Published in final edited form as:
J Vasc Surg. 2013 December ; 58(6): 1678–1687. doi:10.1016/j.jvs.2013.08.034.

Community walking programs for treatment of peripheral artery disease

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Abstract

Background—Supervised walking programs offered at medical facilities for patients with peripheral artery disease (PAD) and intermittent claudication (IC), while effective, are often not utilized due to barriers including lack of reimbursement and the need to travel to specialized locations for the training intervention. Walking programs for PAD patients that occur in community settings, such as those outside of supervised settings, may be a viable treatment option, as they are convenient and potentially bypass the need for supervised walking. This review evaluated the various methodologies and outcomes of community walking programs for PAD.

Methods—A literature review using appropriate search terms was conducted within PubMed/Medline and the Cochrane databases to identify studies in the English language employing community walking programs to treat PAD patients with IC. Search results were reviewed, and relevant articles were identified that form the basis of this review. The primary outcome was peak walking performance on the treadmill.

Results—Randomized controlled trials (n=10) examining peak walking outcomes in 558 PAD patients demonstrated that supervised exercise programs were more effective than community walking studies that consisted of general recommendations for patients with IC to walk at home. Recent community trials that incorporated more advice and feedback for PAD patients in general resulted in similar outcomes with no differences in peak walking time compared to supervised walking exercise groups.

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Disclosure: Dr. Hiatt directs a clinical trials research center for the University of Colorado that conducts trials investigating new treatments for PAD and claudication. Relevant sponsors include Pluristem, Theravasc, NIH sponsored Cardiovascular Cell Therapy Research Network (CCTRN) and Cardiovascular Systems, Inc.

Conclusions—Unstructured recommendations for patients with symptomatic PAD to exercise in the community are not efficacious. Community walking programs with more feedback and monitoring offer improvements in walking performance for patients with claudication and may bypass some obstacles associated with facility-based exercise programs.

Introduction

Atherosclerotic peripheral artery disease (PAD) results from the accumulation of plaque in the arteries of the periphery and causes intermittent claudication (IC) in approximately one-third of patients.[1] A comprehensive medical approach to reducing cardiovascular risk is warranted in all PAD patients. In addition, those with IC should receive therapy focused on improving walking ability, functional capacity and patient-reported outcomes. Supervised walking exercise is an effective therapy for treating PAD and is regarded as the gold standard therapy for improving outcomes. These programs are associated with a number of implementation barriers however, such as lack of reimbursement and the high volume of exercise visits at clinical settings required of patients over an extended period of time. Walking programs that occur in community settings (those programs outside of supervised hospital and clinical settings) have recently gained attention in the vascular medicine literature as they potentially bypass many of the barriers associated with supervised walking programs. However, given that community walking programs have largely been ineffective for PAD patients, a discussion of the various methods employed and relevant outcomes assessed following walking interventions may help reveal why this type of therapy has been ineffective. Thus the purpose of this review was to summarize the methods and results of community walking programs for PAD patients with IC.

Relevant outcomes for PAD

Treadmill walking is a primary objective modality to assess a PAD patient's walking ability and is considered reliable and valid for those with IC.[2,3] The most commonly assessed treadmill outcomes include measures of claudication onset time (COT) or distance walked to claudication onset and peak walking time (PWT) or maximal walking distance.[4,5] Typically COT and PWT are assessed using a graded treadmill protocol,[6] but constant load treadmill testing[6,7] is also an accepted method used to assess walking distance. Functional ability of PAD patients relates to their physical ability to perform sustained ambulation at home or in the community as well as the ability to perform activities that involve the lower limbs (e.g., moving from a seated to standing position). This is an important outcome to evaluate as PAD patients demonstrate a greater functional decline over time compared to those without PAD.[8] Objective measures such as the 6 minute walk test as well as balance and short distance shuttle tests (walking a defined distance back and forth signaled by a timer) have been used to assess functional ability.[9-13] The 6 minute walk test (walking a pre-defined course for a specified time and recording the distance achieved) is perhaps the best and most valid physical function test for PAD and IC.[11-13] Several trials have demonstrated that meters walked over the 6 minutes increase significantly following exercise interventions for PAD.[14-16] This is an important outcome as the 6 minute walk test is strongly related to mortality rates, mobility and overall physical function during daily life in PAD patients.[12,17] Thus, functional outcomes provide clinicians with additional objective information for evaluating the progress of the patient following a therapeutic intervention, given that these tests reflect the patient's walking ability from a practical standpoint.

