

# Prevention of cardiovascular disease in the community through walking intervention: A scoping review

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## Abstract

**Background:** Cardiovascular disease is the number one killer in the world. The SDGs target reducing mortality through cost-effective prevention efforts. Physical activity, including walking, has been proven to prevent cardiovascular disease. Walking is an activity that is cheap, easy, simple, and does not need tools and skills, so it can be done in general by the community. However, the modern world makes people's walking activities low. There is a need to find evidence of walking interventions that can increase walking and prevent cardiovascular disease.

**Purpose:** This scoping review aims to identify literature focusing on walking interventions that increase footsteps and reduce disease risk to prevent cardiovascular disease.

**Methods:** Following the guidelines for the JBI scoping review methodology. Articles conducted searches on the Ebsco CINAHL, Academic, PubMed, and ProQuest databases from 2013 to 2021. The collected data were extracted in tabular and narrative form.

**Results:** Thirteen articles met the criteria involving 2,910 people from eight countries. Eleven studies used a randomized controlled trial, and two used a quasi-experimental design.

**Conclusions:** Walking interventions that support increased footsteps include: distance, duration per week (< 150 minutes or > 150 minutes), supervision, activities accompanied by socio-cultural activities, counselling, and motivation, in addition to the use of tools such as pedometers, accelerators, and smartwatch is used as a footstep monitor. Intervention in walking is beneficial in reducing cardiovascular diseases risk indicators such as blood pressure, BMI, blood glucose, cholesterol, and triglycerides.

**Keywords:** Cardiovascular disease; community; prevention; walking intervention

## Introduction

The World Health Organization (WHO) states that cardiovascular disease is the number one killer in the world (WHO, 2017). The 2030 SDGs target a 30% reduction in deaths from non-communicable diseases through cost-effective interventions (IHME, 2020). Physical activity is a primary and secondary prevention factor for cardiovascular disease in the community (Lavie, Ozemek, & Kachur, 2019). Preventive efforts are more cost and time effective than curative efforts and significantly impact the community (PERKI, 2019). However, the modern world makes people's physical activity low (WHO, 2018).

Technological progress is one of the reasons why people do less physical activity, where more time is spent sitting in front of the television and using smartphones (Benjamin et al., 2019). Four out of five adolescents aged 11-17 years and one out of five adults do not do enough physical activity (WHO,

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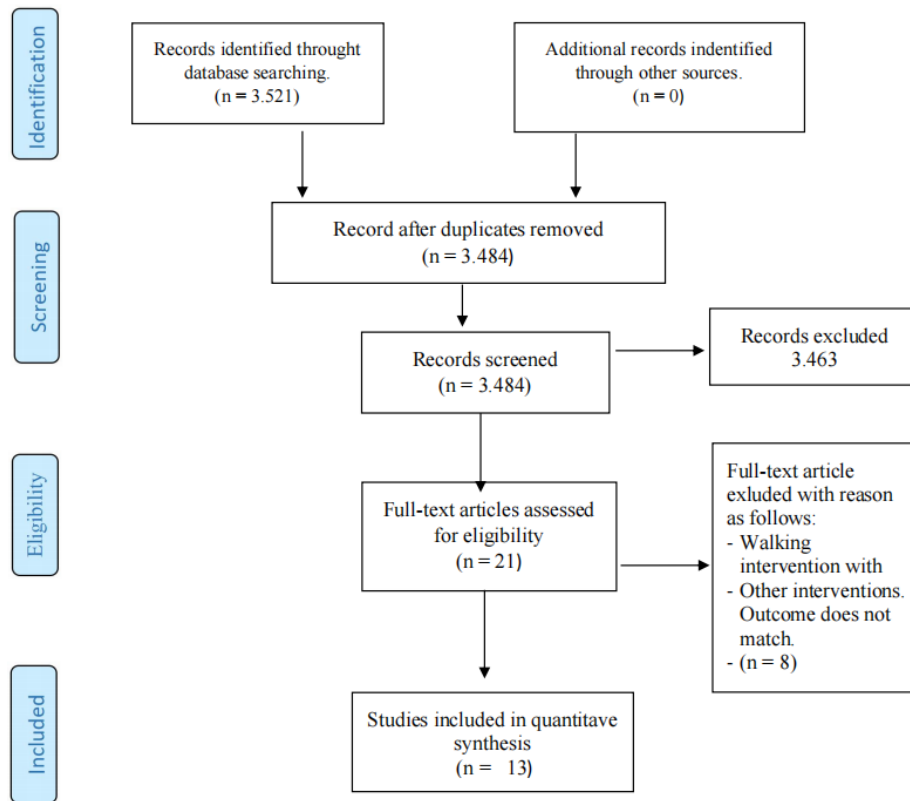


Figure 1. Data processing flowchart

2018). Some evidence shows a relationship between physical inactivity and the risk of cardiovascular disease. Physical activity reduces the risk of disease and death from cardiovascular disorders (Bell et al., 2013; Chomistek et al., 2018; Lear et al., 2017; Mengyu et al., 2019).

