Supervised exercise therapy

Citation for published version (APA):

Hageman, D., Van Den Houten, M. M. L., Spruijt, S., Gommans, L. N. M., Scheltinga, M. R. M., & Teijink, J. A. W. (2017). Supervised exercise therapy: it does work, but how to set up a program? *Journal of Cardiovascular Surgery*, 58(2), 305-312. <https://doi.org/10.23736/S0021-9509.16.09825-6>

Document status and date:

Published: 01/04/2017

DOI:

[10.23736/S0021-9509.16.09825-6](https://doi.org/10.23736/S0021-9509.16.09825-6)

Document Version:

Publisher's PDF, also known as Version of record

Document license:

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HANDLING OF AORTIC AND PERIPHERAL ARTERIAL PATHOLOGIES
PERIPHERAL ARTERIESSupervised exercise therapy: it does work,
but how to set up a program?David HAGEMAN^{1, 2, 3}, Marijn M. L. VAN DEN HOUTEN^{1, 2, 3}, Steffie SPRUIJT³,
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ABSTRACT

Intermittent claudication (IC) is a manifestation of peripheral arterial disease. IC has a high prevalence in the older population, is closely associated with other expressions of atherosclerotic disease and often co-exists in multimorbid patients. Treatment of IC should address reduction of cardiovascular risk and improvement of functional capacity and health-related quality of life (QoL). As recommended by contemporary international guidelines, the first-line treatment includes supervised exercise therapy (SET). In several randomized controlled trials and systematic reviews, SET is compared with usual care, placebo, walking advice and endovascular revascularization. The evidence supporting the efficacy of SET programs to alleviate claudication symptoms is robust. SET improves walking distance and health-related QoL and appears to be the most cost-effective treatment for IC. Nevertheless, only few of all newly diagnosed IC patients worldwide receive this safe, efficient and structured treatment. Worldwide implementation of structured SET programs is seriously impeded by outdated arguments favoring an invasive intervention, absence of a network of specialized physical therapists providing standardized SET and lack of awareness and/or knowledge of the importance of SET by referring physicians. Besides, misleading financial incentives and lack of reimbursement hamper actual use of SET programs. In the Netherlands, a national integrated care network (ClaudicationNet) was launched in 2011 to combat treatment shortcomings and stimulate cohesion and collaboration between stakeholders. This care intervention has resulted in optimized quality of care for all patients with IC.

(Cite this article as: Hageman D, van den Houten MML, Spruijt S, Gommans LNM, Scheltinga MRM, Teijink JAW. Supervised exercise therapy: it does work, but how to set up a program? J Cardiovasc Surg 2017;58:305-12. DOI: 10.23736/S0021-9509.16.09825-6)

Key words: Peripheral arterial disease - Intermittent claudication - Exercise therapy.

Lower extremity peripheral arterial occlusive disease (PAD) is a disorder that leads to progressive stenosis or occlusion of lower extremity arteries.¹ The major cause of PAD is atherosclerosis. Risk factors for atherosclerosis such as cigarette smoking, diabetes mellitus, dyslipidemia, hypertension and hyperhomocysteinemia increase the likelihood of developing PAD. Total disease prevalence ranges from 3% to 10%, increasing to 15% to 20% in persons over 70 years.² Globally, 202 million people were living with PAD in 2010, 70% of them in low-income or middle-income countries.³ Over

the last decade, PAD prevalence increased by 29% in low-income or middle-income countries and 13% in high-income countries.

PAD comes with different presentations, categorized according to Fontaine or Rutherford.⁴ While many patients are asymptomatic, the most common presentation of PAD is intermittent claudication (IC). IC is characterized by pain in calves, thighs or buttocks, provoked by exercise and relieved after minutes at rest. Blood flow in individuals with IC is inadequate to meet the increased local muscular demand for metabolic support during ex-

ercise, resulting in limb muscular fatigue and/or pain.¹ At rest, blood flow suffices and limb ischemic symptoms disappear. Critical limb ischemia is the most severe clinical manifestation of PAD, defined as the presence of ischemic rest pain, ischemic lesions or gangrene objectively attributable to arterial occlusive disease.

