Clinical practice guidelines for physical therapy in patients with intermittent claudication

M.W.A. Jongert[I], H.J.M. Hendriks[II], J. van Hoek[III], K. Klaasboer-Kogelman[IV], G.G. Robeer[V], B. Simens[VI], S. van der Voort[VII], B. Smit[VIII]

Introduction

These clinical guidelines describe the diagnostic and therapeutic processes involved in providing physical therapy for patients with intermittent claudication. The guidelines as such are a summary of the information presented in the second part of this document, entitled "Review of the evidence", in which the choices made in arriving at the guidelines are described in detail. The guidelines and the review of the evidence can be read separately.

These 'KNGF-guidelines Intermittent Claudication' are developed on initiative of the Dutch Heart Foundation en the Dutch Institute of Allied Health Care. The Dutch Heart Foundation has subsidized the development of the guidelines.

Intermittent claudication is a typical complaint of peripheral arterial disease. Based on the available study results in June 2002, it is not yet possible to establish a generally accepted exercise program with respect to form, content, intensity and duration.

Objectives of the guidelines

The objectives of the guidelines are:

1. to offer the individual physical therapist tools to enable him* to give effective care to patients diagnosed with 'intermittent claudication' based on peripheral arterial disease;
2. to make explicit the knowledge on the effectiveness, the efficiency and the bottlenecks of physical therapy care;
3. to enhance an unequivocal approach in daily practice;
4. to change the care in the desired direction based on current scientific research;
5. to assure insight in and define the tasks and responsibilities of the professional group, and to stimulate cooperation between the disciplines.

Target group

The guidelines are primarily intended for physical therapists in intra- and extramural health care who treat patients with intermittent claudication based on peripheral arterial disease. The therapeutic principles described in the guidelines can also be used in groups.

Specific expertise and skills of the treating physical therapist

It is recommended that the treating physical therapist has followed the course 'Peripheral vascular disease

I *Tinus Jongert, exercise physiologist, TNO PG, Movement and Health, Leiden, The Netherlands; previously employed at NEOMED, The Hague, The Netherlands.*

II *Erik Hendriks, physical therapist/epidemiologist, program manager "Guidelines Development & Implementation, Department of Research and Development, Dutch Institute of Allied Health Care, Amersfoort, The Netherlands; Department of Epidemiology, Maastricht University, Maastricht, The Netherlands.*

III *Jeanette van Hoek, physical therapist, Jeroen Bosch Hospital, location Carolus, 's Hertogenbosch, The Netherlands.*

IV *Karin Klaasboer-Kogelman, physical therapist, head of the Department Physical Therapy of the Deventer Hospital, Deventer, The Netherlands.*

V *Bertus Robeer, occupational physician, Arbonet, The Netherlands.*

VI *Bert Simens, physical therapist, coordinator/teacher (SAXION) Hogeschool Enschede, Institute for allied health studies, Enschede, The Netherlands.*

VII *Simon van der Voort, physical therapist, coordinating head of the Department Physical Therapy of the Hilversum Hospital, location Zonnestraal, Hilversum, The Netherlands.*

VIII *Bart Smit, physical therapist, head of the Department Physical Therapy of the St Lucas Andreas Hospital, Amsterdam, The Netherlands.*

* *To stimulate readability the indication 'he/she', 'his/her' etc. is avoided in the guidlines. Where this is applicable both sexes are meant by 'he' and 'his'.*

and training' (or a comparable course) to be able to give the patients with intermittent claudication optimal physical therapy care.
The treating physical therapist has to be able to apply the therapeutic principles, as described in the guidelines, in groups.

Advise regarding the physical therapy practice and equipment
In order to be able to provide optimal physical therapy care to patients with intermittent claudication, it is recommended that the physical therapist can use an electrical graded treadmill, and a rpm (revolutions per minute)-independent electromagnetic bicycle-ergometer.
An exercise room is recommended when instructions are given in groups. A video camera and recorder (with the possibility of freeze frames) might be a good supplement for the diagnosis, especially for the gait analysis.

Epidemiological data
The available data show that the prevalence of peripheral arterial disease is 19.1 percent. The prevalence of intermittent claudication is substan-tially lower, namely 1.6-2.0 percent. These data relate to the general population.
The incidence of intermittent claudication increases with the age (up to 75 years of age). In The Netherlands it amounts to 2.8 new cases per 1000 patients (in the primary care practice) per year (2.7 per mille in men, 3.0 per mille in women). This increases from 0.4 per mille in patients of 25-44 of age to 10.6 per mille in patients older than 75 years.

Health problem
As a symptom of intermittent claudication pain or an unpleasant feeling in the legs (cramp, a burning or oppressive sensation, tiredness) can occur, often one-sided. Complaints occur after walking a certain distance, while walking fast, or when a patient walks up a hill, and the complaints disappear again by rest. An insufficient arterial blood flow to the working muscles, during walking, is the cause of the complaints. The localization of the arterial obstruction determines in which muscle the arterial blood flow is insufficient. The severity of the complaints is often being indicated by the four-points scale of Fontaine (see A.10).

Natural course
The life expectancy of patients with intermittent claudication is on average ten years less than that of healthy persons. The risk of dying is around 2-3 times higher than for people of the same age without symptoms of intermittent claudication. In time 75 percent of the patients with intermittent claudication experiences a stabilization or improvement of the complaints. In 25 percent of the patients known to have intermittent claudication the complaints get worse within five years. Eventually, circa 2-5 percent of the patients will undergo an amputation.

Prognostic factors
Intermittent claudication is a complaint of peripheral arterial disease, mostly as a result of atherosclerosis. In the presence of risk factors atherosclerosis will become sooner clinically manifest sooner and will have an accelerated course. The risk factors for vascular disease which can be influenced (which can influence the prognosis) are: smoking, diabetes mellitus, hypertension, hyperlipidemia, physical inactivity, and obesity. Risk factors which cannot be influenced are gender and age. Several risk factors intensify the influence of one another.

Coping with the complaints
Patients with an active lifestyle and those, who preserve an active lifestyle despite the complaints of intermittent claudication and are able to walk 'through the pain', are coping with their complaints in an adequate way.
Patients who, on the other hand, reduce their activities due to the complaints and avoid walking or stop walking as soon as the pain occurs, are coping inadequately with their complaints. Rest will (on the long term) not reduce but worsen the complaints.

Referral
These guidelines assume a referral of patients with the medical diagnosis 'intermittent claudication' by a primary care physician or by a medical specialist. Patients who are referred by a vascular surgeon, after a surgical intervention, are often diagnosed as patients with peripheral arterial disease. Since, by surgery, the arterial obstruction has been removed, one no longer speaks of intermittent claudication.
The treatment of patients with intermittent claudication is focused on the decrease of complaints, the

increase of the (pain free) walking distance, as well as on the decrease of the risk factors for atherosclerosis. The referring physician determines whether there is a risk-bearing behavior that can be influenced.
Apart from personal data (among others daily activities), additional referral data include, if necessary, information on previous and current treatment interventions (such as an operation, Percutaneous Transluminal Angioplasty (PTA)), medications taken, blood pressure, presence of co-morbidity, diagnostic information (location/ extent of the vascular problems; ankle-arm index; walking distances/ results treadmill test; results blood examination: peripheral oxygen saturation, scale according to the classification of Fontaine).
Data on the cardiac risk level, cardiac exercise tolerance and the contra-indications (for carrying out a treadmill test or walking exercise) are required referral data for the physical therapist.

I Diagnostic process

I.I Objectives

The objective of the diagnostic process of the physical therapist is to document the severity and nature of the health problem of the patient and the extent to which it can be influenced. The starting point is the patient's needs (including the most important complaints). The physical therapist assesses the impairments, disabilities and participation problems of most immediate concern to the patient, the prognosis and, the patient's needs for information.

Based on the diagnostic process, that will take place after referral by the treating physician, the question if physical therapy is indicated will be answered. This will be done in the view of the following six screening questions:

1 Has exertion capacity been reduced objectively?
2 Has exertion capacity been reduced subjectively?
3 Is there an abnormal gait pattern?
4 Is the patient physical inactive?
5 Are there problems with specific activities?
6 Is there a need for information/advise?

I.II History-taking

By history-taking, the physical therapist tries to identify:

- the patient's needs: the most important complaints and expectations of the patient (including goals with respect to activities and participation).
- the health problem with respect to nature, course and prognosis:
  - kind and severity (impairments/disabilities/ participation problems);
  - nature and location of the complaints: the pain free and maximum walking distance; walking pace;
  - walking on a hillside; disappearance of complaints by at rest; decrease in mobility; pain at rest; nightly pain, 'restless legs'; color/temperature of the foot; wounds on the foot;
  - onset and course of complaints;
  - prognostic and risk factors:
    - smoking, diabetes mellitus, hypertension, hyperlipidemia, elevated homocysteine levels, age, gender, obesity, physical inactivity, family history;
    - patient's motivation, believe in (keep on) exercising;
    - co-morbidity: among others coronary heart disease, mobility-limiting disorders such as osteoarthritis, rheumatoid arthritis, COPD;
  - coping strategy: the significance the patient attaches to his complaints and the patient's degree of control over his complaints;
  - psychosocial factors;
  - previous diagnostic procedures;
  - previous treatment interventions.
- Assessment of the current complaints:
  - impairments/disabilities/participation problems: severity and nature (including quality of life);
  - present general health status (functioning, and levels of activity and participation);
  - personal factors;
  - current treatment: medication and other medical or paramedical treatments;
  - the patient's needs for information.