Patient-reported outcomes, defined as patient's perceived physical, emotional, and social well-being and function, are also important to assess as patient perception of a treatment's impact on their health may aid a clinician in determining the appropriate therapy for PAD.[18] A number of validated general and PAD-specific tools exist for measuring patient-reported outcomes following exercise training programs, the most commonly used being the Medical

Outcomes Study Short Form 36-item (SF-36) questionnaire and the Walking Impairment Questionnaire (WIQ).[19-21] Other validated disease-specific questionnaires that have been used in PAD patients with IC include but are not limited to the Peripheral Artery Questionnaire,[22] Vascular Quality of Life questionnaire,[23] the Claudication Scale[24] and the Intermittent Claudication Questionnaire.[25]

Supervised walking exercise: Cornerstone of PAD Therapy

There are a number of supervised exercise modalities such as leg and arm ergometry, pole-striding and strength training that have been used to treat PAD and IC in supervised clinical exercise settings.[26] However, the primary validated exercise therapy for patients with PAD and IC is a program of hospital-based supervised walking.[27,28] This therapy is recommended as an initial treatment for IC prior to any endovascular or open revascularization and is classified IA by the ACC/AHA PAD practice guidelines.[27] This rating is given because of the pronounced improvement in walking ability of PAD patients with IC following the therapy as demonstrated in multiple randomized clinical trials.[29-32] Supervised walking exercise has also been cited in trials to be a beneficial treatment following endovascular or surgical procedures, providing additional evidence of its benefit for PAD patients.[33,34]

Effects of supervised walking for PAD patients

Supervised walking programs consist primarily of treadmill walking exercise and include brief periods of rest when moderate leg pain occurs.[32] Supervised walking exercise has been studied extensively and results of most randomized clinical trials indicate that overall walking ability of PAD patients is improved by this therapy.[29,30,35,36] Additionally, a Cochrane database systematic review of randomized controlled trials conducted by Watson et al[37] found that PWT (or maximal meters walked) as well as COT (or distance to claudication onset) are significantly improved following exercise training compared to the standard of care or placebo for PAD patients with IC.[37] Briefly, in a sample of 255 PAD patients in 7 total studies, the Cochrane review found a PWT mean difference of 5.12 minutes between supervised walking compared to standard of care and placebo groups.[37] Similar results were demonstrated for 391 PAD patients in 6 total studies, where a mean difference of 113.2 meters was found between supervised walking and standard of care or placebo groups ($p<.001$). The COT was also improved for patients in the supervised walking vs standard of care or placebo groups in 9 total studies analyzed.

The exact physiological changes leading to the improvement of walking ability in PAD patients remain unclear. Several PAD studies have reported that the benefit obtained from walking exercise may be due to an improvement in skeletal muscle adaptation and metabolism as well as the oxidative capacity of the active muscles.[38,39] A number of studies have shown that exercise rehabilitation for IC does not improve blood flow to the leg[40,41] although several studies have reported modest improvements.[30,42] Other possible mechanisms for the improvement in walking ability include an improvement in walking economy (rate of oxygen consumption in relation to distance completed),[43,44] increased angiogenesis,[45] a decrease in blood viscosity,[46] improvement in endothelial function,[47] a decrease in atherosclerosis and an increase in pain tolerance.[30]