The prognosis of patients with PAD is characterized by an increased risk of myocardial infarction, stroke and cardiovascular death due to concomitant coronary artery disease and cerebrovascular disease.¹ These cardiovascular ischemic events are more frequent than ischemic limb events. The annual mortality rate of patients with PAD is 4% to 6% and increases with severity of the disease. Claudication symptoms usually remain stable in most patients and do not worsen or improve at rapid rates. Patients with IC are physically impaired and, therefore, treatment goals are to relieve symptoms, and improve exercise performance and activities of daily living.²

Numerous consensus documents discuss an overall strategy and basic treatment for IC.^{1, 2, 4-6} To reduce adverse cardiovascular events associated with PAD, life-long treatment should include modification or elimination of atherosclerotic risk factors (smoking cessation, antiplatelet therapy, lipid-lowering therapy, blood sugar control, blood pressure control), promotion of daily exercise and adoption of a healthy diet. The initial treatment approach of limb symptoms should focus on structured exercise and, in selected patients, pharmacotherapy (cilostazol, naftidrofuryl; not available in every country) to treat the exercise limitation of IC. Failure to respond to exercise would lead to the next level of decision-making, which is to consider limb revascularization.

In this paper, we provide an up-to-date overview of the current literature regarding supervised exercise therapy (SET) as a conditional part of the treatment for patients with IC. In addition, we will discuss the ClaudicatioNet concept, an innovative treatment model launched in the Netherlands to overcome treatment shortcomings and stimulate cohesion and collaboration between stakeholders.

Exercise therapy

In 1898, Wilhelm Erb, a German neurologist, described successful results of exercise therapy for a patient with IC.⁷ The first randomized controlled trial (RCT) was performed by Larsen and Lassen in 1966.⁸

In this study, seven patients treated with exercise therapy were compared with a control group of seven patients who were given “medical treatment” in the form of lactose tablets. For the group treated with exercise, a significant increase in maximum walking time was observed, whereas control patients did not improve.

For over 40 years, exercise therapy has been a cornerstone in the management of IC and has been subject of many case series, RCTs and meta-analyses.⁶ In a Cochrane review by Lane *et al.*, a total of 30 trials were included reporting on a total of 1,816 participants.⁹ Compared with usual care or placebo, exercise improved maximum walking time (MWT) with 4.51 minutes (95% CI: 3.11 to 5.92) and an overall improvement of approximately 50% to 200%. Pain-free walking distance (PFWD) and maximum walking distance (MWD) improved with 82.29 meters (95% CI: 71.86 to 92.72) and 108.99 meters (95% CI: 38.20 to 179.78), respectively.

Exercise therapy is in essence athletic training, albeit on a much more limited scale than practiced by competitive athletes.⁶ The biological mechanisms by which exercise improves outcomes in IC patients are multifactorial and include (a combination of) enlargement of existing collateral vessels, exercise induced angiogenesis, enhanced nitric oxide endothelium-dependent vasodilatation of the microcirculation, improved bioenergetics of skeletal muscle and improved physical properties of blood flow. In addition to the benefits of daily exercise on limb ischemic symptoms, regular exercise is associated with improvements in blood pressure, serum lipid profile and glycemic control.¹ A study by Garg *et al.* demonstrated reduced mortality rates among PAD patients with higher levels of physical activity in daily life.¹⁰

The most basic exercise therapy prescription consists of a single oral advice, usually without supervision or follow-up. The adherence of patients given an oral exercise advice appeared to be low. Comorbidity, lack of (specific) advice, fear, and lack of discipline and supervision are barriers to actually perform regular walking exercise.¹¹ For these reasons, the importance of supervision was recognized.

Supervised exercise therapy

SET programs proved superior to non-SET programs. Based on level A evidence, they should be offered to all

patients with IC, as recommended by contemporary international guidelines.^{1, 2, 4-6}

SET entails adequate coaching by a physical therapist (PT) or by another exercise specialist. SET is more effective than walking advice (WA) alone in patients with IC. In a Cochrane review by Fokkenrood *et al.*, a total of 14 studies involving 1,002 participants were included.¹² SET showed improvement in MWD compared with non-SET, translating to an increase in MWD of approximately 180 meters favoring SET. However, a benefit on QoL parameters was not found.

In the EXITPAD study, the largest RCT to date, 304 IC patients were randomized to WA or SET (with or without daily accelerometer feedback).¹³ SET, provided by trained PTs, resulted in an increase of approximately 200 meters in MWD compared with WA. Moreover, walking impairment (WIQ scores) and relevant domains of QoL (SF-36 scores) improved in the SET groups compared with the WA group.

Community-based versus hospital-based supervised exercise therapy

Most studies on SET for IC are performed in an outpatient setting of a hospital.¹² While this approach is appropriate in trials, there are some limitations for routine implementation. First, the capacity of a single department in a hospital is limited and not sufficient to provide SET to all IC patients of the adherent community. Second, attending a hospital two or three times weekly is time consuming and expensive. These pitfalls can be solved using a community-based approach, consisting of a selected group of community-based PTs who are trained in applying exercise therapy.

