

# Population-level interventions to increase physical activity to prevent cardiovascular diseases and diabetes in low- and middle-income countries: a systematic review

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# Disclosure of interests

I have no actual or potential conflict of interests in relation to this presentation.





## Ten threats to global health in 2019

# Noncommunicable diseases

Noncommunicable diseases, such as diabetes, cancer and heart disease, are collectively responsible for over 70% of all deaths worldwide, or 41 million people. This includes 15 million people dying prematurely, aged between 30 and 69.

Over 85% of these premature deaths are in low- and middle-income countries. The rise of these diseases has been driven by five major risk factors: tobacco use, physical inactivity, the harmful use of alcohol, unhealthy diets and air pollution. These risk factors also exacerbate mental health issues, that may originate from an early age: half of all mental illness begins by the age of 14, but most cases go undetected and untreated – suicide is the third leading cause of death among 15-19 year-olds.

Among many things, this year WHO will work with governments to help them meet the global target of **reducing physical inactivity** by 15% by 2030 – through such actions as implementing the ACTIVE policy toolkit



<https://www.who.int/news-room/feature-stories/ten-threats-to-global-health-in-2019>

# Background

- Population-level interventions may be an effective way to increase physical activity, a modifiable risk factor for NCDs
- Existing reviews focus on
  - Dietary risk factors (Heise 2016; von Philipsborn 2016; McLaren 2012; Lhachimi 2016; Pfander 2016; Crocket 2011)
  - Individual clinical condition, treatment and rehabilitation (Heath 2012; Klausen 2014; Geneen 2017)
  - Community, workplace or school as specific settings (Baker 2011; Klausen 2014; Dobbins 2013)
- Effectiveness of population-level interventions to increase physical activity is unclear.

## Objective

To assess the effects of population-level interventions for increasing physical activity with the primary or secondary aim to prevent CVD and diabetes in low- and middle-income countries (LMICs).

# PICO - review scope

<b>Population</b>	Healthy populations of any age or gender, not diagnosed with CVDs or diabetes (in LMICs and HICs)	
<b>Intervention</b>	<ol style="list-style-type: none"><li>1. Technology and infrastructure interventions (e.g. green spaces/parks)</li><li>2. Policy and regulatory intervention (e.g. national school physical activity programme)</li></ol>	
<b>Comparison</b>	no new intervention or existing interventions to promote physical activity (“business as usual”)	
<b>Outcomes</b>	<b>Primary</b> <ol style="list-style-type: none"><li>1. Measures of population-level physical activity</li><li>2. Anthropometry (e.g. BMI)</li><li>3. Blood pressure</li><li>4. CVD morbidity and mortality</li><li>5. Diabetes morbidity and mortality</li></ol>	<b>Secondary</b> <ol style="list-style-type: none"><li>8. Costs and cost-effectiveness</li><li>9. Satisfaction or dissatisfaction</li><li>10. Impacts on equity issues</li><li>11. Safety issues</li><li>12. Adverse effects</li></ol>

