise group	Dietitian	Local gyms  The cost of the membership was covered by the research grant
Hughes (2013)	Exercise on treadmills or stationary bikes + home-based exercise sessions (e.g., Wii Sports and Fit, jazzercise, jogging, weight training)	1. 30-40 minutes 2. 3 sessions/week 3. 12 weeks 4. 12 kcal/kg/week	Exercise trainer	Full-body stretching with same duration and frequency as the intervention group but with intensity of 4 kcal/kg/week	Exercise trainer	Cooper Institute for preventive medicine and public health  Part of the intervention was performed at home
Lin (2020)	Moderate-intensity running	1. 30 minutes 2. 4 sessions/week 3. 12 weeks 4. 50%-70% of HR max	Research staff	General psychoeducation (i.e., group game, poetry reading and singing)	Research staff	Middle school in Guangzhou, China



						Interventions were performed in the afternoon in the school playground, after class
Mohammadi (2011)	Sport activities (soccer, volleyball, table tennis and badminton)	<ol style="list-style-type: none"> <li>1. 75 minutes</li> <li>2. 3 sessions/week</li> <li>3. 8 weeks</li> <li>4. NR</li> </ol>	NR	No intervention	NR	NR
Nabkasorn (2005)	<ol style="list-style-type: none"> <li>1) 5-10 minutes of warm-up</li> <li>2) 30 minutes of group jogging</li> <li>3) 5-10 minutes of cool-down</li> </ol>	<ol style="list-style-type: none"> <li>1. 50 minutes</li> <li>2. 5 sessions/week</li> <li>3. 8 weeks</li> <li>4. &lt; 50% of max HR reserve</li> </ol>	Physical fitness instructors	Usual care	NR	University nursing program in Chonburi, Thailand
Norris (1991)	High-intensity and moderate intensity aerobic exercise	<ol style="list-style-type: none"> <li>1. 25-30 minutes</li> <li>2. 2 sessions/week</li> <li>3. 10 weeks</li> <li>4. 70%-75% HR max and 50%-60% HR max</li> </ol>	Experienced fitness instructor	Flexibility training with same duration and frequency as the intervention group but with little or no increases in heart rate	Experienced fitness instructor	Local high-school  As the interventions took place during school hours, participants were organized into groups based upon mutual free lesson periods
Olive (2019)	<p>Sessions were based on 5 components:</p> <ol style="list-style-type: none"> <li>1) Coordination and agility drills (i.e., crawling, climbing, running, hopping, stepping, skipping, rope-skipping and jumping)</li> <li>2) Skill activities (i.e., hitting, kicking, throwing, juggling and catching with a variety of objects)</li> <li>3) Movement challenges and games (designed to promote aerobic fitness, cooperation, teamwork and problem solving)</li> <li>4) Core movement (i.e., yoga-like practices to develop muscular strength, flexibility, balance and postural control)</li> <li>5) Dynamic movement control (i.e., gymnastic-based activities to develop rhythm and balance)</li> </ol> <p>Emphasis on balance and gross motor skills as well as fine motor skills Each lesson dedicated time to a reflective discussion related to the movement experience</p>	<ol style="list-style-type: none"> <li>1. 50 minutes</li> <li>2. 2 sessions/week</li> <li>3. 4 years</li> <li>4. NR</li> </ol>	University-qualified PE teachers with additional training	Physical education class once per week for 30 minutes	Teachers	Elementary school  Face-to-face PE lessons, programmed into the school curriculum
Peng (2015)	<ol style="list-style-type: none"> <li>1) Warm-up (i.e., jogging, flexibility, light muscle activity)</li> <li>2) Sport games (i.e., basketball, badminton)</li> </ol>	<ol style="list-style-type: none"> <li>1. 80 minutes</li> <li>2. 2 sessions/week</li> <li>3. 12 weeks</li> <li>4. 65%-75% of HR max</li> </ol>	NR	No intervention	NA	Two middle schools In China