A prospective cohort study by Kruidenier *et al.* showed that one year of community-based SET resulted in a significant 191% and 197% increase in MWD after 6- and 12-month follow-up, respectively.¹⁴ However, a high dropout rate (40% within six months) was observed with such a community-based program. Reports on clinic-based SET showed comparable results in improving MWD (92% and 108%, respectively), suggesting community-based SET is at least equal to clinic-based SET. Similarly, high dropout percentages were found in these hospital-based programs (10% up to 50% after six months of SET). Future studies must identify factors that may explain these unacceptable drop-out rates of both programs.

Components of a supervised exercise therapy program

A typical SET program includes 45 to 60 minutes of treadmill-based or track-based exercises that are performed at least three times a week for a minimum of 12 weeks.¹ Treadmill exercise appears to be most effective in increasing claudication-limited walking capacity. The initial workload of the treadmill is set to a speed and grade that elicits claudication symptoms within three to five minutes. Patients are asked to continue to walk at this workload until they experience claudication of moderate severity. A brief period of rest permits symptoms to resolve. An exercise-rest-exercise cycle is repeated several times during the hour of supervision. Such a program requires intense monitoring of patients aimed at increasing workload by adjusting treadmill grade or speed (or both).

It is unclear whether patients must exercise above a threshold of intensity to experience optimal improvements as uncertainty remains on intensity, duration and content of a program. A systematic review with multivariable meta-regression analysis by Fakhry *et al.* found that no single exercise component was independently associated with improvement in walking distance.¹⁵ In an RCT by Gardner *et al.*, IC patients who completed a low-intensity exercise program (at 40% of maximal exercise capacity) had similar improvements in physical function and health-related QoL compared with individuals who completed a high-intensity exercise program (at 80% of maximal exercise capacity).¹⁶

In most studies, SET involves treadmill or track walking. However, alternative modes of exercise therapy have been described yielding significant results. An RCT by Zwierska *et al.* confirmed that both upper-limb and lower-limb aerobic exercise training provide an adequate stimulus for evoking improvements in PFWD (51% and 57%) and MWD (29% and 31%) in patients with PAD.¹⁷ Evidence from this study suggests that the improvement in walking performance after upper-limb training is due to a combination of central cardiovascular and/or systemic mechanisms in addition to an adaptation in exercise pain tolerance that enables patients to endure a greater intensity of claudication pain.

A Cochrane review by Lauret *et al.* regarding five studies with 135 participants compared supervised walking exercise with alternative modes of exercise.¹⁸ The alternative modes of exercise therapy included cycling, strength training and upper-arm ergometry. Overall, there was no difference between supervised walking

exercise and alternative modes of exercise regarding MWD (173 meters, 95% CI: -56 to 401) and PFW (136 meters, 95% CI: -32 to 304). QoL significantly improved in both groups. However, the applicability of the evidence is limited. More studies with larger sample sizes are needed to make meaningful comparisons between each alternative exercise mode and the current standard of supervised treadmill walking. Nevertheless, a varied program, with combined therapy of supervised walking and alternative exercise modalities, may potentiate increases in aerobic endurance while being more attractive to the patient.

Barriers to supervised exercise therapy

Unfortunately, only few of all newly diagnosed IC patients worldwide receive efficient and structured SET.^{19, 20} Three different reasons explain the reluctance of universally adopting SET.^{21, 22} First there is patient resistance as SET places a particular burden on patients in terms of effort and responsibility, rather than offering a “quick fix” for their discomfort. A second category of reasons involves the clinicians. Self-interest of doctors performing interventions that involve fee-for-service is undoubtedly a contributor. Moreover, outdated arguments favoring an invasive intervention, instead of prescribing SET, are still prevailing.²³ A third and most important factor hindering a wider implementation of SET is lack of access and reimbursement.²⁴ As a result, even clinicians who fully endorse SET as initial treatment for IC may end up performing invasive interventions if their patients cannot find a qualified SET practitioner. In addition, incipient SET initiatives are prevented from coming to full blossom by a lack of funding.²⁵ This poses a striking contrast to the absence of budgetary restrictions regarding invasive procedures.