Supervised walking exercise prescription

The standardized nature of the supervised walking program design has been highlighted as one of its strengths.[1] Supervised exercise training is effective in part because of a prescribed exercise intensity, frequency and duration that induce a training response in PAD patients with IC. Typically, the walking program lasts for a minimum of 30 to 45 minutes each session, for at least 3 sessions per week and a minimum of 3 months.[27] Regarding exercise intensity, walking to moderate (not mild or severe) levels of pain on a treadmill before resting is prescribed most commonly and is also recommended by the ACC/AHA PAD practice guidelines.[27] Thus the patient walks until the onset of moderate leg pain, rests until the pain has subsided and then resumes walking again. It is important to note that PAD patients may experience a familiarization effect during repeated exercise testing and/or training on a treadmill not solely related to a walking intervention.[5] Clinicians and researchers should be aware of this when establishing the efficacy of the walking program or performing repeated exercise tests, as the familiarization with the treadmill may be due to a biomechanical improvements in walking as patients become familiar with the treadmill, which has been cited to be as high as 100% improvement over just several weeks.[5]

The role of the different exercise prescription components (e.g., frequency, duration of exercise and intensity of walking) and assessing which contributes most to the training response is unclear. A recent systematic review of 25 randomized clinical trials evaluated the impact of individual supervised walking exercise prescription components on maximal walking distance and distance to claudication onset in PAD patients using regression analyses.[48] Results indicated that none of the exercise prescription components were independently associated with a significant improvement in maximal walking distance for PAD patients. The authors did note that medium length programs (i.e., 12-26 weeks) were more likely to show improvement in walking outcomes as compared to short (<12 weeks) and long (>26 weeks) term exercise programs (maximal walking distance: +223 vs +123 vs +145 meters; distance to claudication onset: +146 vs +100 vs +109 meters).[48] This finding however conflicts with recent reports by Gardner et al[49] who determined that PWT and COT improve quickly during the first 2 months of supervised walking and then plateau, also implying that adherence to exercise is better with programs that are only 2 months in duration. Until more research in this area is conducted, the greatest improvements in walking ability of PAD patients consists of a comprehensive exercise prescription strategy using established exercise frequency, duration and intensity components, which has been the accepted practice over the last several decades.[32]

Supervised walking is effective but not feasible

Supervised walking exercise has been cited as cost-effective in terms of improving walking ability for patients with claudication.[50-56] Briefly, van Asselt et al[53] evaluated the cost-effectiveness of supervised walking compared to unsupervised walking where only general walking advice was given. Findings indicated that the supervised walking program was more effective for improving maximal walking distance than the unsupervised walking program for PAD patients (620 vs 400 meters, p<.001) but was also more costly (3407 vs 2304 Euros) which may be a barrier to implementing supervised walking programs. In the US, there is a lack of insurance reimbursement for supervised walking programs, few available local training centers, and PAD patients are required to travel to available facilities several days per week for several months which may not be feasible.[57,58] Thus supervised walking programs are effective but the difficulty of implementing such programs provides a rationale for the use of walking programs in community settings, as they may be less costly and more feasible for patients to participate in. When considering the environment of the exercise sessions, many barriers associated with supervised walking programs may be bypassed when programs are conducted in community settings.

Methods

We reviewed PubMed/Medline and the Cochrane database to find studies that conducted community walking exercise programs for PAD patients with IC from 1990 to 2013. Because of the multiple study designs for walking programs in community settings for PAD, we included a broad combination of search terms to identify appropriate studies in the area.

Search terms included “community exercise,” “home exercise,” “unsupervised exercise,” “physical activity,” “walking,” “peripheral artery disease,” “peripheral arterial disease,” “PAD,” and “intermittent claudication.” A large number of studies employed a treatment arm which only included general advice to walk. Therefore, we narrowed our search further to include only those studies that reported peak walking time (PWT) or maximal walking distance as the primary outcome. There were fewer studies identified that included more intensive exercise program components (e.g., monitoring, feedback) for community walking programs and PAD. Thus we included all studies in this area regardless of the design or study endpoints.