# Inclusion criteria: Study designs

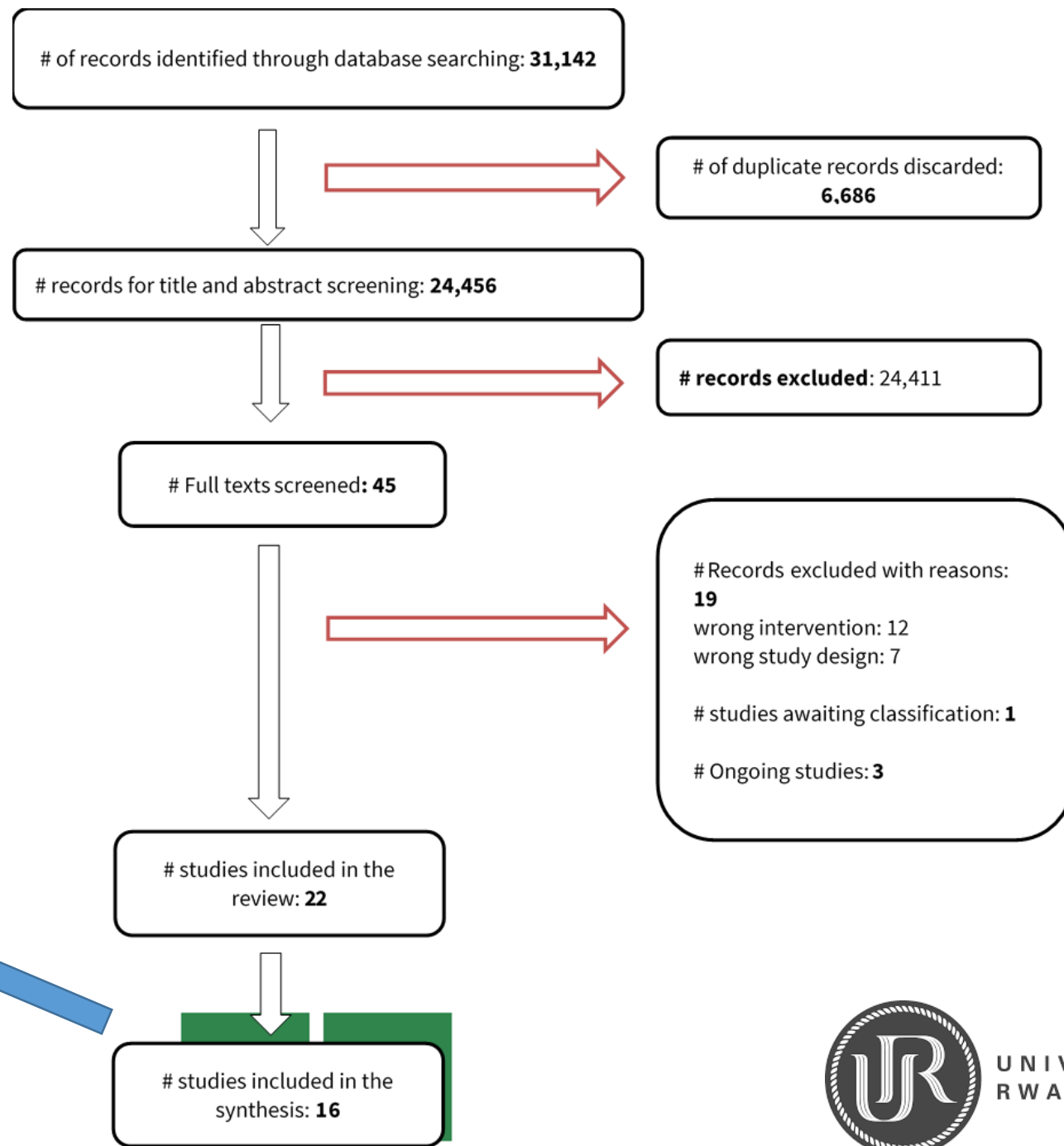
- Randomized controlled trials (RCTs)
- Cluster RCTs
- Other rigorous non-randomized designs often used to evaluate population-level interventions
  - Controlled before-after (CBA) studies
  - Interrupted time-series (ITS) studies

# Methods overview

- Database searches:
  - MEDLINE; Embase; Web of Science ( Conference Proceedings Citation Index, Science Citation Index Expanded, Social Science Citation Index); ClinicalTrials.gov (inception → February 2018)
  - Any language; published and unpublished
- Duplicate screening and data extraction
- Data synthesis using Harvest plots
- Risk of Bias assessment: Cochrane 'risk of bias' tool adapted by EPOC
- Certainty of evidence assessed with GRADE system

# Results

# Search results and study selection



13 CBA studies  
2 ITS studies  
1 cluster RCT

# Included interventions

## Technology & Infrastructure

### Green or other spaces (n = 6)

- upgrade or construction of parks,
- temporary closing of streets to encourage outside play and activities