I.III Recommended measuring instruments

It is important to determine, through history-taking, the precise health problem of the patient, the patient's needs and the severity of his complaints. To record the pain complaints and the extent of activity limitation it is recommended to use the questionnaire Patient Specific Complaints. The Patient Specific

Complaints is a measuring instrument to determine the functional status of the individual patient. The patient himself selects his three most important complaints regarding his physical activities. Important complaints are the ones that are caused by activities which the patient finds hard to do, which the patient carries out regularly, and which the patient would like to carry out better. The patient has to indicate on a Visual Analogue Scale (VAS) how hard it is to carry out certain activities (see appendix 1).
The questionnaire Patient Specific Complaints gives an impression of the patient's needs and the severity of the complaints. The patient's needs for information is mapped based on the questionnaire (see appendix 1). It is recommended to make a personal information plan for the patient.

I.IV Assessment
The assessment comprises:
- inspection;
- palpation;
- functional assessment.

Inspection
The inspection involves observing the patient in standing position, with most attention being given to the position of the back, pelvis, hips, knees and feet, and observing the patient's skin (color, trophic impairments, wounds, color under the nails, hyperkeratosis of the nails)

Palpation
The physical therapist palpates the skin, assesses temperature differences left-right, the presence of (pitting) edema and (if necessary) peripheral pulsations of arteries a. femoralis, a. poplitia, a. tibialis posterior and a. dorsalis pedis in rest, and he assesses the muscle tonus of the muscles of the upper leg and calves. Palpation of the peripheral pulsations and auscultation of the arteries mentioned can also be carried out after exertion (for example 1 or 2 minutes flexion/extension of the foot, the lift-hang test according to Ratschow-Bürger).

Functional assessment
The functional assessment includes a number of items. With the results of the functional assessment, together with the data gained during history-taking, inspection and palpation, the previously described screening questions can be answered. In order to make the patient familiar with the testing procedure, the protocol and the realization of the test, it is recommended to carry out first one familiarization test before the treadmill test actually takes place (see B4).
The three items of the functional assessment are:
1 the physical exertion test, mostly the treadmill test;
2 the gait analysis;
3 other functional assessments.

1 Treadmill test
The treadmill test is an aid to determine if there is an abnormal limitation of physical exertion. The limitation of the exertion can be objectively as well as subjectively.

The treadmill test as a screening instrument to determine the exercise limitation objectively.
During the treadmill test the pain free walking time or walking distance (the time/distance after the onset of the pain) and the maximum walking time or walking distance (the time/distance after which a patient has to stop due to pain) are measured. The result of the measurement gives an indication about the severity of the disorder.
The physical therapist is during the testing on the alert for possible complications, such as cardiac overload and leg pain without vascular cause. On indication the tension is measured during the treadmill test.
During the treadmill test and during exercises the American College of Sports Medicine (ACSM) scale for pain (4-points scale) by peripheral vascular disease can be used.

The treadmill test as a screening instrument to determine the exercise limitation subjectively.
The treadmill test is also used to determine how the patient copes with his complaints, if there is a subjective limitation of the exercise capacity based on inadequate pain behavior or based on fear (to move). With inadequate pain behavior the patient is afraid for (the harmful consequences of) the pain. Besides inadequate pain behavior there can also be fear of physical exercise. This fear can be paralyzing for the performance ability.
While measuring the maximum walking distance

a direct relation will obviously be made with the patient's needs: which impairments, disabilities and possibly participation problems are important to the patient.

2 Gait analysis
In patients with intermittent claudication specific changes in the gait can be observed during walking at the moment that the (pain) complaints occur. These changes are compensating mechanisms occurring in order to avoid or reduce the complaints. In term these compensating mechanisms may hamper the patient during walking.
A gait analysis must be carried out to assess whether the gait is abnormal in such a way that in the treatment special attention has to be paid to an improvement of the coordination. The physical therapist evaluates the quality of the patient's gait. Preferably with the help of video-frames and the 'gait-analysis-list Nijmegen'.

3 Other functional assessments
The physical therapist also evaluates other activities, such as: standing on one leg and climbing stairs. The physical therapist assesses which impairments might be causing the disabilities: mobility and stability of the joints, muscle tonus, muscle strength and muscle length of the affected leg and the not-affected leg. The extensiveness of the functional assessment depends on the severity of the health problem.

I.V Analysis
The decision whether 'physical therapy' is indicated will be made based on the interpretation of the data gained from the referral, history-taking and the assessment. For the analysis the following questions need to be answered:

- Which impairments, disabilities and possibly participation problems are most important to the patient? For example: severity of the pain complaints, mobility limitations; limitations in ADL, work, sports; participation in household, work, sports, hobby's; reduced quality of life; inadequate pain behavior.
- Is there an objective decrease of the (pain free and maximum) walking distance?
- Is there inadequate pain behavior?
- Is there fear of physical exertion?
- Is there an abnormal gait?
- Has the patient problems with specific activities, such as standing on one leg and climbing stairs?
- Is the patient physical inactive?
- What is the patient's needs for information/advise?
- Are there other disorders with higher priority than intermittent claudication because they limit the patient more than the arterial obstruction does?
- What is the prognosis (in terms of timescale, course of patient's complaints e.g. impairments, disabilities, participation problems and the in influence of promoting and hampering factors)?
- Can the current problem areas be influenced by physical therapy? If so, to what extent?
- Is the patient motivated to participate in physical therapy?

I.VI Conclusion
Physical therapy is indicated if one or more of the screening questions above can be answered with a 'yes' and the physical therapist thinks that the problem areas can be influenced by physical therapy.
When a patient can for certain reasons not be treated in accordance with the clinical guidelines, this should be reasoned.

If there is no indication for physical therapy, the physical therapist should contact the referring physician for consultation and advice. If necessary, the patient could be referred (back) to a medical specialist.

I.VII Treatment plan
After answering the questions during the analysis, a treatment plan should be formulated in consultation with the patient (see flow chart). The treatment plan includes the physical therapeutic treatment goals and the priority of these treatment goals. If the patient is currently receiving treatment from a practitioner of another discipline, then both treatments will have to be adjusted to one another.
The starting points for planning information provision are the patient's needs for information, advice and coaching, which would have become apparent during the diagnostic process.

II Therapy
The central goal of physical therapy is to decrease the

complaints, impairments, disabilities and participation problems. Apart from that the decrease of risk factors for atherosclerosis is an important focal point in the treatment of patients with intermittent claudication.

The physical therapy treatment of patients with intermittent claudication has no definite duration. If, based on the analysis, the formulated treatment goals are achieved, or it is assumed that the patient is able to achieve the goals by himself, without physical therapy treatment, the treatment will end. This paragraph describes which interventions and aids can be used to achieve the treatment goals.

II.I Providing information and advise

An essential part of physical therapy treatment is providing information and advise. It forms the basis for the motivation and cooperation of the patient and for achieving a behavioral change. Therefore, proving information and advise is formulated as a separate treatment goal.

Behavioral change

Behavioral change plays an important role in the treatment of patients with intermittent claudication, especially to reduce the risk factors for cardiovascular diseases. Besides that, the behavioral change is necessary to reduce the limitations of the physical exercise capacity and improve the gait.

Physical activating program

The patient receives an activating program from the physical therapist. This is an exercise program which the patient has to perform in addition to the physical therapist treatment. In time the frequency of the physical therapy treatments will decrease while the exercise activities performed by the patient himself will increase in frequency and magnitude.
An example of a such a program is described in appendix 2.

II.II Treatment goals

Depending on the findings during the diagnostic process the physical therapy treatment of patients with intermittent claudication can focus on one or more of the following treatment goals:

1 to decrease the objective exercise limitation:
   a increase the maximum (pain free) walking distance;
   b increase the maximum aerobic capacity;
2 to decrease the subjective exercise limitation:
   a increase the pain tolerance;
   b overcome the fear of physical exertion;
3 to improve the gait;
4 to decrease the physical inactivity;
5 to improve specific activities, such as standing on one leg or climbing stairs;
6 to provide information/advise.

1 Decrease the objective exercise limitation

An objective reduction of the physical exercise capacity in patients with intermittent claudication is caused by local disorders as result of an arterial obstruction. Apart from that the inactivity will in time also result in a decreased maximum aerobic capacity (maximum oxygen uptake). Increasing the maximum aerobic capacity can be a treatment goal for patients with intermittent claudication. Patients which have had a vascular surgical operation will often have to exercise in order to increase their maximum aerobic capacity with respect to duration. Therefore, the guidelines pay attention to this subject.

a Increase the maximum (pain free) walking distance

The mean objective of exercise therapy for patients with intermittent claudication is increasing the pain free walking distance. Walking exercise appears to be an effective means to increase the (pain free) walking distance in patients with moderate to severe intermittent claudication. Walking exercise is also safe and inexpensive.
The best results are seen when the walking exercise (often on a treadmill) is performed at least three times a week for at least 3-6 months, while the walking exercise is being supervised.
See table 1 for an example of an exercise program to increase the maximum (pain free) walking distance in patients with intermittent claudication.

The physical therapist might decide that the patient performs the warming-up and cooling-down partially on a bicycle-ergometer. Besides this program the patient performs the activating program (see appendix 2).

b Increase the maximum aerobic capacity

The maximum aerobic capacity is important for

Table 1. Example of an exercise program to increase the maximum (pain free) walking distance in patients with intermittent claudication.