Walking is an activity that everyone can do because it is easy, simple, and cheap, with no need for tools, special skills, and special facilities (JN, 1997). Walking also improves health (Lee & Buchner, 2008). Light-intensity walking is leisurely, and moderate-intensity walking is brisk walking (Lanier, Bury, & Richardson, 2016).

The American Heart Association (AHA, 2017) says brisk walking can reduce the risk of cardiovascular disease, maintain blood pressure, total cholesterol, and blood sugar, increase stamina, sleep quality, memory, and bone strength, and maintain body weight. Walking also lowers blood pressure, BMI, and HDL cholesterol (Chen, Ismail, & Al-Safi, 2016; Soroush et al., 2013). Research regarding brisk walking for one hour daily finds it effectively reduces the risk of heart disease. In addition, it also increases life expectancy, which is higher, namely 85.2 to 86.8 years in men and 86.7 to 87.8 years in women (Zaccardi, Davies, Khunti, & Yates, 2019).

Group walking also improves social relationships and mental health and increases motivation to stay active (Cooper & Hancock, 2012; Lee et al., 2017;

Yaacob & Azidah, 2018). Walking in green open spaces also elevates mood and reduces depression, feelings of anger, and tension (Barton, Hine, & Pretty, 2009). Group walking activities increase socialization with the environment, encouraging someone to be more active (JN, 1997). Partner support also plays a role in increasing walking practice (Minneboo et al., 2017). The results of the research above provide information that walking accompanied by both physical and psychological support can make people more active in walking activities to increase footfall in society.

It is known that the footsteps of Indonesians rank last out of 46 countries, with an average of only 3,513 per day. The data are below Singaporeans' daily steps, reaching 5,674 per day (Kemenkes RI, 2018). The recommended moderate-intensity walking is 30 minutes daily or about 150 minutes weekly (WHO, 2010). It is necessary to look for evidence of walking interventions that increase walking and reduce disease risk to prevent cardiovascular disease.

## Methods

Scoping review follows the JBI methodology, using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist as a writing guide. A literature search was conducted on PubMed, CINAHL, Academic, and ProQuest.

Table 1. Data Extraction

Author, Year	Country	Design	Title	Population	Prosedur Intervensi	Outcome	Result
(Jong-Hwan et al., 2014)	Japan	Quasi eksperimen	Low-Volume Walking Program Improves Cardiovascular-Related Health in Older Adults	28 people aged > 60 years.	-Distance $\leq$ 3.5 week -Duration $\leq$ 150 minutes per week -Supervised by an experienced assistant -Activities are done alone Using the accelerometer.	-Blood pressure: Significantly lower (P<0.001) -BMI Significantly decreased (P<0.05) -Blood glucose: Lower (P:0.46) -Cholesterol did not drop significantly Triglycerides did not drop significantly.	-Compliance rate 92.3 $\pm$ 1.8%.
(Schulz et al., 2015)	USA	RCT:	Effectiveness of a walking group intervention to promote physical activity and cardiovascular health in predominantly non-Hispanic Black and Hispanic urban neighborhoods: Findings from the Walk Your Heart to Health Intervention	695 people with an average age of 46.6 $\pm$ 13.5 years.	-Duration $\geq$ 150 minutes per week -Supervision by health workers -Accompanied by a partnership approach and counseling Group activities.	-Blood pressure: Significantly lower (P<0.001) -BMI Significantly decreased (P<0.05) -Blood glucose: Significantly decreased (P< 0.05) Cholesterol: Significantly decreased (P<0.05).	-Daily steps increased by 2,110 per day.
(Ohta et al., 2015)	Japan	RCT: Cross-over design	Effects of daily walking on office, home, and 24-h blood pressure in hypertensive patients	65 people with an average age of 60.2 $\pm$ 9.4 years.	-Duration $\geq$ 150 minutes per week -10,000 daily step goal Activities are done alone	-Blood pressure: Significantly decreased (P<0.05) -BMI Significantly decreased (P<0.05) -Blood Glucose: Significantly Decreased (P<0.001) -Cholesterol did not drop significantly Triglycerides decreased significantly (P<0.05).	Daily steps increased by 10049 +3403 per day.

