

Can walking exercise programs improve health for women in menopause transition and postmenopausal? Findings from a scoping review

Authors: Beate C Sydora, PhD, bsydora@ualberta.ca
Cailey Turner, BSc, cailey1@ualberta.ca
Alexandra Malley, BSc, amalley@ualberta.ca
Margie Davenport, PhD, mdavenpo@ualberta.ca
Nese Yuksel, PharmD, nese.yuksel@ualberta.ca
Tami Shandro, MD, Tami.Shandro@albertahealthservices.ca
Sue Ross, PhD Sue.Ross@albertahealthservices.ca

Affiliation: Department of Obstetrics and Gynecology and Department of Family Medicine, Faculty of Medicine & Dentistry, Faculty of Pharmaceutical Sciences, and Faculty of Kinesiology, Sports and Recreation, University of Alberta, and Women's Health Program (LHHW), Alberta Health Services, Edmonton, Canada

Running title: Walking exercise programs for menopausal women

Correspondence: Beate C. Sydora, MSc, PhD
Dept. of Obstetrics and Gynecology,
University of Alberta
626-1 Community Service Centre, Royal Alexandra Hospital
10240 Kingsway Ave, Edmonton,
Canada T5H-3V9
Phone: 780-735-6707
FAX: 780-735-6685
Email: bsydora@ualberta.ca

Abstract

Objective:

Our goal was to explore the range and characteristics of published papers on therapeutic walking programs for menopausal women and to identify program features that resulted in successful outcomes including reduced symptoms and improved long-term wellness.

Methods:

We searched biomedical and exercise-related databases for articles published up to June 1, 2017, using keywords related to menopause and walking. Data were collected into EndNote X8 reference manager to identify and remove duplicates. The final selection included all articles that studied walking as a health intervention for women in menopause transition or postmenopausal.

Results:

A total of 3,244 papers were collected from the six databases. After removing duplicates and applying inclusion and exclusion criteria, 96 articles were charted, including 77 different walking programs. Walking interventions ranged from 4 weeks to 3 years with an average weekly frequency of 3.81.8 and were applied to a variety of symptoms and their biological markers and risk factors. Overall, 91% of the programs showed a beneficial outcome in at least one menopause-related medical issue. Information on menopause-specific symptoms, especially vasomotor symptoms and sleep problems, was scarce.

Conclusion:

The scoping review highlights the growing interest in walking programs as therapies for menopause and related symptoms and provides evidence of their possible benefit as a wellness option for women in menopause and beyond. Further research would be recommended to establish the therapeutic value of walking programs for women with specific focus on typical menopause symptoms at different stages of menopause.

Key words: Menopause, menopause symptoms, walking exercise, walking intervention

Introduction

Hormonal changes during the menopause transition period are often associated with physical and psychological symptoms that can negatively impact a woman's wellbeing and quality of life (QOL).¹⁻³ These symptoms encompass a variety of bothersome health issues including vasomotor symptoms, muscle and joint pain, headaches, sleep problems, lack of energy, mood swings, depression, and anxiety.^{2,4} In addition, menopause transition is temporally associated with increased risk for health issues such as osteoporosis, type-2 diabetes, and cardiovascular diseases. The mainstay treatment for menopause is menopausal hormone therapy (MHT), but many women are reluctant to take hormones due to fear of risking potential illnesses such as cardiovascular events or breast cancer.^{5,6} Women, therefore, may turn to alternative interventions to maintain well-being and physical health.

The health benefit of physical activity is well established^{7,8} including long-term effects for postmenopausal women.⁹ Health Canada suggests at least 30 minutes per day of moderate to vigorous activity as measured by the Canadian Community Health Survey and Physical Activity Benchmarks/Monitoring Program, consistent with the WHO Global Strategy on Diet, Physical Activity and Health.¹⁰ The 2018 US Department of Health and Human Services (HHS) Physical Activity Guidelines for Americans recommend 150 minutes of moderate or 75 min of vigorous or a combination per week for substantial health benefits; nevertheless, they noted that any kind of physical activity is better than none.¹¹ The latter statement is confirmed by findings from a cross-sectional study demonstrating beneficial effects of light-intensity physical activity.¹²

Despite the guideline recommendations, women are often reluctant to exercise, citing barriers such as poor health, lack of time due to family responsibilities, lack of company or encouragement, lack of facility access or adequate opportunities, costs, threat of embarrassment, and fear of safety.¹³⁻¹⁶

Walking is a widely accessible, low cost, low injury risk approach to exercise with proven health benefits for both body and mind, and can be complimentary to almost all contemporary treatments.^{17,18} Still, its therapeutic effect on alleviating menopause symptoms is not well characterized.^{19,20} Understanding the therapeutic scope and effectiveness of walking programs may help to support women in the menopausal transition with symptom alleviation and setting healthy goals in midlife and beyond.