Exercise frequency:	3 times a week;
Exercise length:	20-40 minutes per exercise session;
Exercise intensity:	40-70% VO2max or 40-70% of the heartbeat reserve or Borg-scale 11-15;
Exercise mode:	intermittent training exercises, in which is walked until a score of 2-3 on the ACSM-scale for pain;
Exercise density:	exercise intervals of at least 3-4 minutes, (almost) complete recovery during the rest period;
Exercise type:	walking exercise, graded if possible (if patient can keep it up);
Exercise progression:	start with low intensity (40% VO2max, until score 2 on the ACSM-scale for pain, until the patient has achieved a minimum exercise length of at least 20 minutes (5 intervals of 4 minutes); then increase the exercise length to 30 minutes (for example 6 intervals of 5 minutes); and only then increase the intensity whereby the patient reaches pain-score 3.

intensive activities that last longer than 2-3 minutes. To increase the maximum aerobic capacity the patient has to exercise at least 2-3 times a week for at least 20-30 minutes with an intensity of at least 50-60 per cent of the maximum aerobic capacity (VO_2max). When the data on maximum oxygen uptake are lacking, one might also take 50-60 per cent of the reserve heart rate, 60-70 per cent of the maximum heart rate or the RPE-score of 12-13 on the Borg scale instead of the 50-60 per cent of the VO_2max. This may also take place in intervals with exercise intervals of at least 3-4 minutes.
See table 2 for an example of an exercise program to increase the maximum aerobic capacity in patients with intermittent claudication.

2 Decrease the subjective exercise limitation
It is advised to pay attention to the psychological condition of the patient. Being actively involved in the treatment and meeting other patients with intermittent claudication can already have a positive effect on the patient's coping behavior. Within this treatment goal two subgroups can be distinguished, with clear difference in treatment.

a Increase the pain tolerance
Not every patient copes in the same way with his complaints. In some patients the pain will lead to a decrease in activities. During treatment the physical therapist will learn the patient not to stop at the onset of pain. Learn the patient every time to walk a

Table 2. Example of an exercise program to increase the maximum aerobic capacity in patients with intermittent claudication.

Exercise frequency:	3 times a week;
Exercise length:	20-30 minutes per exercise session;
Exercise intensity:	50-70% VO_2max or 50-70% of the heartbeat reserve or Borg-scale 12-15;
Exercise mode:	continuous training exercises with and without intervals;
Exercise density:	exercise intervals of at least 3-4 minutes, none (in case of endurance exercise training) or recovery intervals of 3-4 minutes.
Exercise type:	dynamic contractions, large groups of muscles, such as walking, cycling, spinning, rowing, stepping, sports and play activities;
Exercise progression:	start at 40-50% VO_2max, increase length of exercise to 20-30 minutes; then increase the intensity to 60-70% VO_2max if it can be tolerated by the patient.

Table 3. Example of an exercise program to increase the pain tolerance in patients with intermittent claudication.

Exercise frequency:	3 times a week;
Exercise length:	20-40 minutes per exercise session;
Exercise intensity:	40-70% VO2max or 40-70% of the heartbeat reserve or Borg-scale 11-15;
Exercise mode:	intermittent training exercises, in which is walked until a score of 2-3 on the ACSM-scale for pain;
Exercise density:	exercise intervals of at least 3-4 minutes, (almost) complete recovery during the rest period;
Exercise type:	walking exercise, graded if possible (if patient can keep it up);
Exercise progression:	walk a bit further 'through the pain'.

bit further 'through the pain'. The pain will hereby be scored on the ACSM-scale for pain (see B4). With this kind of training the physical therapist has to be on the alert for signs of overload.
See table 3 for an example of an exercise program to increase the pain tolerance in patients with intermittent claudication.
Behavior-orientated rehabilitation principles (for example conform cardiac rehabilitation) can be applied in the treatment of patients who are dealing inadequately with their complaints. In this approach, the focus is on the situations in which the behavior occurs, not on the under-lying pathology (impairment).

b Overcome the fear of physical exertion
In order to overcome the fear of physical exertion the physical therapist can use the methods also used in cardiac rehabilitation. The patients learns what the normal symptoms are during physical exertion and how to recognize them. It is recommended that the patient learns to assess the perceived exertion with the Borg scale. The patient also learns to recognize the signs of (cardiac) overload.

3 Improve the gait pattern
Specific changes in the gait pattern can be observed in patients with intermittent claudication when the pain complaints occur. When patients have complaints for a longer period of time, the changes in the gait pattern will not disappear just like that. Even after vascular surgery or PTA the changed gait can remain. Walking exercise focused on improvement of coordination can contribute to a more efficient gait. Exercises to strengthen the leg muscles can contribute to an increase of the walking pace.

4 Decrease physical inactivity
With respect to reducing the risk factors for cardiovascular diseases the physical therapist focuses specifically on a decrease of the physical inactivity. The objective hereby is that patient meets the Dutch Standard of Healthy Moving (Exercise Guidelines).[1] Physical activities have to be moderately intensive and have to be kept up continuously for a relatively longer period of time. This involves dynamic contractions with a relatively large active muscle mass. The exercise intensity has to be at 40-60 per cent of the VO_2max, or 40-60 of the reserve heart rate, or 50-70 per cent of the maximum heart rate, or Borg score

Table 4. Example of an exercise program to decrease the risk of cardiovascular diseases.

Exercise frequency:	5-7 times a week;
Exercise length:	30-60 minutes per exercise session;
Exercise intensity:	40-50% VO_2max or 40-50% of the heartbeat reserve or Borg-scale 11-12;
Exercise mode:	continuous training exercise;
Exercise type:	dynamic contractions, large groups of muscles, such as walking, cycling, spinning, rowing, stepping;
Exercise progression:	start at 40% VO_2max and in time increase the VO_2max to maximally 50-55%.

11-12. The exercise length is at least 30-60 minutes. The exercise frequency is 5-7 times a week. See table 4 for an example of an exercise program to decrease the risk of cardiovascular diseases.

5 Improve specific activities

The history-taking and the functional assessment might demonstrate that the patient experiences problems while performing specific activities, such as standing on one leg or climbing stairs. These activities are exercised in a functional manner.

6 Provide information and advise

Physical therapy treatment includes providing the patient information and advice, and support.
Giving information and improving the compliance are important items in the treatment of patients with intermittent claudication.
Educating the patient forms the basis for the desired behavioral adjustments. This is a process, with a behavioral change as final result. This final result can not be achieved without making the preceding adjustments (steps). The patient's need for advice, which becomes apparent during diagnosis, forms the basis for the patient's individual information/advise plan. In providing information and advise current information material such as brochures and video material might be used.

II.III (Final) evaluation

In addition to carrying out 'continuous' evaluation during treatment, thorough evaluation should take place after four weeks. This will be done based on the specified goals (in terms of improvement of the impairments, disabilities and participation problems) and the level of activities of the patient. Evaluation of the treatment goals takes place by means of history-taking and measurements in the functional assessment. Appendix 3 describes, for each sub-goal, evaluation instruments and desired final results.
Central in the evaluation is the measuring of the effect of the treatment on the patient's quality of life. Based on the questionnaire Patient Specific Complaints the (improvement) of the functional status of the patient is determined in order to check whether the most important complaints of the patient with respect to physical activities are improved.
If indicated the evaluation can take place earlier. The duration and frequency of the treatment of patients with intermittent claudication are flexible. The treatment will end when the patient has achieved the specified goals, or when the patient has partially achieved the specified goals and the patient is expected to be able to achieve the treatment goals on his own.
Based on the evaluation, the treatment plan will be modified, if necessary. When complications occur during treatment the patient will (possibly) be sent back to the referring physician.
If the patient's condition did not improve the physical therapist assesses whether an improvement is expected in the period to come.
When the patient has not achieved the specified goals but is thought to have reached his maximum capacity, the treatment will also be ended and the patient will be sent back to the referring physician.
The final evaluation takes place after 12 weeks. During this evaluation the results of functional assessments such as the treadmill test (pain free and maximum walking distances), gait analysis, risk factors for cardiovascular diseases, and psychological factors can be assessed. Appendix 3 might support the decision-making process during the final evaluation.

II.IV Aiming for independence of the patient

An important aspect in the treatment (to maintain the result) is stimulating the patient to develop an active lifestyle.
During the twelve weeks of physical therapy treatment, the patient and the physical therapist aim at a decrease of patient's dependence. Therefore the physical therapy treatments may gradually take place less frequently while the physical activities performed by the patient himself increase in magnitude. Finally, the patient has to be able (and dare) to perform the physical activities independently, that is without physical therapeutic support, in a responsible way.
There is no scientific basis for the extent of physical therapeutic support. The extent to which treatment is required depends on the individually specified treatment goals and the personal situation of the patient. The treatment will be ended when the specified goals are achieved, or when the patient is able to achieve the treatment goals on his own, or when no progression can be expected. See the treatment scheme in table 5 for an indication.

Table 5. Example of a treatment scheme.

Phase	Frequency of treatment	Duration of phase	Number of treatments
	Phase of starting	3 times a week	1 week 3
Phase of exercising	2 times a week	4 weeks	8
Phase of exercising on one's own	once a week	5 weeks	5
Phase of maintenance phase	once per 2 tweeks	2 weeks	1
Phase of aftercare	once per month	6 months	6

II.V Final evaluation, conclusion and reporting

At the end of the treatment episode, and (if necessary) during treatment, the referring physician will be informed about the treatment. Information will be given on the treatment goals, the treatment results, and the provided advises (see KNGF-guidelines entitled 'Communicating with and reporting back to primary care physicians'[2]).