Cont. Table 1. Data Extraction

(Lee et al., 2017)	South Korea	Quasi eksperimen	Effects of culturally adaptive walking intervention on cardiovascular disease risks for middle-aged Korean-Chinese female migrant workers	132 with an average age of 56.40 ± 5.09 years.	-Duration ≥ 150 minutes per week -Supervision by health workers (Nurses) -Activities are carried out in groups Using a pedometer.	-Blood pressure: Significantly lower (P<0.001) -BMI Significantly decreased (P<0.001) -Blood glucose Significantly decreased (P<0.001).	-Daily steps increased by 10,000 per day.
(Arija et al., 2017)	Spain	RCT	Effectiveness of a physical activity program on cardiovascular disease risk in adult primary health-care users: the "Pas-a-Pas" community intervention trial	364 people with an average age of 65.19 years.	-Distance >3.51 km -Duration ≤ 150 minutes weekly -Supervision by a health professional -Accompanied by socio-cultural activities Done in groups.	-Blood pressure: Significantly decreased (P<0.001) -Blood glucose: Significantly decreased (P<0.001) -Cholesterol Significantly decreased (P<0.001).	-Compliance rate 72.8 % (P<0.001).
(Yu et al., 2018)	China	RCT	A novel prescription pedometer-assisted walking intervention and weight management for Chinese occupational population	802 people with an average age of men and women: 27.3 ± 4.2 and 41.1 ± 9.5 years.	-Done independently Using a pedometer.	-Blood pressure: Significantly decreased (p<0.05) -BMI Significantly decreased (P<0.001) -Blood glucose significantly decreased (p<0.05) -Cholesterol Significantly decreased (P<0.05) Triglycerides don't go down.	Compliance rate of 89.5 %.
(He et al., 2018)	China	RCT	Effects of 12-week brisk walking training on exercise blood pressure in elderly patients with essential hypertension: a pilot study	69 people with an age range of 55-60 years.	-Group activity in the community garden -Society as supervisor Using the Accelerometer tool.	-Blood pressure: Significantly decreased (P< 0.05) BMI Significantly decreased (P < 0.05).	-Compliance rate above 91 percent Daily steps increased by 10,835 + 1235 (P<0.001).

Cont. Table 1. Data Extraction

(Arija et al., 2018)	Spain	RCT	Physical activity, cardiovascular health, quality of life and blood pressure control in hypertensive subjects: randomized clinical trial	207 people with an average age of 68.2 years.	-Distance >3.51 km -Weekly duration ≤ 150 minutes -Supervised by nurses and PA specialists -Accompanied by socio-cultural activities Group activity.	-Blood pressure: Significantly decreased (P < 0.05) -BMI Significantly decreased (P < 0.05).	Increase physical exercise.
(Brustio et al., 2018)	Italy	RCT	Participation in a school-based walking intervention changes the motivation to undertake physical activity in middle-school students	276 people with an average age of 13 ± 1 year.	-Distance ≤ 3.5 km -Duration ≤ 150 minutes per week -Teacher supervision Group activity.	There was no change in BMI.	Increase student motivation in doing physical exercise during school breaks.
(Chiang, Chen, Hsu, Lin, & Wu, 2019)	China	RCT	Is the goal of 12,000 steps per day sufficient for improving body composition and metabolic syndrome? The necessity of combining exercise intensity: a randomized controlled trial	32 people with a mean age of 19.72 ± 0.80 years.	-Weekly duration ≥ 150 minutes -Supervision by a professional instructor Using Smartwatch.	-Blood pressure: Not significant (P>0.05). -BMI Significantly decreased (P>0.05) -Blood glucose Significantly decreased (P<0.05) Triglycerides Significantly decreased (P<0.05)	-Increased 12,288 steps per day Changes in some body composition.
(Lee, Hung, Lin, & Chiang, 2019)	Taiwan	RCT	Controlled randomized trial of walking exercise with positive education on cardiovascular fitness and happiness in retired older adults	150 people with an average age of 61 years.	-Weekly duration ≥ 150 minutes -Supervision by a professional instructor Using a pedometer	-BMI Significantly decreased (P<0.01).	-96.70 percent compliance rate (P<0.01).
(Rodriguez-Hernandez & Wadsworth, 2019)	Spain	RCT	The effect of 2 walking programs on aerobic fitness, body composition, and physical activity in sedentary office employees	68 people with an average age of 46±9 and 48±9 years.	-Weekly duration ≥ 150 minutes -Done independently Using the accelerometer.	-BMI Significantly decreased (P<0.05)	-Compliance rate 80.95%.
(Sousa Jr et al., 2020)	Brazil	RCT	Physical Activity Counseling for Adults with Hypertension: A Randomized Controlled Pilot Trial	22 people with a mean age of 48.8 ± 7.3 years.	-Weekly duration ≤ 150 minutes -Done independently -Accompanied by counseling Using a pedometer.	-Blood pressure: Not significantly decreased.	Daily steps increased by 800 steps.