In the Netherlands, efforts have been made to change the conflicting reimbursement policy. As from January 1st 2017, SET is fully covered by the basic health insurance.²⁶ This decision is based on a recommendation by the National Health Care Institute stating that SET for IC is effective and a stepped care approach could lead to a € 21.5 million annual savings.²⁷ Healthcare insurers are assumed to reimburse revascularization only in case of SET failure. As a result, invasive treatments are expected to focus only on those patients who are refractory for SET.

Endovascular revascularization

If SET fails to achieve satisfying results, invasive techniques may be considered such as endovascular revascularization (ER; percutaneous transluminal angioplasty (PTA) with or without stenting) or vascular surgery. However, it must be recognized that many patients with IC currently receive primary ER even though no evidence substantiates such an invasive first-line treatment.

A systematic review by Frans *et al.* compared SET with ER in patients with IC to obtain the best estimates of their relative effectiveness.²⁸ Eleven articles reporting data on eight RCTs involving 702 patients with aortoiliac and/or femoropopliteal artery disease met inclusion criteria. Comparing SET with ER did not demonstrate superiority of either treatment.

The CLEVER study examined the relative benefit of SET, ER with stenting and optimal medical care exclusively in patients with aortoiliac PAD, long considered ideal for ER.^{29, 30} At the six-months follow-up, SET provided a superior improvement in treadmill walking performance compared with primary aortoiliac ER (mean change in MWT *versus* baseline 5.8±4.6 *versus* 3.7±4.9 minutes, *P*<0.04).²⁹ Although disease-specific QoL (WIQ and PAQ scores) improved with both SET and ER, the extent of improvement was greater with ER for most scales. The 18-months follow-up results of the CLEVER study demonstrated similar durable improvements in functional status and QoL for both SET and ER.³⁰

Overall, good results of invasive interventions for IC are reported. However, effects on walking capacity and QoL are similar for either SET or invasive revascularization after long-term follow-up. Not unexpectedly, restoration of the peripheral circulation itself does not provide the necessarily behavioral change.³¹ Moreover, the irrevocable risks associated with invasive procedures (*i.e.*, bleeding, infection, thromboembolic events) and substantial costs need to be considered when deciding to perform an intervention. In addition, a further benefit for advocating SET is the positive influence of SET on the entire vascular system and cardiorespiratory performance, potentially reducing long-term cardiovascular morbidity and mortality. Therefore, the most recent guidelines propagate a stepped-care approach, with SET programs available for every patient with IC and invasive procedures restricted to those who are unresponsive to SET.⁴⁻⁶

A stepwise therapy of early ER followed by SET

seems promising as the immediate improvement in claudication symptoms after revascularization is combined with long-term benefits of exercise therapy. However, an important condition to achieve this synergetic effect is to have a well-established standardized and accessible SET program for patients to follow after the endovascular revascularization procedure, which is not the case in most countries. The ERASE trial compared a combination of ER with SET and SET only.³² After one year, functional and QoL outcomes (VascuQoL and SF-36 scores) in both groups improved. However, patients receiving the combination therapy had more rapid and significantly greater improvements in MWD (282 meters, 99% CI: 60 to 505), PFW (408 meters, 99% CI: 195 to 622) and disease-specific QoL. A cost-effectiveness analysis may determine whether the incremental benefit of a combination therapy will also be cost-effective given the substantially higher costs of ER compared with SET.

Home-based exercise therapy

Despite growing evidence on the effectiveness of SET programs for the management of PAD, a large underutilization remains.²⁴ Effectiveness is possibly hampered by low accessibility and poor compliance. A home-based exercise therapy (HBET) program may be a solution as a structured approach to exercise and a monitored environment are combined with the convenience and lower cost of a home-based approach. Successful HBET programs typically include self-monitoring (e.g., the patient keeping a logbook of their walking behavior), goal-setting and identification of barriers to walking as well as solutions (behavior change techniques).^{33, 34} There is evidence that HBET programs can improve walking capacity and QoL in patients, albeit possibly to a lesser extent than SET. Nevertheless, clinicians should consider using structured interventions, the use of exercise logbooks, pedometers and specific walking advice to promote self-managed walking in patients with IC, as opposed to simple “go home and walk” advice, when SET is unavailable or impractical.