This scoping review explored the range and variety of available studies using walking as a therapeutic program for menopause-related symptoms and risk factors, such as those for mental and cardiovascular health, arising during the menopause transition period.

Our ultimate goal is to produce evidence for a walking program that encourages sustained engagement in physical activity and can serve as a wellness-promoting option for women during the menopausal transition and continuing after menopause.

Methods

The scoping review follows the Joanna Briggs Institute reviewers' manual 2015^{21,22} (updated in 2017)²³ for scoping review using the framework outlined by Arksey and O'Malley and enhanced by Levac, Colquhoun and O'Brien.^{24,25} The search strategy was

conducted in three steps and the final search is outlined in the PRISMA-ScR Flow Diagram (Figure 1).²⁶

Data base search

A preliminary search was initiated using the discovery service EBSCO through the University of Alberta libraries with keywords 'menopause' and 'walking' to explore the pool of available literature on the topic. This resulted in 842 records including 493 academic papers, 170 magazines, 62 news article, 22 books, 3 theses, and 2 reviews. A search with the same keywords in Google Scholar resulted in over 33,500 hits compelling us to redefine the keyword 'walking'. In the second step, six databases were searched for articles from inception to June 1st, 2017 using menopause-related keywords paired with 'walking' terms such as walking-exercise, - therapeutic, -program. Databases included Medline, EMBASE, CINAHL, Sport Discus, Scopus, and Web of Science. Menopause-related keywords used were peri-menopause, post-menopause, menopause, climacteric, menopause and climacteric symptoms, and menopause transition. As a third search strategy, the reference lists of review papers were scanned for additional studies; review articles themselves were not included.

Eligibility criteria

Types of participants

Studies were eligible if they included a defined group of women in peri-menopause (various stages of menopause transition) or post-menopausal as described by the study authors, with no restriction on years past their last menstrual period. Premenopausal or younger women could be included as comparators as their own distinguishable group.

Studies including men were excluded. We did not put a restriction on participant selection for specific health or lifestyle conditions such as cancer, body weight, sedentary lifestyle, smoking, etc or medication use such as MHT. However, these restrictions were considered in the analysis.

Concept

Any type of study design was included if it used walking as a health intervention for women in menopause and post-menopause age. Study designs could include randomized and non-randomized controlled trials, and cohort or case control studies. Studies that mentioned walking exercises retrospectively in surveys or epidemiological studies without describing details of the walking program were excluded.

Papers in any language were eligible.

Context

Study interventions should describe a walking program of greater than 3 weeks duration. Walking should be evaluated as a single intervention and not combined with other interventions such as drugs, diet, or additional exercises, for example as aerobic dancing, jogging/running, stairs, or circuit training. Other or concomitant interventions could be used for comparison or might be the main study objective. In cases where the walking exercise was used as a control or comparison to another intervention, papers were included if adequate data for this control intervention were provided with regard to control woman group and specifics of control walking intervention. Papers were included if the walking intervention was started and/or finished with 5-10 minutes of stretching or warm ups.

Selection of papers

Articles from the database search were collected into EndNote X8 reference manager to identify and remove duplicates. Articles were subsequently independently assessed by title and abstract by two investigators (CT, BCS) to remove ineligible papers. Meeting abstracts, conference proceedings, and commentaries were excluded from the analysis due to limited information on walking strategies, but were cross-checked with peer-reviewed papers from the same group (in case of abstracts) or the investigating group (in case of commentaries). Authors were not contacted to provide further information on the study. The remaining papers were read in full by three investigators (CT, AM, BCS) and selected according to the eligibility criteria.

Data extraction

Data was extracted from papers meeting the inclusion criteria above and charted according to publication year, author, participant characteristics and selection criteria, symptoms and health issues investigated, walking intervention specifics such as frequency, duration, intensity and type, and intervention results and outcomes (for data extraction details see tables, Supplemental Digital Content 1 and 2). Data was extracted by two independent investigators (BCS, CT); discrepancies were assessed by a third investigator (AM). Data extraction for relevant publications in foreign languages was performed in collaboration with research colleagues native to the foreign language.

Data analysis

Descriptive analysis was applied to describe the walking intervention and health issues investigated. Data entry and data analysis were carried out using an Excel database.

Quantitative analysis included sample size, participant's age and characteristics. If not provided in the text, walking program retention rate was calculated from the number of drop out per total number of women enrolled in the walking intervention. In cases where two or more papers were published on the same intervention with identical participant group(s) but investigated different medical concerns, walking intervention details were consolidated and considered for walking characteristic analysis only once. For all other purposes such as with regard to study design and medical reason investigated, each paper was analyzed descriptively for individual characteristics.

Results

Selection of included papers

The main goal of our selection strategy was to identify articles that described a walking intervention for women in menopause transition or postmenopausal as a therapeutic measure for menopause-related symptoms.