## Inclusion Criteria

### Participant

This scoping review aims to identify all studies focusing on walking interventions in the community (age 12 years to 75 years) that increase walking and reduce disease risk to prevent cardiovascular disease.

### Concept

This review focuses on studies with the primary interventions being walking and brisk walking in the community.

### Context

People aged over 12 years to 75 years who participated in the walking intervention resulted in a decrease in cardiovascular disease risk indicators such as blood pressure, BMI, total cholesterol (HDL and LDL), blood glucose, and triglycerides.

### Type of Source

This scoping review uses a quantitative study with experimental, quasi-experimental, and RCT interventions.

### Study selection

Figure 1.

## Results

Search results from the database obtained 3,521 articles. Thirty-seven duplicate articles were discarded. The selection was conducted until a remaining 13 articles were included in the scoping review. Articles were published from 2014 to 2020 in English and full text. Eleven of the thirteen articles were obtained using randomized research methods and controlled trials, and two used quasi-experimental design methods.

The number of participants involved was 2,910 people, with the smallest number of participants being 22 people and the highest being 802. The number of female participants was generally higher than that of male participants, although one article did not explain the number of participants by gender. The youngest participant's average age was 13 years, and the oldest's average was 68.2 years.

From the results, two studies used distances below 3.5 km, and two used distances above 3.5 km. Five studies were conducted with durations under 150 minutes per week, and eight were conducted with durations above 150 minutes per week. Walking activities were carried out under supervision or monitoring by various professions, including five studies conducted by physical activity professionals, four studies supervised by health workers, one by teachers, and one by the community, while three studies were conducted independently. Three studies were conducted accompanied by sociocultural activities and partnerships. Three studies accompanied counseling and motivation.

Seven studies were conducted in groups, and five studies were conducted individually. Nine of the thirteen studies used activity monitoring devices, both pedometers, accelerometers, and smartwatches.

Almost all studies that measure blood pressure show significant changes in blood pressure. Changes in BMI also got significant results even though some did not. Changes in blood glucose also got more significant results. Total cholesterol only fell in three studies. Decreases in triglycerides were found in two of the four studies that measured it.

## Discussion

### Walking intervention as cardiovascular prevention

Intervention walking is beneficial in reducing cardiovascular disease risk indicators such as blood pressure, BMI, blood glucose, cholesterol (HDL and LDL), and triglycerides. Prevention of cardiovascular disease is focused more on factors that can be changed, namely through sufficient physical activity. The target in the scoping review is a healthy community and people already at risk of experiencing cardiovascular disease. Walking is beneficial for cardiorespiratory fitness, preventing community cardiovascular disease. Besides that, walking also overcomes high blood pressure, increases good cholesterol levels, and controls blood sugar (Bubnis, 2019). It can be concluded that walking is suitable for people who are healthy and who have shown a risk of cardiovascular disease.

Many walk because it is easy, safe, does not require tools, and has a low risk (JN, 1997). In addition, walking is also the right choice for people who do not move much (Ogilvie et al., 2007) because the targets involved in this intervention are groups of people who do not move much or do not actively engage in physical activity.

Getting more than 10,000 daily steps is difficult for people with low activity. Evidence shows that walking an additional 1,000 steps per day can also reduce the cause of death from cardiovascular disease in adults by 5-21% (Hall et al., 2020). It is known that the number of daily steps the Indonesian people is only 3,513 per day (Kemenkes RI, 2018). This shows that the walking activity of Indonesian people is still low.

The problem of low activity is also a problem in some adult populations in East Asia, where some of these populations need to meet the recommended activity recommendations (Wai et al., 2008). This behavior is coupled with the ease of access to transportation in today's modern world, which makes people increasingly lazy to do physical activities, besides that walking facilities in the environment also do not support people to be more active on foot (Kemenkes RI, 2018). So a promotion strategy is needed to increase people's daily steps.