### Active transport (n = 9)

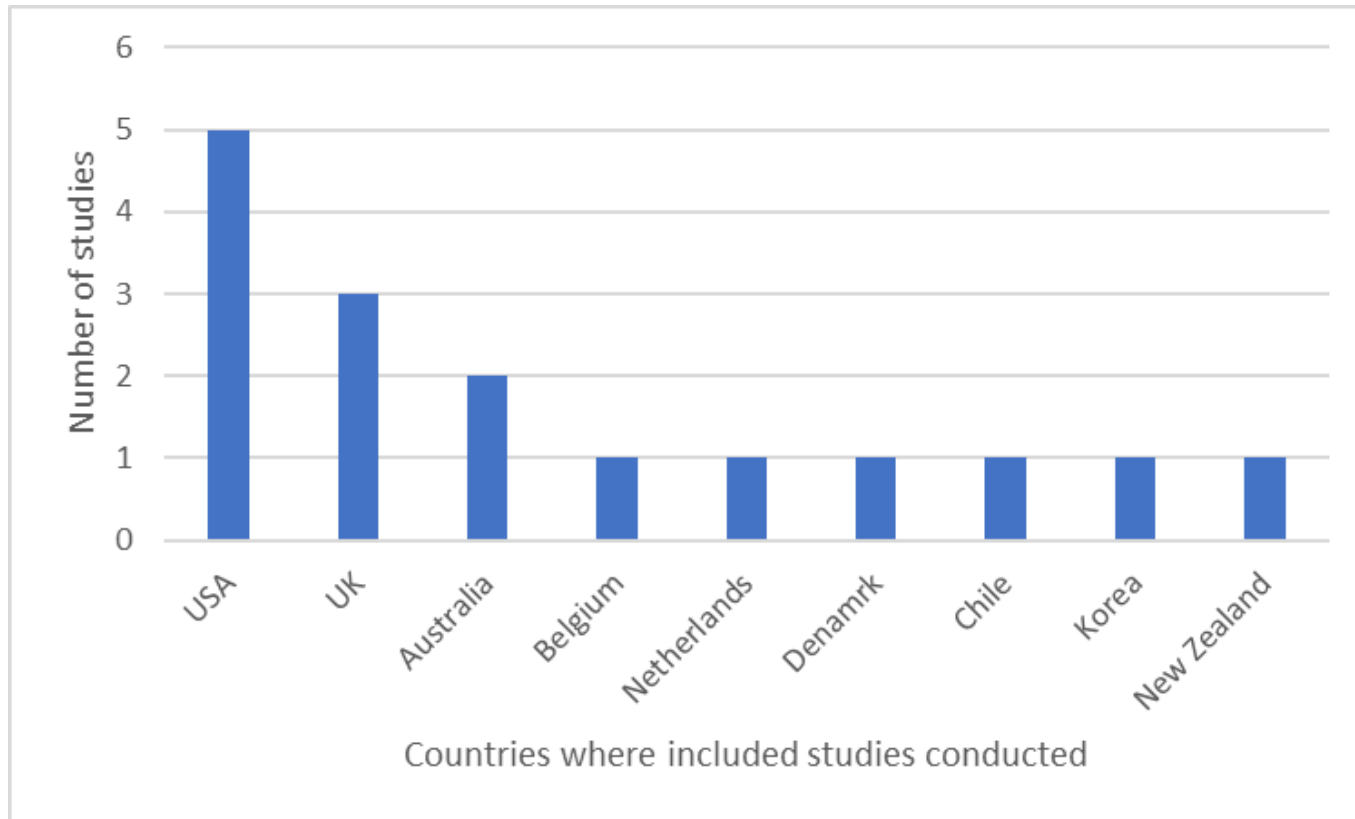
- improvements to the infrastructure by installing new sidewalks or cycle lanes
- extension of a motorway away from residential areas

## Policies & regulations

### Access to PA facilities (n = 1)

- Government scheme to increase access to physical activity facilities.