Our search result from the 6 databases yielded a total of 3244 articles (Figure 1: Prisma-ScR Flow Diagram) with 1486 remaining after removal of duplicates. Eighteen additional papers were handpicked from the reference list of relevant review articles. In cases where the participant group and/or walking intervention could not specifically be identified from the selected articles' titles and abstracts, the full paper was read and assessed for eligibility. The final selection included 96 papers for data extraction and analysis (complete compilation of the included papers is provided in the table,

Supplemental Digital Content 1) describing 77 individual walking programs (described in the table, Supplemental Digital Content 2).²⁷⁻¹²²

Study characteristics

The earliest eligible papers we identified were published in 1984. Since that time, there has been an increase in the number of papers about menopause care and walking as a therapeutic alternative to symptom treatment (Figure 2). Although papers were from research groups from a variety of countries all over the world, the majority of papers (n=85) were written in English language; 6 were written in Persian language^{86,100-102,112,122}, two in Chinese^{72,82}, and one each in Japanese³⁴, Korean⁶³, and Portuguese⁸¹. Studies described in the 96 papers used a variety of designs to investigate the outcome of walking on women's symptom changes, wellbeing, and quality of life (Table 1). The most common study design was the randomized controlled trial (n=44) including 'no exercise' controls, waitlist controls not subjected to the walking program, or 'placebo' (defined by the papers' authors, for example upper limb exercise placebo). In 4 studies that used the walking program as a control, walking was administered in addition to a placebo of the drug under investigation. Of the 52 intervention studies, 14 included a 'no exercise' control; the remaining 38 studies used a before-after research design to evaluate the walking program. Studies compared walking to a variety of other exercise- or nutrition-related health interventions such as resistance or circuit training (n=7), yoga (n=4), swimming (n=2), dancing (n=2), baduanjin/ taijiquan (n=2), pilate (n=1), and use of vibrators (n=3) or dietary supplements (n=5). Eleven studies compared walking in pre- versus postmenopausal women and four studies distinguished women on MHT with

those not taking MHT (details of study characteristics are described in Table Supplemental Digital Content 1).

Participant characteristics

Women participating in the studies were recruited based on their menopause stage and were described in the papers as menopausal, post-menopausal, peri-menopausal or in the menopause transition. A total number of 7456 participants were recruited in the 96 studies (range from 10 to 270 per study) of which 3686 (ranging from 6 to 181 per study) were enrolled in and completed a walking intervention. Walking program retention was on average 86.5% \pm 13.3% (range 53.3-100%). The majority of women appear to be postmenopausal, judged from the average age of all study participants which was 56.8, ranging from 40 to 86 years (Table 1). Half of the studies selected participants with low physical activity and sedentary lifestyle prior to the walking intervention; 17 studies limited participants to those that were classified as overweight or obese. Other study-specific selection criteria include hypertension (n=6), diabetes (n=3), osteoporosis (n=3), coronary artery disease (n=2), and one study each for participants required to have depression, an upper arm fracture in past 2 years, breast cancer, sleep disorder determined by PSQI (Pittsburgh Sleep Quality Index), or severe menopause symptoms determined by either >15 of KI (Kupperman Index) or by >2 hot flashes/day. An array of participant exclusion criteria was identified; many of those relevant and specific to the health issue or symptom investigated in the study. Menopausal hormone therapy was among the most common exclusion criteria with 39

studies (41%) recruiting only women who were not on MHT (details in Table Supplemental Digital Content 1).

Investigated health issues and symptoms

Most of the 96 papers investigated the effect of walking on more than one health issue or symptom (Table 1). The majority of studies included changes in body weight and/or composition in their studies (n=50, 52%). Risk factors for cardiovascular health was investigated in 44 (46%) studies, metabolic, inflammatory, and immune-endocrine serum markers in 38 (40%) studies, and bone health including fracture risk and markers of bone formation and turnover in 24 (25%) studies. Eight studies included psychological symptoms and mental health and 5 studies included sleep in their investigation. General menopause symptoms were assessed in four studies using various symptom scales including the Kupperman Index (n=2), the Green Climacteric scale (n=1), and a non-validated menopause-specific symptom impact inventory (n=1). Quality of life also was assessed in four studies using the short SF36 QOL tool (n=2), Utian QOL scale (n=1), and the menopause-specific QOL (MENQOL) tool (n=1) (Table 1 and Table Supplemental Digital Content 1). Evaluation of QOL, general menopause, sleep, and mental health were often combined in studies. Only 6 papers studied menopause-specific concerns such as vasomotor symptoms.