Results

Community walking programs

Walking programs in community settings for PAD patients can refer to any form of structured ambulation program completed outside a supervised clinical setting. Typically these programs originally consisted solely of advice to walk in the community (thus unsupervised) but more recent studies have provided innovative components and approaches to improve delivery and outcomes of PAD patients. The current recommendation and level of evidence for community walking programs (unsupervised) as reported in the ACC/AHA PAD practice guidelines for the management of patients with PAD is class IIb with an evidence level of B,[27] indicating that these programs are not well established as an effective treatment option. Findings from multiple trials of supervised exercise vs non-supervised exercise programs for patients with PAD and IC support the ACC/AHA ratings. Additionally, a Cochrane database systematic review examined walking outcomes following supervised exercise therapy vs non-supervised (home and community) exercise therapy for IC.[59] The authors reported that maximal walking distance was greater for supervised walking groups compared with the non-supervised groups following 3 month (n=236, 6 studies; overall effect size [magnitude of treatment effect]: 0.58, CI: 0.31 to 0.85, p<0.0001), 6 month (n=172, 5 studies; overall effect size: 0.89, CI: 0.57 to 1.21; p<0.0001) and 12 month (n=69, 2 studies; overall effect size: 1.01, CI: .50 to 1.52, p<.0001) outcome assessment time points.

Results of PAD community walking studies with advice only

Many of the community walking programs for PAD and IC to date have been conducted with advice to walk but with little further instruction, thus relying primarily on patient self-monitoring.[30,36,57,60-69] Regensteiner et al[36] randomly assigned PAD patients to a supervised, hospital-based walking program or an unsupervised walking program in the community setting for a 3-month intervention time period. Patients in the unsupervised community walking program were given detailed exercise instructions during the initial hospital visit followed by a weekly phone call but did not receive any direct training. The main finding was that patients randomized to the supervised walking program improved treadmill exercise performance (PWT: +137%; COT: +150%) more than the unsupervised walking program participants in the community setting (PWT: +5%; COT: +26%). Recently, Allen et al[69] examined walking outcomes of PWT and COT in 33 PAD patients with IC following a 3 month period. Patients were randomized to 1) supervised walking exercise in a hospital setting (intervention) or 2) unsupervised walking at home (control). The unsupervised home program consisted of advice to exercise daily by walking and patients were asked to keep notes of their exercise (also called every 3 weeks to answer exercise related questions patients had, if any). The supervised walking group improved both PWT and COT from baseline to 3 months (PWT: +260 seconds; COT: +138 seconds) while the unsupervised home walking group did not significantly improve either walking outcome from baseline to 3 months (PWT: +93 seconds; COT: +77 seconds). Table I provides a review of randomized controlled PAD exercise trials using the community as the setting for walking where primarily exercise advice was given. Eleven studies including a total of n=595 PAD patients (sample size range n=19 to n=252) were identified that evaluated walking outcomes of PWT or maximal walking distance as well as COT or distance to claudication onset. Four of the 11 studies reported PWT as the primary walking outcome while the other 7 studies evaluated maximal walking distance. Results overall supported that supervised exercise improved walking more than home programs. Many of these programs used the community walking groups as the control arm (standard of care), given that many patients with PAD have not habitually exercised and often the primary aims were to establish the effectiveness of supervised walking exercise. Most of these programs have not yielded significant improvement in walking ability.