The benefit of walking in preventing cardiovascular disease is improving body

composition, which indicates cardiovascular disease risks such as blood pressure, BMI, blood sugar, triglycerides, and cholesterol. The recommended moderate-intensity walking is 30 minutes daily or around 150 minutes weekly (AHA, 2017). Almost all studies that measure blood pressure get significant results, both at interventions  $\leq$  150 minutes or those that are  $\geq$  150 minutes per week. Only one study on each intervention showed no significant results. This is due to the few daily steps achieved, namely 6428 steps per day. Health-promoting benefits are obtained by lowering and controlling blood pressure according to and below recommendations. A blood pressure lowering effect was also found in a meta-analysis by Murtagh et al. (2015), where systolic blood pressure fell to -3.58 mmHg, and diastolic blood pressure fell to -1.54 mmHg.

Walking effectively promotes physical activity in society (Kassavou, Turner, & French, 2013). Walking is also effective at increasing footfall and has many health benefits. Thus it becomes a good exercise as an adjunct to public health care and a proactive health promotion activity (Hanson & Jones, 2015).

### Walking Intervention Steps and Recommendation

Intervention walking procedures that support increasing footsteps include distance. Distance dictates walking exercises that can increase stride. Ten thousand steps per day equal a distance of 6-8 km. One study in this scoping review performed low-volume activities with 2.5-3.5 km distances per session but found results in lower body composition. This shows that walking at a minimum distance is beneficial for maintaining a healthy body. In addition, walking time per week also determines the benefits of walking on cardiovascular health.

The American Heart Association recommends moderate-intensity walking for 30 minutes daily or about 150 minutes weekly (AHA, 2017). Walking as recommended has been shown to get better results on a decrease in body composition. However, this Scoping review also shows significant results in interventions under the recommendation of  $\leq$  150 minutes per week. This suggests that low-volume exercise under the recommendations can also reduce the risk of cardiovascular disease. Low-volume walking exercise can be a promotion for adults and the elderly because of the ease of doing the exercise (Jong-Hwan et al., 2014). In addition, Wen et al. (2011) also found that activity of 92 minutes per week or an average of 15 minutes per day reduced disease rates and increased life expectancy. A brisk 10-minute walk per day also has the potential to improve health (Brannan, Varney, Timpson, Murphy, & Foster, 2017). It can be concluded that low-volume walking per day below 150 minutes a weeks can be done more quickly for older people, so it can be a promotion to reach older people to stay active.

Another determining factor in increasing the daily pace of the community is partnership and

involvement in targeted sociocultural activities. The partnership is a process of improving the relationship between the mind and the community to facilitate the goals of health interventions. To maintain partnerships, reflection, and collaboration are needed (Melo & Alves, 2019), so that interventions involving partnerships can be more accepted by the community, which can increase people's footsteps. Besides that, sociocultural activities included in walking training activities can improve mood and mental health thoughts (Arija et al., 2017). Motivation and counseling are also decisive in increasing daily steps. People must be motivated to carry out activities regularly to get the most out of physical exercise (Ferguson, 2014).

Positive education on walking intervention is an approach that increases positive emotions, strength, self-concept, and motivation (Levy, 2018). In their research, Lee et al. (2019) combined positional exercises to increase the compliance of older people to carry out walking activities. The result is that compliance reached 96.7%. In addition, promoting physical activity must be accompanied by motivation and social support, a pleasant environment, and an atmosphere (Zubala et al., 2017). Supervision also determines success in increasing daily steps; supervision by Physical Activity professionals, health workers, teachers, and the community increases compliance with walking exercises. This aligns with the findings by Picorelli et al. (2014) who said that supervision by health professionals increases adherence to physical activity. Walking intervention by public health nurses in the elderly group has been found to have increased people's footsteps (Harris et al., 2015).

### Conclusion

The target of walking intervention is people with a low level of physical activity. The target is also carried out on people who are healthy and who already have a risk of cardiovascular disease. Walking interventions that support increased footsteps include: distance, duration per week ( $<$  150 minutes or  $>$  150 minutes), supervision, activities accompanied by socio-cultural activities, counseling, and motivation, carried out in groups or individually in addition to the use of tools such as pedometers, accelerometers, and smartwatches are used as footstep monitors. The benefits of walking intervention in preventing cardiovascular disease include blood pressure, BMI, blood glucose, triglycerides, and cholesterol. Changes in blood pressure and BMI are risk indicators that benefit the most from walking interventions. Meanwhile, cholesterol and triglycerides were the most minor measured indicators and experienced changes in the benefits of the walking intervention.

### Conflict of Interest

The authors did not have any conflict of interest regarding this publication.

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**Data Availability**

none

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