						The intervention was delivered as part of the school curriculum
Petty (2009)	High-dose or low-dose aerobic exercise program (i.e., running games, jump rope, basketball and soccer)  One or two 20-minute bouts of intermittent vigorous exercise interspersed by lower intensity activity	1. 20 or 40 minutes 2. 5 sessions/week 3. 13 weeks 4. Vigorous	Trained research staff	No intervention	NA	Local public school  The intervention took place on school day afternoons in the research gymnasium  Children assigned to the intervention group were provided free transportation via school bus to the research gymnasium and back
Romero-Perez (2020)	1) 5-minute warm-up 2) Core session (specific aerobic exercises and pre-sport games to develop conditional and coordinative capacities (strength, resistance, coordination and speed)) 3) 5-minute stretching	1. 50 minutes 2. 2 sessions/week 3. 20 weeks 4. NR	Research staff	Usual activities	NA	Local primary schools  Group sessions performed outside physical education classes, as an extracurricular activity
Roshan (2011)	Pool walking exercise	1. ~30 minutes 2. 3 sessions/week 3. 6 weeks 4. 60-70% of HR max	Research staff	No intervention	NA	NR
Roth (1987)	Running and brisk walking	1. 30 minutes 2. 3 sessions/week 3. 11 weeks 4. 75% of HR max	Instructor trained in exercise physiology and clinical psychology	No intervention	NA	Local university  The exercise program was structured as a 1 credit-hour college course
Silva (2020)	Swimming-learning program (i.e., adaptation to the net, leg propulsion, arms, breathing, and crawl and chest coordination exercises) + current medications  1. Stretching inside the pool and a recreational activity of adaptation to the liquid medium for 5 minutes 2. Four to five swimming-learning exercises for 25 minutes 3. Recreational activity aimed at swimming for 10 minutes 4. Stretching for 5 minutes	1. 45 minutes 2. 2 sessions/week 3. 8 weeks 4. NR	Research staff	No intervention + current medications	NA	UNESC Semi-Olympic thermal swimming pool
Talakoub (2012)	Aerobic exercise implemented with music + 15-30g of fat-free carbohydrates	1. 60 minutes 2. 3 sessions/week 3. 6 weeks	Research staff	No intervention	NA	Endocrine and Metabolism Research Center

		4. NR				(Sedigheh Tahereh Research Center)
Weintraub (2008)	Coed soccer practice 1) Supportive, team-building check-in 2) Warm-up and stretching 3) Soccer skills learning 4) Scrimmage	1. ~150 minutes 2. 3-4 sessions/week 3. 24 weeks 4. Vigorous	Trained undergraduate and medical students	Health education on nutrition and physical activity	Trained undergraduate and medical students	After-school team sports program  The study was implemented in schools in collaboration with school district personnel
Williams (2019)	Playful aerobic activities including vigorous exercises and games (e.g., running games, ball games, jump rope), interspersed with brief rest periods	1. 40 minutes 2. 5 sessions/week 3. 32 weeks 4. Vigorous	Research staff	Sedentary activities (e.g., board games, puzzles, art, music)	Research staff	After-school program  Participants were transported by bus daily to the Georgia Prevention Institute for the after-school intervention
Wunram (2017)	Ergometer training	1. 30 minutes 2. 3-5 sessions/week 3. 6 weeks 4. NR	Research staff	Treatment as usual	Psychotherapist or psychiatrist	Rehabilitation and physiotherapy training rooms of the University Hospital of Cologne
Yu (2020)	Phases of the intervention: 1. Supportive environment – obtain teacher’s cooperation and supervision, obtain parental participation and supervision, advance health propaganda 2. Intervention implement – Compulsory exercise (i.e., jogging 20 min in the morning break every weekday; rope skipping 40 min on Mon and Thu; play badminton 40 min on Wed and Fri; 200-m relay race 40min on Tue) and lifestyle modification (health education on physical activity and diet) 3. Quality control – training, feedback, improve the education method	1. 60 minutes 2. 5 sessions/week 3. 30 weeks 4. Vigorous	Parents and teachers	Wait list	NA	Local primary schools  Interventions delivered as part of the school curriculum
Zhang (2021)	Running on indoor treadmill or alternating running and fast walking on outdoor playground + Sertraline and Fluoxetine	1. 50-60 minutes 2. 3 sessions/week 3. 16 weeks 4. 64%-96%of HR max	Chief physician, senior nurse and several junior nurses	Sertraline and Fluoxetine	Chief physician, senior nurse and several junior nurses	Zhejiang Provincial Hospital of Traditional Chinese Medicine

## **eAppendix 1. Search Strategy**

### **PubMed**

(((((kids[Title/Abstract] OR school[Title/Abstract] OR juvenil\*[Title/Abstract] OR student\*[Title/Abstract] OR pediatric\*[Title/Abstract] OR paediatric\*[Title/Abstract] OR girl\*[Title/Abstract] OR boys[Title/Abstract] OR youth\*[Title/Abstract] OR child\*[Title/Abstract] OR adolescen\*[Title/Abstract] OR young[Title/Abstract] OR teen\*[Title/Abstract] OR children[MeSH Terms] OR adolescent[MeSH Terms]) AND (exercise[Title/Abstract] OR aerobic exercise[MeSH Terms] OR physical activity[Title/Abstract] OR physical activity[MeSH Terms] OR sport[Title/Abstract] OR leisure[Title/Abstract] OR walk\*[Title/Abstract] OR swim\*[Title/Abstract] OR cycl\*[Title/Abstract] OR running[Title/Abstract] OR aerobic[Title/Abstract])) AND (depress\*[Title/Abstract] OR depressive symptom[MeSH Terms] OR dysthymi\*[Title/Abstract] OR emotion\*[Title/Abstract] OR mood\*[Title/Abstract] OR affective[Title/Abstract] OR mental[Title/Abstract])) AND ((allocation, random[MeSH Terms] OR randomized controlled trials as topic[MeSH Terms]) OR (random\*[Title/Abstract] AND control\*[Title/Abstract])))