New perspectives for PAD walking programs in community settings

More recently, programs are being developed using established supervised walking exercise guidelines that more intensively train and monitor PAD patients over the course of an intervention and provide direct feedback on how to improve walking ability. In contrast to supervised walking exercise programs, less is known about the optimal prescription for PAD patients walking in the community given that barriers and facilitators to exercise are different between settings. Because supervised exercise training is efficacious, modeling the community program on some elements of the supervised program may be beneficial. However, a limiting factor of community walking program implementation is that the guidelines for supervised exercise training overall may not be feasibly applied in the typical community setting. For example, when a patient experiences IC in the community while walking, they may stand in place rather than sitting as there may not be adequate seating available. Thus, patients with PAD have cited the need to take rest breaks as a key barrier and that availability of seating for rest facilitates walking in community settings.[70] An additional impedance to walking exercise in community settings (outdoors specifically) that has been cited by PAD patients in focus groups is the quality of sidewalks. Uneven or icy sidewalks were discouraging to patients and led to decreased ambulation. Environmental factors relating to low quality walking surfaces have also been cited as a precipitating factor for falls among middle aged and older adults, with 73% of falls directly resulting from uneven sidewalk surfaces and due to objects such as curbs.[71] Thus the walking environment could potential present numerous barriers to implementing effective walking programs in community settings for PAD patients with barriers varying for each individual and highly specific to their disease-related impairments.[72-74] Given this constraint, it may be important that interventions based in the community include an evaluation of objective features of the local walking environment to help PAD patients develop a tailored walking plan to improve adoption and adherence to exercise in the community setting. The question of how the elements of supervised exercise programs can be implemented into the community setting is critically important and requires additional attention for these programs to be successful. Thus the failure of community exercise training studies that have only provided advice to walk at home, demonstrates the lack of acknowledgment of the multifaceted social and environmental landscape that is associated with community walking. While it has been previously understood that exercise programs should ideally incorporate a sufficient level of intensity, duration and frequency to be effective,[32] recent evidence indicates prescription components such as low intensity exercise may be just as beneficial as high intensity walking.[75-77] This is important to acknowledge as PAD patients are generally sedentary [78] and may not be aware of the appropriate exercise regimen required to improve their walking ability (thus non-compliant at higher levels of walking intensity). Another factor that is important, is that a program of exercise training initially may provide the knowledge and skills necessary to increase a patient's propensity to walk. However, if travel to clinical settings for supervised walking is not feasible even for a short period of time (1-2 weeks), community locations may need to be selected to adequately train PAD patients on how to walk effectively.

Results of recent approaches to PAD community walking programs

Recent community walking studies have provided clinicians and researchers further direction on how to successfully utilize supervised walking program components in an effort to translate the success of supervised programs to community settings.[44,56,79-84] Evidence suggests that this type of intervention yields better results than studies where little or no instruction is given to patients with regard to exercise. Gardner et al[44] randomized 119 patients with IC into a supervised walking program, a walking program in the community setting, and a non-exercising control group. Patients in the walking groups were 1) provided activity monitors, 2) received seven, 15 min sessions where patients discussed their progress with an exercise physiologist, 3) were given feedback about the data from the activity monitor and 4) were given new instructions on changes in exercise duration. Differences were found between both exercise groups vs the control group for walking outcomes of PWT and COT (supervised walking: PWT +215 and COT +165 seconds; community walking: PWT +124 and COT +134 seconds; control group: PWT −10 and COT −16 seconds, $p<.05$).[44] A multi-center, randomized control trial conducted by Hiatt et al[85] found that the inclusion of supervised walking at set intervals in addition to using an activity monitor and exercise log book during a 6 month community walking program was beneficial for PAD patients, as the authors concluded that exercise was as effective for improving walking outcomes and patient-reported outcomes (via the WIQ and SF-36) compared to exercise in combination with the medication propionyl-L-carnitine. Thus community programs with more intensive individual interventions modeled after supervised walking programs provide evidence of effectiveness for improving walking ability and patient-reported outcomes.

Recently, McDermott et al[14] conducted a randomized, controlled walking trial for PAD patients with and without IC using a group-mediated cognitive behavioral walking intervention that included principles from social cognitive theory, group dynamics and the self-regulation knowledge base. Control patients attended weekly (60 min) health education group sessions as well as lectures for management of health (e.g., hypertension control, cancer screenings). Patients in the intervention group attended once per week group meetings for a total of 90 minutes, consisting of 45 minutes of education lectures and counseling (e.g., benefits of walking, self-monitoring) and 45 minutes of walking in a supervised setting at an indoor track. Patients were then instructed to walk to severe leg discomfort in the community (outside, over-ground rather than indoor treadmill walking) over the course of the 6 month intervention for a minimum of 5 days per week and up to 50 minutes each session. Results indicated that the primary outcome of change in 6-minute walk distance was significantly different for patients in the intervention group (+42.4, CI=27.9 to 56.8 meters) compared to patients in the control group (−11.4, CI=−25.4 to 3.2 meters, $p < .001$). Secondary outcomes of PWT and COT were also significantly different between intervention and control groups (+1.54 vs. +0.53 min, $p=.04$; +1.43 vs. +0.42 min, $p=.02$). Thus the use of appropriate training advice to walk in community settings, the inclusion of exercise supervision at pre-defined locations and implementation of exercise and health education for PAD patients in group settings may be beneficial for use in the development of comprehensive community-based walking programs. Table II provides a review of community walking trials that have provided more intensive programming for patients with PAD and IC. In total, 9 trials (n=823 PAD patients) were reviewed which included 3 studies that did not have a comparison group or were retrospective by design. Three trials evaluated PWT and COT and the other 6 trials examined maximal walking distance and distance to claudication onset in PAD patients following the exercise programs.