For reporting see the KNGF-guidelines entitled 'Physical therapy documentation and reporting'.[3]

To ensure good communication and information exchange between physicians and physical therapist, the following five items can be helpful: Indication setting, Consultation, Referral, Contact during treatment, and Reporting.[4]

II.VI Aftercare

At the end of the treatment, the physical therapist should encourage the patient to stay active and continue the healthy lifestyle. Exercising plays an important part in this. In the long term, it is easier for patients to continue exercising if it is in a form that the patient enjoys and is carried out in a group setting. Therefore, the physical therapist informs the patient about the possible exercise activities (e.g. Sporty Walking, Corefit, Heart-in-Movement).

III Literature

1 Coumans B, Leurs MTW. Richtlijn Gezond Bewegen. Geneeskunde en Sport 2001:34;4:142-6.
2 Verhoeven ALJ, Heuvel CMF van den.KNGF-richtlijn Informatieverstrekking Huisarts. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 1997.
3 Heerkens YF, Lakerveld-Heyl K, Verhoeven ALJ, Hendriks HJM. KNGF-richtlijn Fysiotherapeutische Verslaglegging. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 2003.
4 Heuvel CMF van den, Vogels EMHM, Wams HWA. Verslag van het HOF-project: Handreikingen voor huisartsen, oefentherapeuten Cesar, oefentherapeuten-Mensendieck, fysiotherapeuten. Amersfoort: Nederlands Paramedisch Instituut; 1999.

Review of the evidence

in the KNGF-clinical practice guidelines 'intermittent claudication' is explained in detail and based on scientific information. This section also includes additional information.

A.1 Definition of the KNGF-guidelines

KNGF-guidelines are defined as 'a systematic development form a central formulated guide which has been developed by professionals focusing upon the context of the methodic physical therapy treatment according to certain health problems and aspects which have to do with the (organization) of the profession'.[1]
The KNGF-guidelines describe the physical therapeutic diagnostic process and therapy of patients with intermittent claudication and is evidence-based as much as possible.

A.2 Objectives of the KNGF-guidelines

The general objectives of the KNGF-guidelines can be considered on two levels: firstly on the level of the individual professional and secondly on the level of the professional group physical therapy. Guidelines are primarily meant for internal use. The professional organization, the Royal Dutch Society for Physical Therapy, has chosen to use the guidelines as an instrument for quality-control and quality improvement.

The objectives of the KNGF-guidelines on the level of the individual professional are:

- to support the physical therapist's decision-making process;
- to create a reference point for orientation and education;
- to provide criteria for self-evaluation and peer review;
- to initiate (if necessary) changes of the procedure of physical therapy care into the desired direction.

The objectives of the KNGF-guidelines on the level of the professional group physical therapy are:

- to make the care explicit based on the results of scientific research and consensus reached between the experts.
- to diminish the differences in procedure and to improve the quality and uniformity of care.
- adapt the care provided based on current scientific research;
- provide insight into, and to define, the tasks and responsibilities of the professional organizations, and to stimulate cooperation with other professions.

The recommendations in these guidelines are neither obligations, nor meant as a straitjacket. If this is augmented it is possible to deviate from the guidelines. The individual physical therapist is responsible for the physical therapy interventions.[2] Guidelines have a dynamic character and need to be adapted in time.

A.3 Procedure for developing these guidelines

The guidelines were developed in accordance with the concept as described in the document for guidelines development of the KNGF.[1] The structure of the guidelines intermittent claudication is in accordance with the methodological physical therapy interventions such as recommended by the KNGF.[1,2]

A.3.1 Literature

The literature is collected via computer-aided searches in MEDLINE, Cochrane and DocOnline of the Dutch Institute of Allied Health Care over the period 1990-2002. The keywords used in the search were 'intermittent claudication', 'peripheral vascular disease', 'arterial occlusive disease', and 'walking', 'physical education', 'training', 'gymnastics', 'exercises', exercise therapy', and 'running'.
Additionally literature is collected via experts and secondary references in publications. Randomized clinical trials with a control group (RCT's), meta-analyses, and systematic reviews were especially searched for. The guidelines are as much as possible based on the conclusions found in the literature, preferably RCT's. Starting point in the development of the guidelines were the meta-analyses of Brandsma and Robeer.[3,4] To assess the methodological quality of the RCT's the list, as proposed by Chalmers and Bouter, was used.[3] An update was made by the same authors in 2001. Based on the results available in June 2002, it is not yet possible to establish a generally accepted exercise program which is, with respect to form, content, intensity and duration, fully based on qualitatively well performed studies (randomized clinical tri-

als). Therefore, some of the recommendations in the guidelines are based on the consensus reached within the working group.

A.3.2 The working group

In December 2000 a working group of professionals was formed to develop these guidelines. In forming the working group, an attempt was made to achieve a balance between professionals with experience in the area of concern and those with an academic background. All members of the working group stated that they had no conflicts of interest in participating in the development of these guidelines.

Three members of the working group individually selected and graded the documentation that was under consideration as scientific evidence. Thereafter, a final summary of the scientific evidence, which included details of the amount of evidence available, was made. In addition to scientific evidence, other important factors were taken into account in making recommendations, such as: the achievement of a general consensus, cost-effectiveness, the availability of resources, the availability of the necessary expertise and educational facilities, organizational matters, and the desire for consistency with other mono-disciplinary and multidisciplinary guidelines.

Once the draft mono-disciplinary guidelines were completed, they were sent to a secondary working group comprising external professionals or members of relevant professional organizations, or both, so that a general consensus with other professional groups or organizations, and with any other existing mono-disciplinary or multidisciplinary guidelines could be achieved. In addition, the wishes and preferences of the patients' association were taken into account. These guidelines are consistent with the standard recommendations of the Dutch College of General Practitioners (NHG Standard 'Peripheral Vascular Diseases')[5] and the consensus document of the (Dutch) Collaborating Center for Quality Assurance in Healthcare (CBO) entitled 'Consensus arterial intermittent claudication'.[6]

A.3.3 Validation by intended users

Before they were published and distributed, the guidelines were systematically reviewed by intended users for the purpose of validation. The draft KNGF guidelines on intermittent claudication were presented for assess-ment to a randomly selected group of 65 physical therapists who were working in different settings. Physical therapists' comments and criticisms were recorded and discussed by the working group. If possible or desirable, they were taken into account in the final version of the guidelines. The final recommen-dations on practice, then, are derived from the available evidence and take into account the other above-mentioned factors and the results of the guideline evaluation carried out by intended users (physical therapists).

A.4 Conclusions and recommendations

In these guidelines the methodological quality of the trials was assessed using the criteria laid down by the Evidence-Based Guidelines Meeting (EBRO platform) and specified in the CBO consensus document (see table 6). The scientific weight of the material collected was evaluated according to the four levels of evidence described in table 7.

A.5 Defining the health problem

These clinical guidelines describe the diagnostic and therapeutic processes involved in providing physical therapy for patients with intermittent claudication. Intermittent claudication is a typical complaint of peripheral arterial disease, or an occlusion or obstruc-

Table 6. Description of the quality levels used for evaluating the material collected on interventions.

A1	meta-analyses (systematic reviews) which include at least some randomized clinical trials at quality level A2, that show consistent results between studies;
A2	randomized clinical trials of a good methodological quality (randomized double-blind controlled studies) with sufficient power and consistency;
B	randomized clinical trials of a moderate methodological quality or with insufficient power, or other non-randomized, cohort or patient-control group study designs that involve inter-group comparisons;
C	patient series;
D	expert opinion.

Table 7. Description of the four levels of evidence used for evaluating the scientific weight of the material collected.

Level of evidence	Supported by	Description of conclusion or recommendation in the guidelines
Level 1	one systematic review at quality level A1 or at least two independent trials at quality level A2.	'It is demonstrated that…' or 'One has to…'
Level 2	at least two independent trials at quality level B	'It is plausible that…' or 'One should …'
Level 3	one trial at quality level A2 or B, or research at quality level C	'There are indications that…' or 'One might…'
Level 4	expert opinion, such as that of working group members	'The working group takes the view that …'

tion of the large and medium-sized arteries in the legs, almost always caused by atherosclerosis.[7-10]
There is scientific evidence that exercise therapy is effective in patients with intermittent claudication.[4,11] Walking exercise, which is at the center of conservative therapy, is the best choice in the treatment of intermittent claudication.[5] Exercise therapy has a better cost-effectiveness with a smaller risk of complications compared to other treatment methods such as bypass surgery, percutaneous transluminal angioplasty or medical treatment.[12,13]
Physical therapists can contribute essentially in the treatment of patients with intermittent claudication, because of their knowledge and skills on the area of exercise therapy, pathology, movement analysis, motor learning and behavioral change. The treatment of patients with intermittent claudication should not only be focused on decreasing the complaints but also on reducing the risks for artherosclerosis.[6] Establishing a behavioral change is a process that has to be guided. Providing good and adequate information and advise is a predicament to achieve such a behavioral change. The specific expertise of the physical therapist of patients with intermittent claudication is can best be used in the guidance of the following patients:

- patients with a low cardiac exercise tolerance or a low musculoskeletal load-bearing capacity with a elevated risk for complaints, when these patients perform walking exercises on their own;
- patients with co-morbidity that limits them in performing walking exercises on their own, such as coronary heart diseases, diabetes mellitus, hypertension or mobility-limiting disorders such as osteoarthritis, rheumatoid arthritis, COPD;
- patients for which a gait analysis, and possibly, walking exercises in order to improve the coordination and efficiency is needed;
- patients with an inadequate pain behavior;
- physical inactive patients, who need guidance in the first stage of the walking exercises until they have developed a more active lifestyle;
- patients who want physical therapeutic guidance.