Characteristics of walking programs

The 96 selected papers described 77 different walking programs; 19 papers were duplicates or multiples of the same program including part or all of the same woman group but differed in outcome measures. Health issues were assessed pre and post

walking program intervention or were compared to control no-walking cohorts. Walking programs varied considerably with regard to length of intervention, frequency, and intensity (Table 1 and Table Supplemental Digital Content 2). Sixty-two papers reported on the time walked for individual sessions, 10 papers reported on the distance walked during an individual session, and 5 papers described both time and distance. The majority of programs (n=49, 64%) had a length between 12 to 24 weeks with a frequency of walking 3 to 5 times per week. Three programs were observed over one to three years. Several programs (n=22) described an increase in session length or distance (n=17 increase in session time, n=5 increase in distance) in the initial stage of the intervention, before plateauing with a set intervention regime. Similarly, in some studies (n=10) the intensity was increased over the first several weeks from low to moderate intensity, sometimes reported as an increase in percent heart rate reserve (HRR) or increase in maximal oxygen uptake (VO₂max), for example from 40 or 50% to 60 or 70%. While measures of walking intensity varied and were mostly given as a range it appeared that the majority of programs aimed for a moderate to vigorous exercise intensity at around 60-70% maximum heart rate or heart rate reserve (for details see Table Supplemental Digital Content 2).

Most intervention programs were fully (n=31) or partially (n=14) in-person supervised. Twenty-one programs were not supervised during the intervention; however, seven used occasional or scheduled post walk checks in-person, by telephone, or online. If not fully supervised, participants were frequently asked to record walking progress and

intensity in form of exercise logs and completed time sheets, or it was measured via pedometers (Table 2).

Compliance with program requirements was described in only 26 programs. A compliance rate of >90% was reported more often in fully supervised programs including post walk checks (6 out of 11, 55%) than in partially supervised (3 out of 8, 38%) or unsupervised programs 3 out of 7, 43%).

The majority of programs used natural walking (not using exercise machines) as the intervention (n=61), including Nordic walking (n=9) and walking with ankle weights (n=1); 10 programs were performed on treadmills (Table 1).

Outcomes of walking programs

Of the 96 studies 87 (91%) reported a beneficial outcome from their walking program in at least one of the menopause-related health issues investigated (see Table Supplemental Digital Content 1). This includes 27 studies that demonstrated benefits for one or more health issue but no improvement for one or more others in the same study. In nine studies (9%) the issue investigated did not improve or showed no difference compared to the non-walking control group. None of the studies noted an increased risk or worsening of the investigated health issue(s) in the walking groups.

Most improvement from walking programs was recorded for mental health (100%), cardiovascular risk factors (91%), and physical fitness (88%) (Table 3). However, it was cautioned in several papers that positive outcome was not noted in all women and was dependent on adherence^{30,54,61,66,121} and intensity level^{85,110,119}.

Outcome for menopause-specific symptoms and menopause-specific QOL was generally positive; however, in the majority of these studies the participants were specifically selected for their experience of moderate to severe menopause symptoms and four studies excluded women on MHT. There were contrasting results in two studies regarding outcomes in the sexual domain compared to symptoms in other domains. One study⁵⁴ showed improvement in sexual symptoms but not in all other menopause symptoms; another study¹⁰⁰ reported improvement in vasomotor, psychosocial, and physical domain, but not in sexual domain (Table 4) though weekly session length and intensity between the two studies were similar (for program characteristics see Table Supplemental Digital Content 2).

Discussion

We conducted a scoping review of therapeutic walking programs for menopausal women to investigate walking program characteristics and identify features (walking frequencies, durations, intensities, places, etc.) that have resulted in successful outcomes such as reduction in menopause symptoms and disease risk factors, QOL improvement, and program adherence.

The benefits of exercise in general is well established; however, there is conflicting evidence of its effect in alleviating menopausal symptoms.^{19,123,124} In our scoping review we specifically concentrated on walking programs as therapeutic interventions as walking is a low cost exercise, does not require special equipment, is accessible to all able-bodied persons, and can be complementary to other therapeutics. In this regard

walking presents fewer barriers for women in midlife who are looking to start and maintain an easily available, hassle-free exercise program.

Key findings

Our search up until June 2017 yielded 77 individual walking programs for menopausal women described in 96 studies. Walking impact was investigated for a variety of menopause-related health issues including cardiovascular risk, weight changes, bone health, mental health, sleep, and vasomotor problems. With an average weekly exercise length of 162 minutes at moderate to vigorous intensity, most programs are in range with the suggested exercise guidelines (150 minutes of moderate- to vigorous-intensity physical activity per week) of the North American Health Authorities.^{10,125} Not surprisingly, our findings demonstrate a remarkably beneficial effect on women's health for the majority of walking programs.

Gaps in research

Our scoping review identified only 6 papers that specifically investigated walking as a therapy for typical menopausal symptoms such as vasomotor symptoms. While none of the papers in our studies reported on adverse outcomes or increased symptoms, there are reports that amplified physical activity can lead to increased symptoms under certain conditions.¹²⁶ Increase in hot flashes has been reported in a study by Elavsky for women with lower fitness levels.¹²⁷ Several studies found no change in vasomotor symptoms in response to physical activity;¹²⁸⁻¹³¹ indeed, some authors recommend that women should not be advised that physical exercise can reduce hot flashes.¹³¹ In this

area of uncertainty, further research should be conducted to unambiguously establish the effect of a walking exercise programs on vasomotor symptoms.