Cost-effectiveness of supervised exercise therapy

Several cost-effectiveness analyses in the treatment of IC have been performed. SET was compared with

both WA and ER in RCTs and Markov models. A study by Van Asselt *et al.* assessed the cost-effectiveness of SET versus WA.³⁵ SET was more costly and more effective than WA, for both quality-adjusted life years (QALYs) and walking distance. For cost per QALY, the incremental cost-effectiveness ratio (ICER) was € 28,693, which is considered a reasonable amount to pay for a QALY gained. In a Markov model developed by Bermingham *et al.*, SET was also cost-effective with an ICER of £ 711 to £ 1608 per QALY gained.³⁶

A study by Mazari *et al.* compared costs and utilities of ER, a SET program and combined treatment in patients with IC.³⁷ There was no significant difference between treatments in mean QALYs gained. However, the cost per QALY was € 381,694 higher for ER compared with SET. QALYs were lost when ER alone was used as first-line treatment in comparison with SET or combined treatment. In a Markov model constructed by Van den Houten *et al.*, ER was associated with an additional € 91,600 per QALY gained compared with SET, which exceeds most international willingness-to-pay thresholds.³⁸ Overall, SET is the most cost-effective treatment for IC, and when combined with ER is more cost-effective than ER alone. This research supports implementation of SET programs in clinical practice.

Fokkenrood *et al.* published a budget impact analysis investigating the overall economic consequences once a stepped care model (SCM; primary SET treatment followed by revascularization in case of SET failure) was implemented in the Dutch healthcare system.²⁰ Based on hypothetical scenarios, implementation of a SCM may lead to anywhere between € 24.2 to € 33.0 million yearly savings. SCM savings may even be larger in other European countries as most foreign healthcare systems have low penetration of SET programs and thus a potentially lower threshold for invasive vascular interventions.

The ClaudicationNet concept: a blueprint for the nationwide implementation of SET

To enhance access, continuity and (cost) efficiency of the healthcare system regarding IC treatment, the ClaudicationNet concept was launched in the Netherlands in 2011.³⁹ ClaudicationNet is an integrated care network of PTs, vascular surgeons and general practitioners (GPs). By implementing regional networks, ClaudicationNet

aimed to improve quality and transparency of care for patients with IC. Nationwide coverage was attained at the beginning of 2014. To date, ClaudicationNet includes 1728 fully trained PTs.

The concept of ClaudicationNet is based on methods and results of the EXITPAD trial.¹³ For the implementation period, an administration and monitoring office became available after an initiation grant from the Innovation Fund of the Joint Dutch Healthcare Insurers. As of 2016, structural financial support exists. The Dutch Society for Vascular Surgery, the Royal Dutch Society for Physical Therapy and the Dutch Patient Association for Cardiovascular Diseases endorse ClaudicationNet.

Both referring physicians and PTs benefit from participation in ClaudicationNet. For referring physicians, an infrastructure to find specialized PTs became available. By referring patients only to PTs connected to ClaudicationNet, vascular surgeons, GPs and healthcare insurers are guaranteed transparent and standardized high quality treatment for all patients. For PTs, ClaudicationNet provides a trajectory of specialization in PAD. This trajectory could be complementary to existing PT specializations in the field of chronic diseases or cardiopulmonary rehabilitation programs as well as rehabilitation of cancer patients. Last but not least, IC patients reap the benefits of ClaudicationNet as they are able to receive optimized quality of care and first-line treatment for their disease.

Improving integrated care pathways

The structure of and working method for ClaudicationNet are based on the internationally accepted chronic care model that provides an evidence-based, conceptual framework to improve the functional and clinical outcomes for people with chronic illness.⁴⁰ ClaudicationNet bridges the gap between the various healthcare professionals.

GPs and vascular surgeons are the initial caregivers to diagnose a patient with IC, and thus, have the responsibility to assess associated cardiovascular risk factors and attributing lifestyle factors. ClaudicationNet stimulates GPs and vascular surgeons to refer patients only to a ClaudicationNet PT.

PTs participating in ClaudicationNet perform standardized SET, perform lifestyle interventions (e.g., smoking cessation, dietary advice, weight loss, increasing physi-

cal activity) and regularly assess medication adherence. PTs provide standardized feedback of results, motivation and medication adherence to the referring physician, and maintain outcome and process indicators of all patients. In addition to these tasks, PTs initiate contact with the GP (or vascular surgeon) in case of deterioration of the patient's condition, noncompliance of medication adherence or other (possibly) relevant events.

Patients are centrally placed in the care structure of the ClaudicationNet concept, in which shared decision-making and patient self-management are essential for optimal patient outcomes. In addition to the provided services of the involved healthcare professionals, ClaudicationNet provides supporting patient information through an interactive patient web portal.