A.6 Target group

The guidelines are primarily intended for physical therapists in intra- and extramural health care who treat patients with intermittent claudication.

A.7 Specific expertise and skills

It is recommended that the treating physical therapist has followed the course 'Peripheral vascular disease and training' (or a comparable course) to be able to give the patients with intermittent claudication optimal physical therapy care. The knowledge and skills presented in the mentioned course are an essential contribution to the ones learned during the physical therapist education. Specific aspects with regard to pathology, physiology, diagnostics, and treatment of intermittent claudication are insufficiently dealt with during the physical therapy education. Therefore, a physical therapist who did not follow an additional course on this subject can not guarantee optimal physical therapy care for patients with intermittent

claudication.
In order to be able to treat patients with intermittent claudication it is recommended that the physical therapist can carry out a gait analysis. By means of the gait analysis an abnormal gait pattern can be determined on the basis of which walking and coordination exercises can be given.

A.8 Advise concerning the interior of the exercise room of the practice

Although not yet all aspects of the physical therapeutic treatment of patients with intermittent claudication can be based on the most concrete scientific criteria, it is possible to give a good indication of the effective treatment methods.
There are a number of advises with respect to the interior of the practice and the equipment used to carry out these effective treatment methods:

- It is recommended to have an electrical graded (0-15 percent) treadmill.
- To exercise with patients with low exercise capacity a bicycle-ergometer is useful, preferably a rpm (revolutions per minute)-independent electromagnetic bicycle-ergometer with graded power (with a possible load as low as 20W, and exercise increments of 5W).
- To perform an optimal gait analysis a video camera (25 frames per second) and recorder (with the possibility of freeze frames) are recommended. In this way it is possible to analyze the gait frame by frame. The gait analyses can be performed in extramural health care.
- An exercise room is recommended when instructions are given in groups

A.9 Epidemiological data

Prevalence

The prevalence of peripheral arterial disease and intermittent claudication is scarcely studied, especially in the general population.[14]
The available data show that the prevalence of peripheral arterial disease in the general population is 19.1 percent.[14,15] The prevalence of intermittent claudication is substantially lower, 1.6 percent according to the ERGO-study.[14] These data are in line with the findings of Stoffers et al.[16] According to Kaiser et al.[5], the prevalence of intermittent claudication is 2.0 percent.

Incidence

The Framingham-study shows that the incidence of intermittent claudication increases with the age (up to 75 years of age). The Framingham-study is a longitudinal study following people for 36 years. The study started with 5209 persons being 30-62 years of age at that moment. In all ages the incidence of intermittent claudication is higher in men than in women. In the age of 35-74 years the mean incidence is 7 (new cases) in men per 1000 and 4 in women per 1000.[17] In The Netherlands the incidence amounted to 2.8 new cases per 1000 patients (in the primary care practice) per year (2.7 per mille in men, 3.0 per mille in women). This increased from 0.4 per mille in patients of 25-44 of age to 10.6 per mille in patients older than 75 years.[5,18-20]
Because of the proportional increase of the ageing population it is expected that the incidence and prevalence of intermittent claudication will increase.[3] In the period 1994-2015 it is expected that the number of patients with old people's illnesses, among which coronary vascular diseases, will increase with 25-60 percent.[21]

Morbidity and mortality

Patients with peripheral vascular diseases have an increased risk of getting coronary and cerebro-vascular disease and of dying.[14,16,22-27] Within 10 years after the occurrence of the intermittent claudication 43 percent of the patients suffers from a coronary heart disease, 21 percent from a cerebro-vascular accident (CVA) and 24 percent from heart failure.[17] The life expectancy of patients with intermittent claudication is on average ten years less than that of healthy persons. The risk of dying is around 2-3 times higher than for people of the same age without symptoms of intermittent claudication.[28] This elevated risk goes for people with asymptomatic peripheral arterial diseases too.[16] In men, intermittent claudication is a strong predictor of mortality as a result of a CVA.[29]

A.10 Health problems

Symptoms of intermittent claudication can be pain or an unpleasant feeling in the legs (cramp, a burning or pinching sensation, tiredness). These complaint occur after walking a certain distance, while walking fast, or when a patient walks up a hill. The complaints disap-

pear again by rest.
An insufficient arterial blood flow to the working muscles, during walking, is the cause of the complaints. At a certain moment the amount of oxygen that is transported to the muscles is not enough. The aerobic energy supply converts to an anaerobic energy release to be able to keep on walking. This results in an accumulation of lactic acid in the muscles, which causes the pain and can induce cramp.[30]
The arterial obstructions, which cause the intermittent claudication complaints, are mostly the result of artherosclerosis. The localization of the arterial obstruction determines in which muscles the complaints occur:

- With an arterial obstruction of the aorta or a. iliaca, the 'pelvic type' of intermittent claudication, the complaints occur in the gluteal or femoral muscles.
- With an arterial obstruction of the a. femoralis, a. poplitea, or a. tibialis, the 'upper or lower leg type' of intermittent claudication, the complaints occur in the muscles of the calf.
- With the 'distal type' of intermittent claudication, the complaints occur in the sole of the foot and the toes.

The severity of the complaints is often being indicated by the four-points scale of Fontaine. This scale knows four stages:

I. There is atherosclerosis, but the patient has no complaints.
II. During physical activities the legs become ischaemic resulting in intermittent claudication.
III. In rest pain occurs.
IV. There are ulcers, (threatening) necrosis and gangrene.

The classical classification of Fontaine is based on history-taking and physical assessment.[5] In addition to the stages the ankle-arm index values are often mentioned. The index is determined by the quotient of the systolic blood pressure of the arm and the ankle. Measurement of the blood pressure in the ankle, which happens at the a. tibialis posterior or a. dorsalis pedis, can be done with a cuff and stethoscope or with Doppler-echocardiography.
At stage I the ankle-arm index is < 0.9 (without typical complaints of intermittent claudication). At stage II belong often ankle-arm indexes of 0.5-0.9 (with typical complaints of arterial intermittent claudication). At stage III the ankle-arm indexes are often <0.5.[5]

A.11 Natural course

Most patients have peripheral arterial diseases without symptoms of intermittent claudication. With respect to the vitality of the leg the course for patients having symptoms of intermittent claudication is usually hardly severe. Most patients (75 percent) experience a stabilization or improvement of the complaints of intermittent claudication.[4,31-33] For a small group of patients, however, the disorder can result in severe complications with loss of mobility, pain in rest, and eventually necrosis and gangrene, for which an operation might be indicated.[14,34-36] In 25 percent of the patients known to have intermittent claudication the complaints get worse within five years. Eventually, circa 2-5 percent of the patients with intermittent claudication will undergo an amputation.[5,37]

A.12 Prognostic factors and risk factors

Intermittent claudication is caused by atherosclerosis.[3,37,38] In the presence of risk factors atherosclerosis will become sooner clinically manifest sooner and will have an accelerated course.[17,37]
This is particularly studied with respect to coronary heart disease, but it seems to be true also for peripheral arterial disease.[17,37]
The risk factors for vascular disease which can be influenced are: smoking, diabetes mellitus, hypertension, hyperlipidemia, physical inactivity, and obesity. Risk factors which cannot be influenced are gender, age and genetic predisposition. Several risk factors intensify the influence of one another.[18,39] The most important risk factors enhancing the vascular disorder are the presence of multiple disorders, diabetes mellitus, smoking[20], hypertension[5].
Smith et al. identified, in a longitudinal study (1985-1990) with 415 (smoking) participants, hyperlipidemia as the most important independent factor connected with the progression of peripheral arterial disease and the occurrence of critical ischaemia.[25]

A.13 Coping with the complaints

Patients who, despite the complaints of intermittent claudication, have an active lifestyle and who are

able to walk 'through the pain', are coping with their complaints in an adequate way.
Patients who, on the other hand, reduce their physical activities due to the complaints and avoid walking or stop walking as soon as the pain occurs, are coping inadequately with their complaints. Although, on the short term, rest is effective in reducing the pain during walking, it will on the long term worsen the complaints.

B Diagnostic process

By applying the guidelines in the diagnostic process the question if physical therapy is indicated has to be answered. This phase consists of the history-taking and the physical therapeutic assessment. The starting point is the patient's needs (including the most important complaints). The physical therapist assesses the impairments, disabilities and participation problems of most immediate concern to the patient, the prognosis and, the patient's needs for information.