Where specifically investigated it was found that improved outcome was associated with greater adherence to the walking program.^{30,54,61,66,121} However, it also appeared that the same walking program while beneficial for one health issue or risk factor may not be effective in improving another. Further research should help to dissect the association between health issues and their individual response to walking exercise.

Study limitations

While one of our objectives was to establish program characteristics that are beneficial in reducing menopause-specific symptoms as well as those frequently arising at the age of the menopause transition period, it became obvious that we could not directly pool evidence on the walking programs described in the selected studies due to the wide variation in program characteristics.

Programs vary with regard to venue, intensity, length, and frequency. In addition some studies lack pertinent information on some of their program characteristics.

While some studies make adequate information available, the majority of studies provide limited details about adherence and compliance to walking programs. Because not all study interventions were supervised or recorded, it is not clear how committed women were to the walking intervention as family and work schedules are known to interfere with women's ability to comply with exercise commitments.^{15,51}

Another limitation that hampers consolidating walking therapy outcomes is the variety in participant eligibility criteria. While all participants are women in menopause

transition or postmenopausal and the majority of studies involve over-weight and sedentary women, participants do not present a homogenous group. The age range could be relative large and was not restricted to a specific menopause stage in the majority of papers; as well menopause stage was rarely defined for participant eligibility. Individual studies often have additional restrictions for study inclusion and exclusion dependent on the specific parameter under investigation. Few studies require women to experience severe or bothersome menopause symptoms at the time of recruitment, consequently beneficial results may be less obvious and may not be easily transferable to women suffering from severe symptoms.

Another limitation in the selected studies is the lack of knowledge about the participants' pre-existing fitness levels. Though women may not be involved in organized fitness programs, their daily work and habits may or may not lead to enhanced fitness level, adding to variability in physical aptitude. In addition, it should be considered that participation in a stringent walking program might impact daily physical activity; women might reduce other daily physical chores when taking up rigorous walking, thus essentially limiting their overall activity level.¹³²

Implications for research

The selected papers describe a variety of walking exercises with different features and characteristics. Thus, our scoping review can only summarize tendencies of combined program successes or failures for medical symptoms, risk factors, and illnesses under investigation. The fact that there are few papers investigating the symptoms that have been identified as most bothersome for symptomatic women seeking help in

menopause clinics, such as sleep problems, mental issues, and vasomotor problems,^{133,134} highlights the need for further research investigating the therapeutic potential of walking programs for this group of women. Detailed reporting on program features as well as ensuring adherence and compliance will facilitate combining program results and identify walking characteristics that best suit women with specific symptoms or at risk for certain illnesses.

Implications for practice

As a scoping review, our investigation of papers does not provide ratings on the quality of studies included or on the level of evidence provided. Therefore, our results are not geared at informing practice or providing recommendations for therapies.

One concern is that most of the studies enrolled women from the general public; although all women were in menopause transition or postmenopausal only three papers recruited women that were specifically selected for having moderate or severe menopause symptoms such as high scores in Kupperman or greater than two episodes of hot flashes per day.^{82,90,100} This has important implications for the management of women presenting with severe symptoms, especially hot flashes. Results from one RCT on the effectiveness of exercise for women suffering from severe hot flashes indicate that exercise is not effective in relieving severe hot flashes and should not be recommended.¹³¹ Indeed, women with severe menopause symptoms may be too unwell to perform exercise. In such cases other treatment options of severe menopause symptoms such as MHT might be considered as a prelude to joining a walking exercise program.

Menopause is a stage in a woman's life where she may be more concerned about her health due to increasing physical and psychological symptoms associated with the hormonal changes during menopause. For many women this is the time she would be most likely to consider healthy lifestyle changes including diet and exercise regimes. Walking programs may result in long term health benefits rather than immediate relief of prototypical symptoms.

Conclusion

The scoping review highlights the growing interest in walking programs as therapies for menopause-related symptoms and as a wellness option for women in menopause and beyond. Although the majority of studies report a positive impact of their program on the health issue or symptom under investigation, a general consensus is hard to establish due to the challenge of program and participant characteristic comparability. In addition, our scoping review revealed a lack of information on the effect of walking on symptoms identified as most bothersome during the menopause transition such as vasomotor symptoms, sleep, and mood changes. Although a walking program will help women to stay fit in midlife and postmenopausal, the benefit with regard to relief of typical menopausal symptoms remains unclear. Further research including providing detailed information on menopause stage and walking program characteristics in published studies would be recommended to establish the therapeutic value of walking programs for women at various stages of menopause with specific focus on typical menopause symptoms.

Conflicts of interest

All authors declare the absence of any conflict of interest.