Quality and transparency of provided care

A web-based referral system locates and notifies the PT closest to the patient's home.⁴¹ It is not the patient who needs to find a PT, but the PT who contacts a potential participant within three working days and initiates the SET program within five working days. In case a PT does not make contact with the patient within three working days, the next nearby PT is notified automatically.

All PTs can join ClaudicationNet. However, they must meet a set of criteria. Completion of the registered course termed "Intermittent claudication" is obligatory. Moreover, a well-equipped practice and a broad patient orientation are required for recognizing and reporting possible limitations. After these primary criteria are met, a PT enters a specialization program and participates in an online web-based "care-finder" directory. This part of the website is used by patients as well as referring physicians to find a PT based on aspects such as location and personal portfolio data. During this three-year specialization program, PTs must comply with a progressive set of criteria to ensure participation. If these criteria are not met, visibility on the referral system ends, leading to cessation of referrals.

Given their frequent contact with patients, PTs are ideal counselors to initiate a lifestyle intervention. For this reason, all participating ClaudicationNet PTs participate in a certified three-day motivational interviewing course. After meeting all final criteria, PTs must update their knowledge by attending the annual ClaudicationNet

congress once every two years and will participate in lifelong learning activities through relevant education. Progress of individual PTs is monitored, and if necessary, acted upon. ClaudicationNet promotes networking between healthcare professionals by organizing regional network meetings with PTs, GPs and vascular surgeons.

ClaudicationNet improves the transparency of provided care by creating clear and extensive portfolios on the care-finder website. Portfolios are updated with real-time outcome information as a connection is made between the ClaudicationNet database and electronic health records of all participating PTs (in close collaboration with the Royal Dutch Society for Physical Therapy). PTs will be able to effectively monitor the progress of their patients and, possibly even more importantly, monitor their own outcome results by comparison with data of a nationwide benchmark. PTs with outstanding results can easily be identified and showcased. Others with suboptimal results will be stimulated to learn from these colleagues or, if performing structurally inadequate, ultimately be removed from the care-finder directory.

Stimulating self-management enables patients to learn and become more engaged in their own health process. ClaudicationNet is developing an innovative mobile application, the "WalkBuddy" app, with several features to help reinforce self-management and patient empowerment through peer support, gamification, and telecoaching. Ultimately, outcome parameters of this WalkBuddy application will be incorporated into a personal patient portfolio on a personal domain of the portal website.

Conclusions

The central role of SET in the management of IC is undisputed. According to contemporary international guidelines, SET should be offered as initial treatment modality to each patient with IC. Nevertheless, SET is not offered to all IC patients in the world. Several barriers seriously impede implementation of structured SET programs worldwide. In the Netherlands, ClaudicationNet was launched to enhance access, continuity and (cost) efficiency of the healthcare system regarding IC treatment. This care intervention has resulted in optimized quality of care for all patients with IC. The ClaudicationNet concept may serve as a blueprint for the implementation of structured SET programs for IC.