B.1 Referral and first physical therapy contact

These guidelines assume a referral of patients with the medical diagnosis 'intermittent claudication' by a primary care physician or by a medical specialist. According to NHG- Standard 'Peripheral Vascular Diseases' of the primary care physicians[5] and the consensus document of the CBO[6] the treatment of patients with intermittent claudication aims at reducing the complaints as well as at reducing the risk factors for atherosclerosis. In all stages of peripheral vascular disease the reduction of the risk profile forms the basis for the treatment.[5] An elevated risk for cardiovascular diseases can be an indication for physical therapy.[40-43] The physical therapist can obviously not take part in the decrease of all risk factors (that can be influence). To stop smoking, adjusting the food intake (diet limited in calories
and fat) and reducing hypertension fall outside the professional scope of the physical therapist. However, the physical therapist might contribute to the reduction of the physical inactivity and to the stimulation of the patient to adopt a physical active lifestyle.
A part of the patients will be referred by a medical specialist, often a vascular surgeon. The vascular surgeon can choose for a conservative treatment with walking exercise and medication or for a surgical intervention. After the surgical intervention, physical therapeutic assessment (among others gait analysis) and, if necessary, physical therapy treatment is still preferred despite the improved circulation as a result of the surgery. Another part of the patients is directly referred by a primary care physician, without intervention of a medical specialist. Based on history-taking and physical assessment, the primary care physician can rule out the diagnosis peripheral arterial diseases for a lot of patients. To be able to diagnose peripheral arterial diseases with sufficient certainty an arm-ankle index is needed in most cases. Literature shows that the negative predictive value for history-taking (87-90%), peripheral pulsations (86-93%) and a souffle in the groin (91%) are high but only a little higher than the a priori change on peripheral arterial diseases. The positive predictive values, on the other hand, are low (22-55%, 18-49%, and 37%, respectively).[5,44]

Through a study performed in eighteen Dutch practices of primary care physicians, results are available on the diagnostic meaning of a combination of clinical data. With the help of multivariate analyses ten clinical characteristics that contribute independently to the diagnosis could be determined, namely: male gender, being older than 60 years, positive history-taking for intermittent claudication, temperature differences between the feet, abnormal palpation of the feet arteries, souffle over the a. femoralis, hypertension, smoking, a history of coronary diseases or diabetes mellitus.[5]

With respect to the ankle-arm index the presence of peripheral arterial diseases is almost certain (chance ≥ 95 percent) if an once-only measurement of the ankle-arm index is less than 0.8 or if a mean (of 3 measurements of the) ankle-arm index is less than 0.9. At a cut-off point of 0.9 for the ankle-arm index the mean sensitivity is 82% and the mean specificity 98%. The presence of peripheral arterial diseases is considered impossible if an once-only measurement of the ankle-arm index is more than 1.1 or if a mean (of 3 measurements of the) ankle-arm index is more than 1.0. When the ankle-arm index varies between 0.9 and 1.0 the diagnosis peripheral arterial diseases can not be determined with sufficient certainty.[5,45]

With differential diagnostics it is important to exclude other disorders. Complaints caused by the follo-

wing disorders might resemble the complaints caused by intermittent claudication: orthopedic disorders, such as coxa osteoarthritis or 'referred pain' around the knee; neurological disorders, such as lumbal nerve root compression; venal disorders, such as varicose veins and the compartment syndrome.
The physical therapist has to assess in patients diagnosed with arterial obstruction, whether there are other disorders with higher priority because they limit the patient more than the arterial obstruction does. The physical therapist determines the most limiting disorder.
Apart from personal data (among others daily activities), additional referral data include, information on previous and current treatment interventions (such as an operation, PTA), medications taken, blood pressure, presence of co-morbidity (for example coronary heart disease or other mobility-limiting disorders such as osteoarthritis, rheumatoid arthritis, COPD), diagnostic information (location/ extent of the vascular problems; ankle-arm index; walking distances/ results treadmill test; results blood examination: peripheral oxygen saturation, scale according to the classification of Fontaine).
Patients with intermittent claudication often show coexistent coronary heart disease and a significantly higher risk for cardiac complications.[4,28] The cardiac exercise tolerance of these patients have to be tested prior to the exercise program.[4,46] Also the cardiovascular risk factors have to be determined. Data on the cardiac risk level, cardiac exercise tolerance and the contra-indications are required referral data for the physical therapist. The assessment of the cardiac exercise tolerance belongs to the responsibility of the referring physician.

B.2 History-taking

By history-taking, the physical therapist tries to identify:

- the patient's needs: the most important complaints and expectations of the patient (including goals with respect to activities and participation).
- the health problem with respect to nature, course and prognosis:
  - kind and severity (impairments/disabilities/ participation problems);
  - nature and location of the complaints: the pain free and maximum walking distance; walking pace; walking against a hill; disappearance of complaints by rest; decrease in mobility; pain at rest; nightly pain, 'restless legs'; color/temperature of the foot; wounds on the foot;
  - onset and course of complaints;
  - prognostic and risk factors:
  - smoking, diabetes mellitus, hypertension, hyperlipidemia, elevated homocysteine levels, age, gender, obesity, physical inactivity, family history;
  - patient's motivation, believe in (keep on) exercising;
  - co-morbidity: among others coronary heart disease, mobility-limiting disorders such as osteoarthritis, rheumatoid arthritis, COPD;
  - coping strategy: the significance the patient attaches to his complaints and the patient's degree of control over his complaints;
  - psychosocial factors;
  - previous diagnostic procedures;
  - previous treatment interventions.
- Assessment of the current complaints:
  - Impairments, disabilities and participation problems: severity and nature (including quality of life);
  - present general health status (functioning, and levels of activity and participation);
  - personal factors;
  - current treatment: medication and other medical or paramedical treatments;
  - the patient's needs for information.

B.3 Measuring instruments

It is important to determine, through history-taking, the precise health problem of the patient, the patient's needs and the severity of his complaints. To record the pain complaints and the extent of activity limitation it is recommended to use the questionnaire Patient Specific Complaints. This questionnaire is a measuring instrument to determine the functional status of the individual patient.[47] The patient himself* selects his three most important complaints regarding his physical activities. Important complaints are the ones that are caused

* *To stimulate readability the indication 'he/she', 'his/her' etc. is avoided in the guidlines. Where this is applicable both sexes are meant by 'he' and 'his'.*

by activities which the patient finds hard to do, which the patient carries out regularly, and which the patient would like to carry out better. The patient has to indicate on a Visual Analogue Scale (VAS) how hard it is to carry out certain activities (see appendix 1). No specific education is required to perform the test. The VAS can be easily scored, but the patient has to be able to see the line as a representation of an abstract concept. The questionnaire Patient Specific Complaints gives an impression of the patient's needs and the severity of the complaints.

Based on the above the working group formulated the following recommendation:

Pain Specific Complaint (level 4)
The working group takes the view that the questionnaire Pain Specific Complaints is an useful instrument to list the complaints of the patient with intermittent claudication.

The patient's needs for information is mapped based on the questionnaire. With the questionnaire (see appendix 1) can be determined:
- if the patient needs information and if so, on which area;
- what the patient knows about the disorder, the treatment and adequately coping with the complaints;
- if the patient knows how the complaints can be improved;
- what the patient's expectations are with regard to the treatment.

By making a good analysis of the patient's needs the physical therapist can provide specific ('tailor-made') information. It is recommended to make a personal information plan for the patient.

B.4 Assessment

The assessment comprises:
- inspection;
- palpation;
- functional assessment.

Inspection

The inspection involves observing the patient in standing position, with most attention being given to the position of the back, pelvis, hips, knees and feet, and observing the patient's skin (color, trophic impairments, wounds, color of the nails, hyperkeratosis of the nails)

Palpation

The physical therapist palpates the skin, assesses temperature differences left-right, the presence of (pitting) edema and (if necessary) peripheral pulsa-tions of arteries a. femoralis, a. poplitia, a. tibialis posterior and a. dorsalis pedis in rest, and he assesses the muscle tonus of the muscles of the upper leg and calves. Palpation of the peripheral pulsations and auscultation of the arteries mentioned can also be carried out after exertion (for example 1 or 2 minutes flexion/ extension of the foot, the lift-hang test according to Ratschow-Bürger).
Without wanting a thorough discussion on the comorbidity, it has to be mentioned that during the physical assessment of patients with diabetes mellitus, the physical therapist must especially pay attention to sensibility impairments and wounds. In case of wounds or pressure points, also the footwear has to be examined. Pay attention to irregularities and pressure points that are able to cause wounds. Vascular assessment (palpation and measurement of the ankle-arm index) is less reliable for patients with diabetes mellitus.[48] For these patients the measure-ment of the ankle pressure is not suitable to follow the effects of the treatment.[48]

Functional assessment

The functional assessment includes a number of items. With the results of the functional assessment, together with the data gained during history-taking, inspection and palpation, the screening questions presented below can be answered. The items in the functional assessment are physical exertion tests (mostly treadmill test), gait analysis and other functional assessments.
Screening questions:
1. Has limited exercise capacity been reduced objectively?
2. Has limited exercise capacity been reduced subjec-

tively?
3. Is there an abnormal gait pattern?
4. Is the patient physical inactive?
5. Are there problems with specific activities?
6. Is there a need for information/advise?

Exercise capacity
To determine if the exercise capacity is objectively reduced, physical exertion tests (exercise tests) can be used. In patients with intermittent claudication an objective reduction of the exercise capacity can be the result of a decreased maximum aerobic capacity (maximum oxygen uptake) as well as the result of the local limitations caused by an arterial obstruction. A combination of both is also possible. Because of the complaints, intermittent claudication may lead to physical inactivity and immobilization. Secondary to the disorder the maximum aerobic capacity might reduce. A reduced maximum aerobic capacity can negatively influence the results of the physical exertion tests. The maximum walking distance can not only be decreased by the direct pain complaints as a result of intermittent claudication, but also by a poor maximum aerobic capacity. The assessment of the maximum aerobic capacity is often carried out based on the results of a bicycle-ergometer test performed, for instance, by a medical specialist. The results of such a bicycle-ergometer test are not only used to assess the maximum aerobic capacity, they are also used as an important aid in determining the cardiac exercise tolerance.[49]
Physical therapists often use tests that specifically focus on the physical therapeutic treatment goals, such as the treadmill test or the six-minute walk test.