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Figure 1
PRISMA-ScR Flow diagram

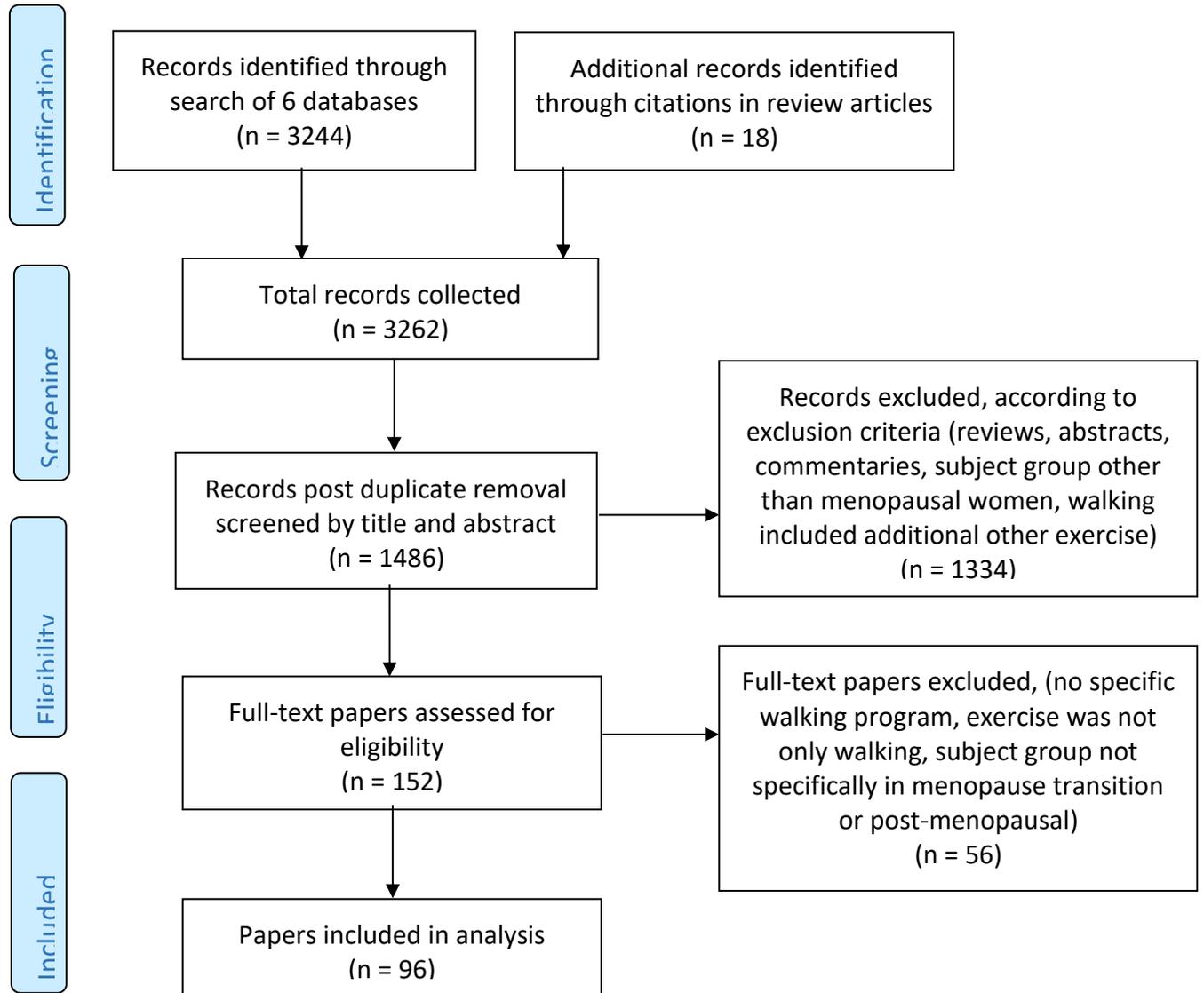


Figure 2

Increase in numbers of publications from 1984 to 2016

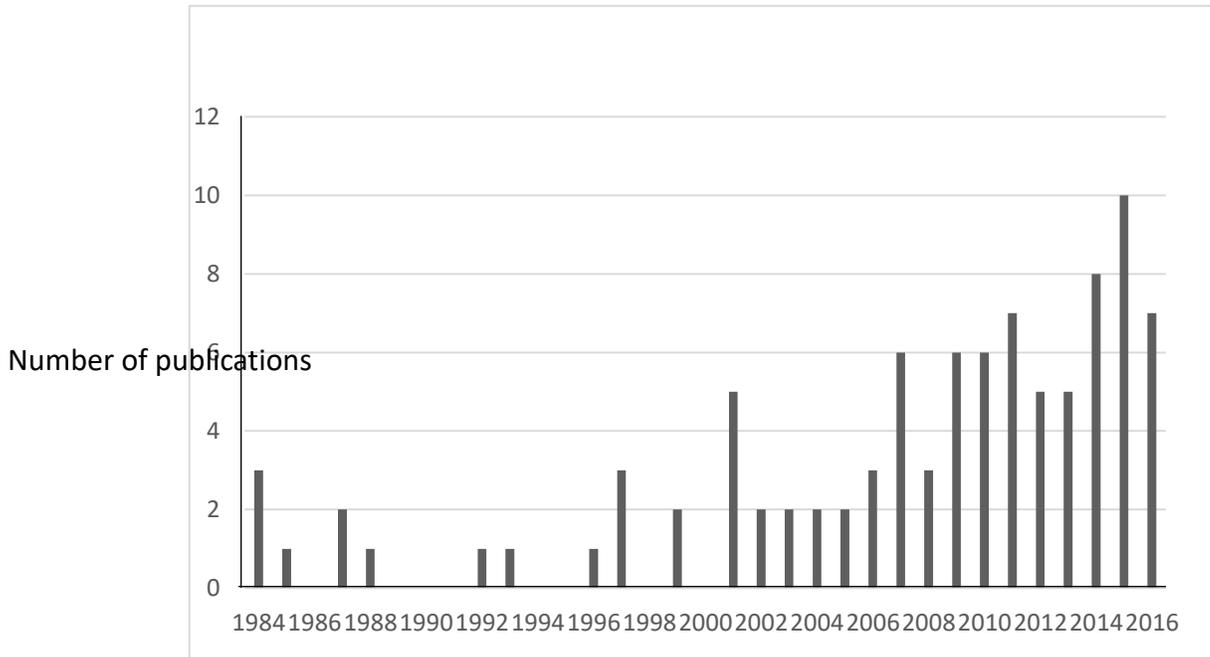


Table 1

Characteristics of selected papers and walking programs

Characteristics of Papers (N=96)	
Study design [Number of papers (%)]	
RCTs	44 (46)
'No exercise' control	34 (35)
Waitlist control	5 (5)
Placebo control	5 (5)
Experimental intervention studies ^a	52 (54)
'No exercise' control	14 (15)
No control (compare pre vs post walking)	38 (40)
Participant characteristics	
Participant recruitment: total number (n=96)	7456
mean \pm SD	77.67 \pm 63.64
range (min to max)	10 to 270
Participants completing walking intervention	
total number (n=96)	3686
mean \pm SD	38.40 \pm 37.30
range (min to max)	6 to 181
Participant age mean \pm SD (n=93) ^b	56.79 \pm 5.03
range (min to max) (n=68) ^b	40 to 86
Participant selection criteria [Number of papers (%)] ^c	
Sedentary, low physical activity	41 (43)
Overweight, obese	17 (18)
Other ^d	20 (21)
Participant exclusion criteria ^c	
Hormone Therapies	39 (41)
Musculoskeletal disease, orthopedic limitations, fracture risk	39 (41)
Cardiovascular diseases, hypertension	38 (40)
On medications that could affect outcome measures	30 (31)
Smoking	27 (28)
Diabetes	12 (13)
Chronic renal, hepatic diseases	11 (11)
Chronic lung diseases	7 (7)
Mental problems	7 (7)
Chronic metabolic diseases	4 (4)
Surgical menopause/oophorectomy	3 (3)
Cancer	2 (2)
Chronic diseases (general)	7 (7)
Health issue/symptom investigated (outcome measures) ^e	