Not all studies have been successful for improving outcomes in PAD patients. Two of the nine studies demonstrated mixed results.[79,83] In general however, the majority of these types of studies did report improvements in walking ability and questionnaire-based outcomes for PAD patients.

Conclusions

This review provides an overview of the benefits of walking exercise and a discussion of community walking programs to improve the health of PAD patients. Supervised walking exercise improves the walking ability, functional ability and patient-reported outcomes of PAD patients. However, because the current state of the healthcare system limits the supervised exercise treatment options for PAD patients in addition to other logistical barriers (e.g., transportation, proximity to clinics), it is clear that innovative community walking programs need to be developed. Community programs have potential to be successful as they are generally more convenient in terms of a patient's schedule, that is, patients are able to exercise at locations close to their homes and avoid potential barriers such as transportation to supervised exercise in clinics. It should be noted that inclusion of some elements of supervised training may be needed for exercise programs that primarily occur in community settings as a way of coaching PAD patients who have never exercised consistently. Thus future studies aimed at improving upon the “go home and walk” exercise advice strategy often provided to PAD patients should incorporate more intensive monitoring by staff as well as coaching patients to monitor their own exercise while in the community. Community walking programs for symptomatic PAD may be effective when a proper intervention is employed, as the characteristics of the intervention need to go beyond simple recommendations to exercise. The implications of successful programs include the improvement of PAD patients' walking ability, enhanced functional ability in community settings, an improved overall quality of life and a potential decrease in healthcare expenditures.

Acknowledgments

Dr. Mays is supported by a K01HL115534-01 grant from the National Institutes of Health and the National Heart, Lung and Blood Institute.

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Table I

Randomized controlled trials primarily using exercise advice in community walking programs for peripheral artery disease patients

First author (year)	Sample size [a]	Study length [b]	Other interventions	Community walking program description	Performance outcomes
Hiatt[30] (1990)	19	12 wks	supervised walking	Control group given instructions to continue usual activity & no regular exercise.	PWT increased 7.5 min in supervised group & improved to greater degree than control group PWT (+1.1 min, p<.05).
Regensteiner[36] (1997)	20	12 wks	supervised walking	Fast walking 3 d·wk^{-1}; walk rest for 35-50 min to moderate pain & weekly support calls from staff.	Supervised walking improved PWT (+137%) compared to unsupervised community walking (+5%, p<.05).
Patterson[63] (1997)	47	12 wks	supervised walking	Walking advice (3 times·wk^{-1}, 20-40 min); weekly education lectures; completed exercise logs.	PWT & COT improved more in supervised (+207 & +337%) than home exercise (+70 & +131%, p<.05) groups.
Delis[64] (2000)	37	4.5 mo	IPC	Instructed to walk at least 1 h·d^{-1} & given 75 mg·day^{-1} aspirin.	Median PWD & COD improved in the IPC group compared to the unsupervised home group (p<.05).
Savage[66] (2001)	21	12 wks	supervised walking	Advice to walk to maximal pain & rest (15 min total walking) 3 times·wk^{-1}; contacted monthly by staff for support.	PWD change scores statistically similar for patients in supervised walking & advice to walk groups (+311.8 vs +204.2 m, p>.05).
Degischer[62] (2002)	59	12 wks	supervised walking; combined supervised walking & clopidogrel	Upfront advice for walking exercise (1 h·d^{-1} on track); walk until 60% pain level, rest, resume upon cessation of pain.	Improvements in PWD for supervised walking & combined group (+83%; +131%, p<.05); no significant change in PWD for walking advice group pre-post (+5.4%).
Cheetham[61] (2004)	56	12 wks	supervised walking	General advice to walk (3 times ·wk^{-1}, 30 min·session^{-1}); advice for stair climbing & tiptoe walking.	Supervised walking improved PWD (+129%) compared to the advice group (+69%, p=.001).
Kakkos[60] (2005)	26	12 wks	supervised walking; IPC	Patients instructed to walk daily to near maximal pain, for at least 45 min.	No significant change in walking advice group for median PWD (+5 m) or median COD (+0 m).
Parr[67] (2009)	25	6 wks	supervised aerobic exercise; [c] supervised strength training	Patients advised to 'walk as much as possible at home.'	PWD higher for aerobic exercise group compared to strength training & walking advice groups (+93.9 vs +7.3 vs +7.0%, p<.01).
Allen[69] (2010)	33	12 wks	supervised walking	Walked at home 3 times·wk^{-1} for 30 min & recorded activity (phone call once every 3 wks).	No significant change in PWT or COT for home walking group (+93 & +77 s).
Nicolai[57] (2010)	252	52 wks	supervised walking; supervised walking with feedback	Walking advice & exercise brochure provided; instructed to complete 3 sessions·d^{-1} to maximal pain.	Differences in PWD for advice group vs supervised walking & supervised walking with feedback groups (110 vs 310 vs 360 m, p<.001).