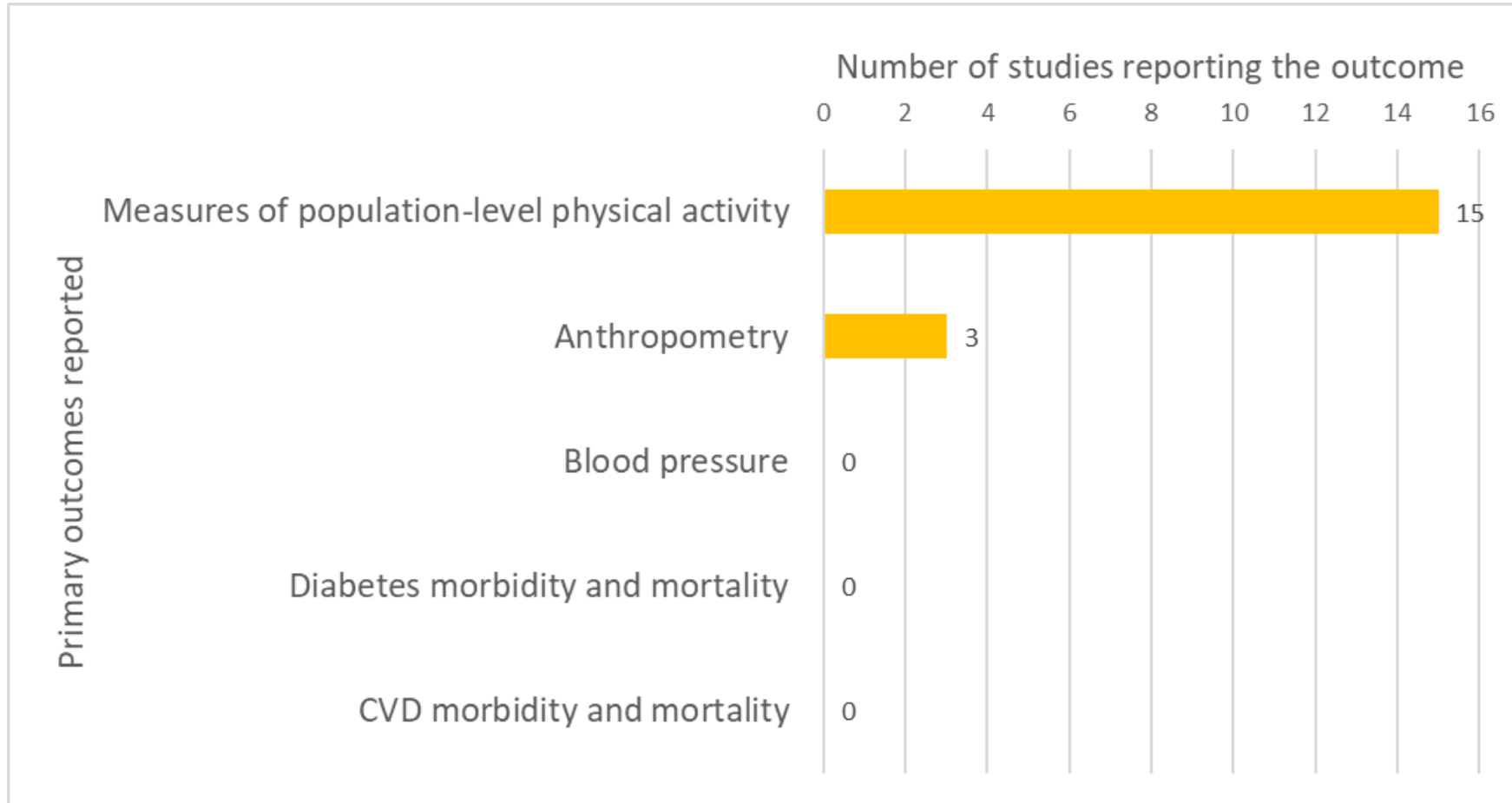
# Context & participants in included studies



No studies from LMICs identified

Population	N
Primary school children	5
Children living in selected neighborhoods	2
Adults	6
Pedestrians using selected interventions streets and people visiting a park where the intervention was implemented	3

# Outcomes reported in included studies



## Measures of physical activity:

- Meeting PA guidelines
- MVPA/ walking/ cycling (time/proportion)

# Risk of bias assessment

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
BenjaminNeelon 2015	●	●	●	●	●	●	●	●	●	●										
Brown 2016	●	●	●	●	●	●	●	●	●	●										
Cortinez ORyan 2017	●	●	●	●	?	●	?	●	●	●										
DHaese 2015	●	●	●	?	●	●	●	●	?	●										
Fitzhugh 2010	●	●	●	●	?	●	?	?	●	?										
Goldsby 2016	●	●	●	●	?	●	?	●	●	?										
Goodman 2013	●	●	●	●	?	●	●	●	?	?										
Higgerson 2018											?	●	?	●	●	●	●			
Jung 2017	●	●	●	?	?	●	●	?	●	?										
Kramer 2014											●	●	?	●	●	●	?			
McDonald 2013	●	●	●	?	?	●	●	?	?	●										
Ostergaard 2015	●	●	●	●	●	●	●	●	●	●										
Prins 2017	●	●	●	●	●	●	●	●	●	●										
Quigg 2012	●	●	●	●	?	●	?	?	?	?										
Rissel 2015	●	●	●	●	?	●	●	?	●	●										
Veitch 2018	●	●	●	●	?	●	●	●	●	●										

- Lack of randomization: Selection bias
- Missing outcome data
  - Reported
  - Poor reporting

# Effects of interventions

## Intervention effects

1 study/  
outcome  
measure

GRADE  
Certainty of  
evidence

	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity		<div>4 b</div> <div>4 c</div>	<div>1</div> <div>5</div> <div>4 a</div>	<div>2</div> <div>6</div>
Anthropometry			<div>3</div>	