Change in body weight/composition (BMI, weight, body fat)	50 (52)

CVD risk (heart rate, blood pressure, respiratory/cardiovascular fitness)	44 (46)
Serum marker imbalance (metabolic, immune-endocrine, inflammatory) ^f	38 (40)
Bone health, fracture risk (BMD, markers of bone formation and turnover)	24 (25)
Change in physical aptitude, fitness	17 (18)
Mental health, psychological symptoms	8 (8)
Diabetic risk (Insulin resistance, diabetic risk factors)	6 (6)
Sleep problems	5 (5)
General menopause symptoms (assessed in menopause symptom scales) ^g	4 (4)
Reduced QOL (assessed with QOL measures) ^h	4 (4)
Low perceived health and physical self-esteem	3 (3)

Characteristics of walking programs (N=77)

Program duration and frequencies

Length of intervention [weeks] ⁱ (n=77):	mean ± SD	23.23 ± 26.99
	range (min to max)	(4 to 144)
Frequency of sessions [days/week] (n=74):	mean ± SD	3.75 ± 1.10
	range (min to max)	(2 to 7)
Length of session [minutes] ^j (n=67):	mean ± SD	45.30 ± 14.15
	range (min to max)	(22.5 to 90)
Distance in one session [km] ^j (n=15):	mean ± SD	3.62 ± 1.10
	range (min to max)	(2 to 4.8)
Exercise length [minutes/week] ^j (n=67):	mean ± SD	161.94 ± 67.85
	range (min to max)	(90 to 325)
Exercise distance [km/week] ^j (n=15):	mean ± SD	14.20 ± 5.86
	range (min to max)	(6 to 25.2)

Program type [Number of papers (%)]^k

Exercise on treadmill	10 (13)
Natural walking ^l	61 (79)

^a: Could include non-randomized trials and randomized comparison studies

^b: data for age mean and range were taken from only walking group or walking + control group if not distinguished.