Treadmill test
The treadmill test is performed to determine whether there is an objective limitation in maximum walking distance in relation to the distance needed by the patient during work, household activities, recreation and in view of prevention of cardiovascular diseases. In order to make the patient familiar with the testing procedure, the protocol and the realization of the test, it is recommended to carry out a familiarization test one or a few days before the treadmill test actually takes place. The reliability can considerably increase through such a test.
The treadmill test is an aid in determining if there is an abnormal reduction of the exercise capacity. During the treadmill test the pain free walking time or walking distance (the time/distance after onset of pain) and the maximum walking time or walking distance (the time/distance after which a patient has to stop) are measured. The results give an indication about the severity of the disorder.
Because the patient's needs is the most important thing in the treatment, the results of the treadmill test have to be related to what is needed during work, household activities, recreation.
The onset of ischaemia during walking expresses itself in intermittent claudication and leads to a limited pain free and maximum walking distance and walking time. The complaints are variable pain, cramp or tiredness and a stiff feeling.[5] The walking distance is clearly reduced by local complaints in the leg, often in the calf.
During the treadmill test and during exercises the following American College of Sports Medicine (ACSM) scale for pain by peripheral vascular disease can be used:50
Grade 1: light discomfort or onset of pain on modest level (present, but minimal);
Grade 2: moderate discomfort or pain of which the patient's attention can be diverted, for example by conversation;
Grade 3: intense pain (almost grade 4) from which the patient's attention cannot be diverted;
Grade 4: Excruciating and unbearable pain.

Based on the above the working group formulated the following recommendation:

ACSM-scale for pain (level 4)
The working group takes the view that the ACSM-scale for pain (4-points) is an useful instrument to score the pain during walking of the patient with intermittent claudication.
A lot of the patients with whom the physical therapist performs a treadmill test, belong to stage II according to the classification of Fontaine. This stage can be subdivided based on the pain free walking distance. According to the 'NHG Standard Peripheral Vascular Diseases' the intermittent claudication is considered non-invalidating when the pain free walking distance is more than 100 meters. This is stage IIA. A pain free walking distance of less than 100

Table 8. Symptoms of cardiac overload.[43]

- angina pectoris
- heart pump functional disorders:
  - shortness of breath
  - excessive exhaustion for the level of physical exertion
- heart-rhythm disorders
  - faster than expected heart rate for the level of physical exertion
  - alterations in normal rhythm (such as ventricular extra systoles)
- abnormal changes in blood pressure, (fast) increase or decrease of the blood pressure
- fainting
- dizziness
- orthosympathetic responses (sweating, pallor)

meters is called invalidating.[5] In that case it is stage IIB.

During the testing the physical therapist is on the alert for possible complications, such as cardiac overload (see table 8) and leg pain without vascular cause (for example as a result of neuropathy, arthritis or other orthopedic-related pain).[49]

The recognition of the signs of overload without cardiac or vascular cause is not addressed in these guidelines, this is supposed to be known by physical therapists.

A treadmill test with increasing intensity is often used. To provoke intermittent claudication a treadmill test is often used in which, gradually, the grade is increased. The working group recommends the usage of, for instance, a protocol in which the walking tempo is set at 3-3.5 km/hour.

The grade will progressively be increased, for example each 3 minutes with 3.5 percent or each 2 minutes with 2 percent.[51,54] The treadmill test offers the opportunity to measure the ECG, blood pressure and subjective pain (four-point scale).[51]

Cachovan et al. studied the reliability of the treadmill test by determining the pain free walking distance and the maximum walking distance at the start of the therapy.[55,56] They determined the reliability of a treadmill test with constant-load as well as the reliability of a treadmill with graded exercise. The treadmill test with constant-load as well as the treadmill test with graded exercise appears to be well reproducible.

The study of Gardner et al. showed that the progressive exercise test on the treadmill has a better reliability to assess the severity of peripheral obstructive vascular diseases.[51] The reliability of the pain free walking distance, maximum walking distance and transcutaneous oxygen pressure were higher during a progressive treadmill test than during the treadmill test with constant-load intensity.

With respect to the ankle-arm index and the assessment of the systolic blood pressure no differences were found between both protocols. The constant-load test was performed on a treadmill with a speed of 3.2 km per hour and a grade of 7.5 percent. In the progressive exercise test on the treadmill the speed was 3.2 km per hour. At the start of the test there was no grade (0 percent). Every 2 minutes the grade was (with a constant speed of 3.2 km per hour) increased with 2 percent.

The study of Gardner et al. shows that the pain distance of patients with intermittent claudication can, on a number of variables, be predicted more accurately on the basis of treadmill test than on the basis of the 'self-report' by patients.[57]

Based on the above the working group formulated the following recommendations:

Treadmill test (level 2)

It is plausible that the treadmill test is a useful measuring instrument to assess the severity of complaints in patients with intermittent claudication.

Quality of the publications found: B (Gardner et al.[51], Cachovan[55])

Treadmill test with graded exercise intensity (level 3)

There are indications that the treadmill test with graded exercise intensity is a more reliable measuring instrument than the treadmill test with constant-load intensity to assess the severity of the complaints in patients with intermittent claudication.

Quality of the publication found: B (Gardner et al.[51])

The treadmill test can also be used to assess whether there is a subjective exercise limitation. During the performance of the treadmill test attention is being paid to the way in which the patient copes with his complaints. It can be noticed if there is an inadequate pain tolerance. If that is the case, the patient will quickly stop exercising out of fear of (the harmful consequences of) pain. The patient stops exercising when the pain starts, that is to say in grade 1 or 2 on the ACSM scale for pain by peripheral vascular disease,[50] although the patient could go on. The pain free and maximum walking distance are relatively close to one another.
Apart from inadequate pain behavior the patient can also be afraid of physical exertion. It is known that, for example, in cardiac patients the fear can be paralyzing for the exercise capacity.[40,41,43] The fear of physical exertion will be evaluated on the basis of the history-taking and the observation (during the treadmill test). The patient will experience a light exercise load as hard, which means that the patient experiences the load subjectively as hard, as is evident from the high score on the Borg scale (see appendix 1) or a pain scale such as the ACSM, while this is not shown by the exercise load or objective symptoms of exercise load. As objective measures for the exercise load intensity can, for example, the determination of the oxygen uptake, heart rate, the pulmonary ventilation (Ve), and the reduction of the ankle-arm index after physical exertion.
Finally, the results of the treadmill test have to be related to the required amount of exercise which is necessary to decrease the risk profile for cardiovascular diseases. After all the physical therapy treatment of patients with intermittent claudication has to be focused also on decreasing the risk for atherosclerosis. Decreasing this risk places demands on the patient's exercise capacity: the patient has to be able to exercise half an hour daily with a reasonable intensity.
The treadmill test can indicate if a patient is able to walk for at least 30 minutes (preferably non-stop), in order to meet the Dutch Standard of Healthy Moving.[58] The treadmill test can be performed by a physical therapist if the referring physician thinks the patient is capable of such a physical exertion or after screening of the cardiac exercise tolerance by a medical specialist. Based on this screening of cardiac exercise tolerance (including exertion-ECG, tension measurement) the medical specialist can inform the physical therapist about the allowed exercise intensity of the patient.
By signs of cardiac overload (see table 8) or when the patient's cardiac exercise tolerance changes during the treatment period of the physical therapist, the physical therapist consults with the referring physician about a cardiologic screening.
The recognition of musculoskeletal overload is not addressed in these guidelines, this is supposed to be known. This knowledge is part of the basic knowledge of a physical therapist.
Besides the treadmill test with graded intensity also the six-minute walk test is advised.[49] During the six-minute walk test the patients have to walk for six minutes on a flat surface. The patient has to walk as far as possible without endangering his health.
Gardner et al. found that the six-minute walk test correlates the best with the level of activity in the patient's daily life.[59] As a measure for the daily life activities the energy consumption was measured with double-labeled water and indirect calorimetry.
Gardner et al. found out that the score in the six-minute walk test (mean = 368 m, SD 68 m) correlates with the energy consumption ($r = 0.629$, $p < 0.001$).[59] There also appeared to be a significant correlation between the energy consumption and the number of steps taken during the six-minute walk test. (mean = 605 steps, SD 99, $r = 0.470$). Montgomery and Gardner showed that the six-minute walk test is a reliable test for patients with intermittent claudication. The test correlates significantly with functional and hemo-dynamic parameters.[60] So, there is a significant correlation between the 6-minute walking distance and the pain free walking distance ($r = 0.346$, $p = 0.007$), the maximum walking distance ($r = 0.525$, $p < 0.001$) and the ankle-arm index ($r = 0.552$, $p < 0.001$).

Based on the above the working group formulated the following recommendation:

Six-minute walking test (level 3)
There are indications that the six-minute walk test is a useful functional measuring instrument for patients with intermittent claudication.