COD, claudication onset distance; *COT*, claudication onset time; *IPC*, intermittent pneumatic compression; *PWD*, peak walking distance; *PWT*, peak walking time

[a] Total sample size for patients who completed the study

[b] Study length for intervention time period

[c] Forty-five minutes of walking, cycling, circuit training & stretching

Table II

Review of trials using more intensive community walking programs to treat patients with peripheral artery disease

First author (year)	Study design & other interventions (sample size; [a] study length [b])	Community walking program description	Performance outcomes
Wullink[83] (2001)	-non-randomized -single group (n=24; 24 wks)	Instructed to walk 3 times·d^{-1} & 3 times·wk^{-1} at self-selected speed until near maximal pain then rested. Recorded walking sessions in a diary. HCM model[86] employed & patients met staff every 3 wks.	COD improved (+58 m, p<.05) but no significant changes in PWD (+54 m). No significant changes in WIQ distance (+3.0%), speed (+3.2%) or stair climbing (+1.5%) scores.
Roberts[68] (2008)	-prospective cohort -no control (n=47; 12 wks)	Advice given to walk at least 1 h·d^{-1} with rest periods. Patients contacted by phone weekly for support & also completed exercise logs.	Increase in PWD between baseline & 12 wks (+76.2%, p<0.001). The VascuQOL[23] total score improved (+22.4%, p<.001).
Manfredini[80] (2008)	-non-randomized -walk advice (Ti-E) (n=126; 6 mo)	Patients in the Ti-To group completed walking at home consisting of 1 min each of walk/rest, twice daily, 6 d·wk^{-1} for 10 min each session, at MAS (metronome used to maintain speed, chair used during rest). Patients completed walking diary & family/caregiver ensured diary completion.	Significant intragroup change scores for COD & PWD in both theTi-To (+51 & +83 m, p<.0001) & Ti-E (+27 & +44 m, p<.0001) groups. Significant differences between groups for walking outcomes at 6 mo time point (COD: p=.001; PWD: p=.0001). [c]
Mouser[82] (2009)	-retrospective -no control (n=41; 6 mo)	Exercise physiologist provided upfront advice for home walking program (30 min of walking 3-5 d·wk^{-1} to near maximal pain followed by rest until pain resolved, walking resumed). Also completed walking log & given feedback at least every 2 mo.	Patients demonstrated a significant increase from baseline to follow-up for COD (103.0 to 192.0 m, p=.001) & PWD (400.9 to 480.1 m, p=.006).[d]
Collins[79] (2011)	-RCT -control group (n=145; 6 mo)	Upfront education sessions targeting readiness to engage in walking (modified PACE protocol[87]). Patients completed two, 1 h walking sessions with staff (eg, at hospital/park), were encouraged to walk with staff & other patients 1 d·wk^{-1} & minimum 3 d·wk^{-1} unsupervised for 50 min·$session^{-1}$ with pedometers & received biweekly calls from staff.	The primary outcome of PWD was not different between groups (24.5 vs. 39.2 m). Walking speed assessed by the WIQ did increase significantly in the intervention (+5.7±2.2%) vs control group (-1.9±2.8%, p<.05). Significant differences in the mental health component score of the SF-36 between intervention (+3.2±1.5%) & control group (-2.4±1.5%, p<.05).