References

1. Hirsch AT, Haskal ZJ, Hertzner NR, Bakal CW, Creager MA, Halperin JL, *et al.* ACC/AHA 2005 Practice Guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease): endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation; National Heart, Lung, and Blood Institute; Society for Vascular Nursing; TransAtlantic Inter-Society Consensus; and Vascular Disease Foundation. *Circulation* 2006;113:e463-e654.
2. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *J Vasc Surg* 2007;45(Suppl S):S5-S67.
3. Fowkes FG, Rudan D, Rudan I, Aboyans V, Denenberg JO, McDermott MM, *et al.* Comparison of global estimates of prevalence and risk factors for peripheral artery disease in 2000 and 2010: a systematic review and analysis. *Lancet* 2013;382:1329-40.
4. Tendera M, Aboyans V, Bartelink ML, Baumgartner I, Clement D, Collet JP, *et al.* ESC Guidelines on the diagnosis and treatment of peripheral artery diseases: Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries: the Task Force on the Diagnosis and Treatment of Peripheral Artery Diseases of the European Society of Cardiology (ESC). *Eur Heart J* 2011;32:2851-906.
5. Layden J, Michaels J, Bermingham S, Higgins B. Diagnosis and management of lower limb peripheral arterial disease: summary of NICE guidance. *BMJ* 2012;345:e4947.
6. Conte MS, Pomposelli FB, Clair DG, Geraghty PJ, McKinsey JF, Mills JL, *et al.* Society for Vascular Surgery practice guidelines for atherosclerotic occlusive disease of the lower extremities: management of asymptomatic disease and claudication. *J Vasc Surg* 2015;61(3 Suppl):2S-41S.
7. Erb W. [About intermittent walking and nerve disturbances due to vascular disease]. *Deutsch Z Nervenheilk* 1898;13:1-76. [Article in German]
8. Larsen OA, Lassen NA. Effect of daily muscular exercise in patients with intermittent claudication. *Lancet* 1966;2:1093-6.
9. Lane R, Ellis B, Watson L, Leng GC. Exercise for intermittent claudication. *Cochrane Database Syst Rev* 2014;7:CD000990.
10. Garg PK, Tian L, Criqui MH, Liu K, Ferrucci L, Guralnik JM, *et al.* Physical activity during daily life and mortality in patients with peripheral arterial disease. *Circulation* 2006;114:242-8.
11. Bartelink ML, Stoffers HE, Biesheuvel CJ, Hoes AW. Walking exercise in patients with intermittent claudication. Experience in routine clinical practice. *Br J Gen Pract* 2004;54:196-200.
12. Fokkenrood HJ, Bendermacher BL, Lauret GJ, Willigendael EM, Prins MH, Teijink JA. Supervised exercise therapy versus non-supervised exercise therapy for intermittent claudication. *Cochrane Database Syst Rev* 2013;8:CD005263.
13. Nicolai SP, Teijink JA, Prins MH. Multicenter randomized clinical trial of supervised exercise therapy with or without feedback versus walking advice for intermittent claudication. *J Vasc Surg* 2010;52:348-55.
14. Kruidenier LM, Nicolai SP, Hendriks EJ, Bollen EC, Prins MH, Teijink JA. Supervised exercise therapy for intermittent claudication in daily practice. *J Vasc Surg* 2009;49:363-370.
15. Fakhry F, van de Luitgaarden KM, Bax L, den Hoed PT, Hunink MG, Rouwet EV, *et al.* Supervised walking therapy in patients with intermittent claudication. *J Vasc Surg* 2012;56:1132-42.
16. Gardner AW, Montgomery PS, Flinn WR, Katzel LI. The effect of exercise intensity on the response to exercise rehabilitation in patients with intermittent claudication. *J Vasc Surg* 2005;42:702-9.