Low certainty



Anthro-  
pometry

Low certainty



Outcomes

# Green and other spaces

	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity  Low certainty  ⊕⊕		<div>4</div> <div>b</div> <div>4</div> <div>c</div>	<div>1</div> <div>5</div> <div>4</div> <div>a</div>	<div>2</div> <div>6</div>
Anthro- pometry  Low certainty  ⊕⊕			<div>3</div>	

- 6 studies
- Intervention may slightly increase Physical Activity and reduce BMI

# Active transport

	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity Very low certainty ⊕		7 8	2 c 6 5 a	1 2 a 2 b 3 4 5 b
Anthro- pometry Very low certainty ⊕		6		1

- 8 studies
- It is uncertain whether active transport interventions increase Physical Activity or reduce BMI

# Access to physical activity facilities

	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity  Low certainty  ⊕⊕				1
Anthro- pometry				

- 1 study
- Intervention may increase the use of Physical Activity facilities









# Summary - what works?

- 16 studies identified
  - No included studies in LMICs – applicability?
- No CVD/Diabetes related endpoints reported
- There is potential benefit for some interventions on physical activity and BMI, e.g. green spaces, but
  - variability and uncertainty regarding effectiveness
- Little indication that interventions were harmful.
- Complex interventions - Need to consider implementation context

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	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity		 4 b	 1	 2
Low certainty		 4 c	 5	 6
Anthro- pometry			 3	
Blood pressure				
CVD/Diabetes morbidity				
CVD/Diabetes mortality				

## 1.1 Green and other spaces

















### # Study outcome

1. Cortinez-O’Ryan 2017 *meet PA guidelines*
2. D’Haese 2015 *MVPA*
3. Goldsby 2016 *BMI*
- 4a. Kramer 2014 *leisure-time walking*
- 4b. Kramer 2014 *leisure-time cycling*
- 4c. Kramer 2014 *leisure-time sports*
5. Quigg 2011 *total daily PA*
6. Veitch 2018 *MVPA participation at park*

 Long-term follow-up  
(> 3 mo)

 Short-term follow-up  
(3 months or less)


It is important to note that the grey shaded area is characterized by uncertainty with regard to the direction of effect. e.g. a RR of 1.02, with a 95% CI of (0.91; 1.15) will be found under ‘Unclear effect; favors intervention’. However, based on the 95% CI we can see that this intervention could also be harmful.


	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity		 	  	     
Very low certainty 		7 8	2c 6 5a	1 2a 2b 3 4 5b
Anthropometry				
Very low certainty 		6		1
Blood pressure				
CVD/Diabetes morbidity				
CVD/Diabetes mortality				

## 1.2 Active transport



### # Study outcome

1. Benjamin Neelon 2015 *MVPA; BMI*
- 2a. Brown 2016 *active transportation in transit*
- 2b. Brown 2016 *non-transit walking*
- 2c. Brown 2016 *cycling*
3. Fitzhugh 2010 *2-hour total PA*
4. Goodman 2013 *cycling to work*
- 5a. McDonald 2013 *walking*
- 5b. McDonald 2013 *cycling*
6. Osterrgaard 2015 *cycling; BMI*
7. Prins 2017 *MVPA*
8. Rissel 2015 *cycling*

 Long-term follow-up  
(> 3 mo)

 Short-term follow-up  
(3 months or less)


It is important to note that the grey shaded area is characterized by uncertainty with regard to the direction of effect. e.g. a RR of 1.02, with a 95% CI of (0.91; 1.15) will be found under 'Unclear effect; favors intervention'. However, based on the 95% CI we can see that this intervention could also be harmful


	Favors control	Unclear effect; potentially favors control	Unclear effect; potentially favors intervention	Favors intervention
Physical activity				
Low certainty				1
Anthropometry				
Blood pressure				
CVD/Diabetes morbidity				
CVD/Diabetes mortality				

## 2.1 Access to PA facilities

# Study outcome

1. Higgerson 2018 *PA at facilities*

 Long-term follow-up  
(> 3 mo)

 Short-term follow-up  
(3 months or less)

It is important to note that the grey shaded area is characterized by uncertainty with regard to the direction of effect. e.g. a RR of 1.02, with a 95% CI of (0.91; 1.15) will be found under 'Unclear effect; favors intervention'. However, based on the 95% CI we can see that this intervention could also be harmful