Gardner[44] (2011)	-RCT -supervised walking group -control group (n=92; 3 mo)	Community program similar to supervised walking (walking to near maximal IC, 3 d·wk^{-1}, 20 min sessions progressing to 45 min). Patients completed exercise logs & wore activity monitors during walking & participated in seven, 15 min feedback sessions with staff (discussed progress & new goals).	PWT & COT higher in supervised (+215; +165 s) & community (+124; +134 s) groups compared to the control group (−10; −16 s, p<.05). Community group improved WIQ distance (+10%), speed (+11%), stair climbing (+10%) scores (p<.05) & the SF-36 physical function (+8%, p<.01) score.
Hiatt[85] (2011)	-RCT -combined PLC & home walking group (n=59; 6 mo)	Two weeks of initial supervised walking, monthly thereafter. Patients instructed to walk at home for 50 min, 3 d·wk^{-1} to moderate leg pain in 3-5 min followed by rest. Completed walking diaries & wore an activity monitor for each session.	No significant differences in changes scores for PWT or COT between home walking group (PWT: +218±367 s; COT: +100±100 s) vs combined group (PWT: +266±243 s; COT: 174±183 s). Both WIQ & SF-36 scores improved for both groups but were not different from each other post 6 mo.
Fakhry[81] (2011)	-longitudinal cohort -supervised walking group (n=95; 24 wks)	Patients enrolled in home walking group given information sheet & advice to walk daily for 30 min to near maximal pain & 1 min walking at slower pace until pain resolved. Patients also completed 3 interim evaluations of walking distance as well as 3, 1 h individual counseling sessions with staff.	Adjusted mean differences were demonstrated between the supervised & home walking groups for PWD (361%) & COT (953%). No differences between groups for VascuQOL, EuroQOL & SF-36 scores measured at the 24 wk time point.
McDermott[14] (2013)	-RCT -control group (n=194; 6 mo)	Home-based program consisting of goal setting and a cognitive behavioral walking intervention. Included weekly group discussions with trained facilitator (45 min)	Six-minute walk distance improved significantly in the intervention group compared to controls (357.4 to 399.8 vs 353.3 to 342.2 m, p<.001). PWT changes scores also

First author (year)	Study design & other interventions (sample size; [a] study length [b])	Community walking program description	Performance outcomes
		and walking on an indoor track (45 min). Patients instructed to walk "overground" rather than on treadmill.	higher for intervention compared to controls (+1.01 min, p<.05)

COD, claudication onset distance;*COT*, claudication onset time;*EuroQOL*, European Quality of Life questionnaire;*HCM*, Health Counseling Model;*IC*, intermittent claudication;*MAS*, maximal asymptomatic speed;*PACE*, Patient-centered Assessment & Counseling for Exercise;*PLC*, propionyl-L-carnitine;*PWD*, peak walking distance;*PWT*, peak walking time;*RCT*, randomized controlled trial;*SF-36*, Short Form 36-item questionnaire;*Ti-E*, traditional home-based free walking program;*Ti-To*, test in-train out walking program;*VascuQOL*, Vascular Quality of Life questionnaire;*WIQ*, Walking Impairment Questionnaire

[a]Total sample size for patients who completed the study

[b]Study length for intervention time period

[c]A retrospective analysis was conducted by Malagoni[56] evaluating the "test in-train out" program on patient-reported outcomes over a 2 y period in patients with peripheral artery disease & intermittent claudication (see reference for details)

[d]Note that patient-reported outcomes were not examined in this trial