^c: papers can include more than one criteria

^d: Other selection criteria include specific requirements such as hypertension (n=6), diabetes (n=3), osteoporosis (n=3), Coronary artery disease (n=2), and n=1 for a requirement each of depression, an upper arm fracture in past 2 years, sleep disorder determined by PSQI (Pittsburgh Sleep Quality Index), severe menopause symptoms determined by >15 of KI (Kupperman Index) and by >2 Hot Flashes/day, and being breast cancer patient.

^e: papers can include more than one medical reason

^f: include lipids, cholesterol, hormones, blood glucose, cytokines, inflammatory markers

^g: general menopause symptoms established with Kupperman Index, Green Climacteric Scale, or a non-validated symptom impact inventory

^h: QOL established with SF-36, Utian QOL Scale, or MENQOL

ⁱ: calculating 4 weeks per months if months was given

^j: using median data point for frequency, time, or length if there was a range for individual programs

^k: six papers did not report on program type

^l: Natural walking included 9 Nordic walking and one walking with ankle weights

Table 2

Type of monitoring recorded for the walking programs (N=77)

	Fully supervised walk	Partially supervised walk	Unsupervised Walks	Scheduled post walk checks by phone, email, or in person	Supervision not recorded
N (%)	N=31	N=14	N=14	N=7	N=11
No additional monitoring	27 (87.1)	8 (57.1)	1 (7.1)	2 (28.6)	8 (72.7)
Pedometer,	2 (6.5)	-	2 (14.3)	1 (14.3)	-
Exercise log	1 (3.2)	5 (35.7)	10 (71.4)	4 (57.14)	1 (9.1)
Pedometer + Exercise log	1 (3.2)	1 (7.1)	1 (7.1)	-	2 (18.2)

Table 3

Effect of walking on menopause-related health issues

Health issue/symptom investigated ^a	Number of studies reporting on health issues ^b	Improved [N (%)]	No improvement [N (%)]
Change in body weight/composition	50	33 (66)	17 (34)
CVD risk and CVD risk factors	44	40 (91)	4 (9)
Serum marker imbalance	38	30 (79)	8 (21)
Bone health ^c	24	17 (71)	7 (29)
Change in physical aptitude, fitness	17	15 (88)	2 (12)
Mental health, psychological symptoms	8	8 (100)	0 (0)
Diabetic risk and diabetic risk factors	6	3 (50)	3 (50)
Sleep problems	5	2 (40)	3 (60)
General menopause symptoms	4	3 (75)	1 (25)
Reduced QOL	4	4 (100)	0 (0)
Low perceived health and physical self-esteem	3	3 (100)	0 (0)

^a Health issues, symptoms, and health markers are grouped under general categories.

^b Studies can include more than one issue

^c Includes fracture risk and changes in bone mineral density (BMD) and bone markers

Table 4

Impact of walking program on menopause-specific symptom assessment

Assessment	Specific selection criteria	Outcome tool	Improvement	Outcome	Study duration [weeks]	Walking duration [min/week]	Ref
Menopause symptoms	sedentary, not on HT	Symptom impact inventory ^a	Yes No	Improvement in sleep, urogenital, and sexual symptoms No difference to walking group in all other menopause symptoms	24	100	54
Menopause symptoms	symptomatic, depression	Kupperman	Yes	Overall improvement of menopause symptoms	12	225	82
Menopause symptoms	symptomatic, not on HT	Kupperman	Yes	Overall improvement of menopause symptoms	12	90	104
Menopause symptoms	symptomatic, sedentary, not on HT	Green Climacteric Scale	some	Improvement was associated with improvement in sleep and improved fitness	16	90	66
Menopause QOL	symptomatic, sedentary, not on HT	Utian QOL Scale	Yes	Women with reduced symptoms reported improvement in all QOL domains	16	90	60
Menopause QOL	symptomatic, low activity level	MENQOL	Yes No	Improvement in vasomotor, psychosocial, and physical domain No improvement in sexual domain	12	112.5	100
QOL assessment using general QOL tools (not menopause-specific)							
Mental and physical QOL	generally healthy	SF-36 QOL tool	Yes	Improvement in mental and physical wellbeing	16	135	74
Mental and physical QOL	generally healthy	SF-36 QOL tool	Yes	Improvement in mental and physical wellbeing	4	150	113

^a not validated^b further details including study design and participant characteristics see Supplementary Table 1

List of Supplemental Digital Content

Table Supplemental Digital Content 1.exl

List of all 96 papers included in the scoping review analysis with study design, characteristics of participants with inclusion and exclusion criteria, medical issue examined and study outcome.

Table Supplemental Digital Content 2.exl

Includes characteristics of the 77 distinct walking programs studied in the 96 papers.