17. Zwierska I, Walker RD, Choksy SA, Male JS, Pockley AG, Saxton JM. Upper- vs lower-limb aerobic exercise rehabilitation in patients with symptomatic peripheral arterial disease: a randomized controlled trial. *J Vasc Surg* 2005;42:1122-30.
18. Lauret GJ, Fakhry F, Fokkenrood HJ, Hunink MG, Teijink JA, Spronk S. Modes of exercise training for intermittent claudication. *Cochrane Database Syst Rev* 2014;7:CD009638.
19. Shalhoub J, Hamish M, Davies AH. Supervised exercise for intermittent claudication - an under-utilised tool. *Ann R Coll Surg Engl* 2009;91:473-6.
20. Fokkenrood HJ, Scheltinga MR, Koelemay MJ, Breek JC, Hasaart F, Vahl AC, *et al*. Significant savings with a stepped care model for treatment of patients with intermittent claudication. *Eur J Vasc Endovasc Surg* 2014;48:423-9.
21. Popplewell MA, Bradbury AW. Why do health systems not fund supervised exercise programmes for intermittent claudication? *Eur J Vasc Endovasc Surg* 2014;48:608-10.
22. Gommans LN, Teijink JA. Attitudes to supervised exercise therapy. *Br J Surg* 2015;102:1153-5.
23. Lauret GJ, van Dalen HC, Hendriks HJ, van Sterkenburg SM, Koelemay MJ, Zeebregts CJ, *et al*. When is supervised exercise therapy considered useful in peripheral arterial occlusive disease? A nationwide survey among vascular surgeons. *Eur J Vasc Endovasc Surg* 2012;43:308-12.
24. Makris GC, Lattimer CR, Lavida A, Geroulakos G. Availability of supervised exercise programs and the role of structured home-based exercise in peripheral arterial disease. *Eur J Vasc Endovasc Surg* 2012;44:569-75.
25. Evans T, Roberts M, Lewis M. Re: 'Why do health systems not fund supervised exercise programmes for intermittent claudication?'. *Eur J Vasc Endovasc Surg* 2015;49:487.
26. Schippers EI. Kamerbrief over Zvw-pakket per 2017. Ministerie van Volksgezondheid, Welzijn en Sport. 20 May 2016.
27. van Eijndhoven M, Hermesen L, de Wit J. Rapport over gesuperviseerde oefentherapie bij claudicatio intermittens. Zorginstituut Nederland. 1 March 2016.
28. Frans FA, Bipat S, Reekers JA, Legemate DA, Koelemay MJ. Systematic review of exercise training or percutaneous transluminal angioplasty for intermittent claudication. *Br J Surg* 2012;99:16-28.
29. Murphy TP, Cutlip DE, Regensteiner JG, Mohler ER, Cohen DJ, Reynolds MR, *et al*. Supervised exercise versus primary stenting for claudication resulting from aortoiliac peripheral artery disease: six-month outcomes from the claudication: exercise *versus* endoluminal revascularization (CLEVER) study. *Circulation* 2012;125:130-9.
30. Murphy TP, Cutlip DE, Regensteiner JG, Mohler ER 3rd, Cohen DJ, Reynolds MR, *et al*. Supervised exercise, stent revascularization, or medical therapy for claudication due to aortoiliac peripheral artery disease: the CLEVER study. *J Am Coll Cardiol* 2015;65:999-1009.
31. Cunningham MA, Swanson V, Pappas E, O'Carroll RE, Holdsworth RJ. Illness beliefs and walking behavior after revascularization for intermittent claudication: a qualitative study. *J Cardiopulm Rehabil Prev* 2014;34:195-201.
32. Fakhry F, Spronk S, van der Laan L, Wever JJ, Teijink JA, Hoffmann WH, *et al*. Endovascular Revascularization and Supervised Exercise for Peripheral Artery Disease and Intermittent Claudication: A Randomized Clinical Trial. *JAMA* 2015;314:1936-44.
33. Al-Jundi W, Madbak K, Beard JD, Nawaz S, Tew GA. Systematic review of home-based exercise programmes for individuals with intermittent claudication. *Eur J Vasc Endovasc Surg* 2013;46:690-706.
34. Li Y, Li Z, Chang G, Wang M, Wu R, Wang S, *et al*. Effect of structured home-based exercise on walking ability in patients with peripheral arterial disease: a meta-analysis. *Ann Vasc Surg* 2015;29:597-606.
35. van Asselt AD, Nicolai SP, Joore MA, Prins MH, Teijink JA. Cost-effectiveness of exercise therapy in patients with intermittent claudication: supervised exercise therapy versus a 'go home and walk' advice. *Eur J Vasc Endovasc Surg* 2011;41:97-103.
36. Bermingham SL, Sparrow K, Mullis R, Fox M, Shearman C, Bradbury A, *et al*. The cost-effectiveness of supervised exercise for the treatment of intermittent claudication. *Eur J Vasc Endovasc Surg* 2013;46:707-14.
37. Mazari FA, Khan JA, Carradice D, Samuel N, Gohil R, McCollum PT, *et al*. Economic analysis of a randomized trial of percutaneous angioplasty, supervised exercise or combined treatment for intermittent claudication due to femoropopliteal arterial disease. *Br J Surg* 2013;100:1172-9.
38. van den Houten MM, Lauret GJ, Fakhry F, Fokkenrood HJ, van Asselt AD, Hunink MG, *et al*. Cost-effectiveness of supervised exercise therapy compared with endovascular revascularization for intermittent claudication. *Br J Surg* 2016;103:1616-25.
39. Lauret GJ, Gijsbers HJ, Hendriks EJ, Bartelink ML, de Bie RA, Teijink JA. The ClaudicationNet concept: design of a national integrated care network providing active and healthy aging for patients with intermittent claudication. *Vasc Health Risk Manag* 2012;8:495-503.
40. Epping-Jordan JE, Pruitt SD, Bengoa R, Wagner EH. Improving the quality of health care for chronic conditions. *Qual Saf Health Care* 2004;13:299-305.
41. Fokkenrood HJ, Lauret GJ, Scheltinga MR, Spreuvenberg C, de Bie RA, Teijink JA. Multidisciplinary treatment for peripheral arterial occlusive disease and the role of eHealth and mHealth. *J Multidiscip Healthc* 2012;5:257-63.

Conflicts of interest.—Joep A. W. Teijink is co-founder and chairman of ClaudicatioNet, a charitable foundation with no financial benefits for its founders or board members. David Hageman, Marijn M. L. van den Houten and Lindy N. M. Gommans are (former) PhD students for ClaudicatioNet. Steffie Spruijt is national coordinator of ClaudicatioNet. ClaudicatioNet is a nationwide network of specialized physical therapists providing standardized supervised exercise therapy in the Netherlands (e-mail: info@claudicationet.nl).

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript. Article first published online: December 19, 2016.