### **CINAHL**

((((kids OR school OR juvenil\* OR student\* OR pediatric\* OR paediatric\* OR boys OR girl\* OR youth\* OR child\* OR adolescen\* OR teen\* OR young) OR SU (children or adolescents or youth or child or teenager)) AND ((exercise OR physical activity OR sport\* OR leisure OR walk\* OR running OR swim\* OR cycl\* OR aerobic) OR SU (exercise or physical activity)) AND ((depress\* OR dysthym\* OR emotion\* OR affective OR mood OR mental) OR SU (depression)) AND ((random\* AND control\*) OR SU (randomized))))

### **EMBASE**

((kids.mp. or school.mp. or juvenil\*.mp. or student\*.mp. or pediatric\*.mp. or paediatric\*.mp. or boys.mp. or girl\*.mp. or youth\*.mp. or child\*.mp. or adolescen\*.mp. or teen\*.mp. or young.mp. or exp children/ or exp adolescent/) AND (exp exercise/ or exp physical activity/ or exercise.mp. or physical activity.mp. or sport\*.mp. or leisure.mp. or walk\*.mp. or running.mp. or swim\*.mp. or cycl\*.mp. or aerobic.mp.) AND (exp depression/ or depress\*.mp. or dysthym\*.mp. or emotion\*.mp. or affective.mp. or mood.mp. or mental.mp.) AND (random\* and control).mp

### **SPORTDiscus**

((((kids OR school OR juvenil\* OR student\* OR pediatric\* OR paediatric\* OR boys OR girl\* OR youth\* OR child\* OR adolescen\* OR teen\* OR young) OR SU (children or adolescents or youth or child or teenager)) AND ((exercise OR physical activity OR sport\* OR leisure OR walk\* OR running OR swim\* OR cycl\* OR aerobic) OR SU (exercise or physical activity)) AND ((depress\* OR dysthym\* OR emotion\* OR affective OR mood OR mental) OR SU (depression or depressive disorder or depressive symptoms or major depressive disorder)) AND ((random\* AND control\*) OR SU (random sampling))))

### **PsychINFO**

((kids OR school OR juvenil\* OR student\* OR pediatric\* OR paediatric\* OR boys OR girl\* OR youth\* OR child\* OR adolescen\* OR teen\* OR young) AND (exercise OR physical activity OR sport\* OR leisure OR walk\* OR running OR swim\* OR cycl\* OR aerobic) AND (depress\* OR dysthym\* OR emotion\* OR affective OR mood OR mental) AND (random\* AND control\*))

## **eAppendix 2. Risk-of-Bias Assessment**

Bias in the following domains was assessed for each study: 1) Randomization process, 2) Deviations from intended interventions, 3) Missing outcome data, 4) Measurement of the outcome, and 5) Selection of the reported result. To ensure a systematic assessment of the risk of bias, we utilised the Excel template provided in the “Cochrane Handbook for Systematic Reviews of Interventions”,<sup>1</sup> which includes ‘signalling questions’ that can be used to determine risk of bias for each domain.

1. Assessment of bias due to the randomization process was based on whether the allocation of participants was blinded and/or concealed, and whether there were baseline differences between groups suggesting a problem with the randomization process.
2. Assessment of bias due to deviations from intended interventions was based on whether participants were aware of their group assignment during the study, and whether carers and people delivering the intervention were aware of participants’ group assignment.
3. Assessment of bias due to missing outcome data was based on whether data for the outcome of interest was available for all or most of the participants randomized.
4. Assessment of bias due to the measurement of the outcome was based on whether the method for measuring the outcome was appropriate, whether the measurement of the outcome may have differed between groups, and whether the assessors were aware of the interventions received by the participants.
5. Assessment of bias due to selection of the reported result was based on whether a pre-specified statistical analysis plan was used before the data of participants was available, and whether the result was likely to have been selected from multiple outcome measurements and/or statistical analyses.

Overall, the study bias was rated as follows: 1) a study was defined as having a ‘low’ risk of bias if all domains were considered to be at low risk, 2) a study was defined as having ‘some concerns’ if at least one domain raised concerns about the risk of bias, and 3) a study was defined as having a ‘high’ risk of bias if any domain was rated as high risk or if several domains showed some concerns, such that the confidence in the results of the study was substantially lowered.

## **eReference**

Higgins JPT, Savović J, Page MJ, Elbers RG, Sterne JAC. Chapter 8: Assessing risk of bias in a randomized trial. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). *Cochrane Handbook for Systematic Reviews of Interventions* version 6.3 (updated February 2022). Cochrane, 2022. Available from [www.training.cochrane.org/handbook](http://www.training.cochrane.org/handbook).