Quality of the publication found: B (Gardner et al.59, Montgomery and Gardner.[60])

Gait analysis
In patients with intermittent claudication specific changes in the gait occur during walking at the moment that the (pain) complaints occur. These changes are compensating mechanisms occurring in order to avoid or reduce the complaints. In term these compensating mechanisms may hamper the patient during walking.
A gait analysis might then be carried out to assess whether the gait is abnormal in such a way that in the treatment special attention has to be paid to an improvement of the coordination. The physical therapist evaluates the patient's gait. During the gait analysis attention is paid (among others) to: walking speed; step frequency, step length, foot run.
Hereby usage is made of video-frames and the 'gait-analysis-list Nijmegen' (GALN, see appendix 1). This list is translated in Dutch by A.C.H. Geurts, (Department of Rehabilitation-Research, Sint Maartenskliniek, The Netherlands). The list is developed further and validated by the Department of Physical Therapy of the UMC St. Radboud (The Netherlands).
With the GALN the abnormalities in the gait are scored. The Gait-analysis-list includes twelve items. Each item comprises a part of the gait. Through questioning the different body parts (trunk, pelvis, hip, knee, ankle) are being evaluated during walking. This can best be done with the help of video-frames, with the possibility of freeze frames. Usage of the GALN enables to standardize the gait analysis.
Patients with intermittent claudication show a specific (abnormal) gait.
A limited number of studies (RCTS) show that patients with intermittent claudication have a slower walking speed (≤ 1.0 m/sec) and a decrease in step length.61-65 Gardner et al. found a mean step length of 60 cm in patients with intermittent claudication.[59] A practical field-study showed the following characteristic changes in the gait in patients with intermittent claudication:65

- the foot take-off on the claudication-side is less powerful;
- a decreased foot run;
- the stance phase is not completely finished;
- there is a decreased dorsal flexion during heel contact;
- from heel contact to midstance plantar flexion occurs to fast;
- the step frequency is lower than in persons without complaints caused by intermittent claudication (< 120 steps/minute).

The gait analysis is performed to determine if the complaints caused by intermittent claudication have led to such an abnormal gait that exercise therapy is indicated. The usage of the Gait-analysis-list Nijmegen offers starting points for the physical therapy treatment of patients with intermittent claudication.

Based on the above the working group formulated the following recommendation:

GALN **(level 4)**
The working group takes the view that the GALN is a useful measuring instrument to determine the quality of the gait in patients with intermittent claudication.

Other functional assessments
The physical therapist also evaluates other activities, such as: standing on one leg and climbing stairs. Hereby, attention is paid to the patient' s coping behavior, for example, if there is a subjective limitation of physical exercise, or if the patient has fear to exercise. The physical therapist assesses which impairments might be causing the disabilities: mobility and stability of the joints, muscle tonus, muscle strength and muscle length of the affected leg and the not-affected leg. The extensiveness of the functional assessment depends on the severity of the health problem. The performance of such functional assessments is not further addressed in these guidelines. This skill is part of the basic skills of a physical therapist.

B.5 Risk profile for cardiovascular diseases

In *all* stages of peripheral vascular disease the reduction of the risk profile forms the basis for the treatment.[5]
The referring physician assess if there is a risk profile that can be influenced and for which physical therapy is indicated. The physical therapist aims at a decrease of the physical inactivity. There can be an indication for physical therapy in case of one or more of the following aspects: obesity; disturbed lipid-spectrum; inactivity or hypertension. To stop smoking has to be specially

mentioned. Although to stop smoking falls outside the professional scope of the physical therapist, the physical therapist will indirectly be troubled by it because smoking influences the exercise capacity of the patient.

B6 Analysis

The decision whether 'physical therapy' is indicated will be made based on the interpretation of the data gained from history-taking, complemented by the medical data from the referral and the assessment. For the analysis the following questions need to be answered:

- Which impairments, disabilities and possibly participation problems are most important to the patient? For example: severity of the pain complaints, mobility limitations; limitations in ADL, work, sports; participation in household, work, sports, hobby's; reduced quality of life; inadequate pain behavior.
- Is there an objective decrease of the (pain free and maximum) walking distance?
- Is there inadequate pain behavior?
- Is there fear of physical exertion?
- Is there an abnormal gait?
- Has the patient problems with specific activities, such as standing on one leg and climbing stairs?
- Is the patient physical inactive?
- What is the patient's needs for information/advise?
- Are there other disorders with higher priority than intermittent claudication because they limit the patient more than the arterial obstruction does?
- What is the prognosis (in terms of timescale, course of patient's complaints e.g. impairments, disabilities, participation problems and the in influence of promoting and hampering factors)?
- Can the current problem areas be influenced by physical therapy? If so, to what extent?
- Is the patient motivated to participate in physical therapy?

B.7 Conclusion

Physical therapy is indicated if one or more of the screening questions above can be answered with a 'yes' and the physical therapist thinks that the problem areas can be influenced by physical therapy.
When a patient can for certain reasons not be treated in accordance with the clinical guidelines, this should be reasoned.
If there is no indication for physical therapy, the physical therapist should contact the referring physician for consultation and advice. If necessary, the patient could be referred (back) to a medical specialist.

B.8 Treatment plan

After answering the mentioned questions, a treatment plan will be formulated in consultation with the patient (see flow chart). The treatment plan includes the physical therapeutic treatment goals and the priority of these treatment goals. If the patient is currently receiving treatment from a practitioner of another discipline, then both treatments will have to be adjusted with one another.
The starting points for planning information provision are the patient's needs for information, advice and coaching, which would have become apparent during the diagnostic process.

C Therapy

The central goal of physical therapy treatment is to decrease the complaints related to intermittent claudication, the limitations (such as walking and climbing stairs) and the participation problems (such as working, taking part in hobby's or household). In other words: to optimize the activities and participation. Apart from that, the decrease of risk factors for atherosclerosis is an important focal point in the treatment of patients with intermittent claudication.
The therapeutic process of the physical therapist focuses on exercising the functions and activities (such as walking and climbing stairs), on stimulating an adequate coping behavior, on proving information and advise, and on stimulating an active lifestyle. The physical therapist evaluates the goals systematically.
The physical therapy treatment of patients with intermittent claudication has no definite duration. If, based on the analysis, the formulated treatment goals are achieved, or it is assumed that the patient is able to achieve the goals by himself, without physical therapy treatment, the treatment will end.
Hereby, it is important that the minimal exercise length, intensity and frequency are guaranteed and that the continuity of the physical activities (compliance) is not endangered. Finally the treatment will be ended when no progression can be expected, even when the specified goals are not yet achieved.
This part of the guidelines describes which interventions and aids the physical therapist might use to

achieve the treatment goals.

C.1 Behavioral change

The treatment of patients with intermittent claudication intends to decrease the complaints as well as reduce the risks for atherosclerosis.[5] On indication of the referring physician the physical therapist focuses on combating the physical inactivity. Therefore a structural behavioral change is needed. The final objective of this behavioral change is that the patient meets the Dutch Standard of Healthy Moving.[58] To enable the patient to achieve the desired behavioral change, education (by providing information and advise) is essential. Van der Burgt and Verhulst provide a model for patient education that could be used as starting point in allied health professions.[66] They view education as being a process in which maintenance of the new behavior is the last step (see appendix 5). The patient's readiness to change his behavior is determined by an interplay between attitude (how does the patient perceive the change in behavior?), social influences (how do others perceive the change in behavior?) and the patient's perception of his own efficacy, his self-efficacy (will it work to change the behavior?).[67] Van der Burgt and Verhulst emphasize that a behavioral change can only be achieved after fulfillment of a number of conditions first.[66] In the process they distinguish six steps. The final step cannot be achieved if the preceding steps have not been taken.
The information and advise has to be provided well-dosed. The working group recommends an education plan as aid in the systematic provision of the necessary information and advise, without providing the patient to much.
All the time one has to take into account:

- locus of control: to which extent the patient thinks he can influence his situation?
- attribution: to which attributes the patient the influences on his course of life?
- coping behavior: how deals the patient with occurrences?
- (emotional) condition of the patient.

C.2 Physical activating program

The patient receives an activating program from the physical therapist. This is an exercise program which the patient has to perform in addition to the physical therapist treatment. In time the frequency of the physical therapy treatments will decrease while the exercise activities performed by the patient himself will increase in frequency and magnitude.
An example of a such a program is described in appendix 2.

C.3 Treatment goals

Depending on the findings during the diagnostic process (based on referral, history-taking and assessment) the physical therapy treatment of patients with intermittent claudication can focus on one or more of the following treatment goals:

1 to decrease the objective exercise limitation:
  a increase the maximum (pain free) walking distance;
  b increase the maximum aerobic capacity;
2 to decrease the subjective exercise limitation:
  a increase the pain tolerance;
  b overcome the fear of physical exertion;
3 to improve the gait pattern;
4 to reduce the physical inactivity;
5 to improve specific activities, such as climbing stairs or standing on one leg;
6 to provide information/advise.

The physical therapist is during the exercises on the alert for possible complications, for example with respect to cardiac overload (see table 8) and leg pain without vascular cause (for example as a result of neuropathy, arthritis or other orthopedic-related pain).[49] When complication occur, the physical therapist will adjust, if necessary, the exercise load.

1 Decrease the objective exercise limitation

a Increase the maximum (pain free) walking distance

The mean objective of exercise therapy for patients with intermittent claudication is increasing the pain free walking distance. Exercise therapy, often walking exercises, appears to be an effective means to increase the (pain free) walking distance in patients with moderate to severe intermittent claudication.[4,11,38,68,69] Besides that exercise therapy is also considered as a relatively safe and inexpensive form of therapy for this group of patients.[11,12] Leng et al. compared different forms of therapy in patients with intermittent claudication.[11]

Exercise therapy causes a greater improvement of the walking time, compared to a treatment with an angioplasty as well as a therapy with anticoagulants. There is no significant difference in the increase of the (pain free and maximum) walking time after exercise therapy and after surgical treatment. A small trial shows that exercise therapy is less effective than providing pentoxifylline. Leng et al. concluded that exercise therapy causes a significantly positive improvement in patients with pain in the leg.[11] In The Netherlands walking exercise is recommended as a conservative form of treatment for patients with intermittent claudication.[5,20]

The physiological effects of walking exercises which could lead to an improvement of the physical performance ability in patients with intermittent claudication are: an increase and a more effective division of the blood flow[11,49]; a better use of the aerobic energy supply; an increase of oxidative enzymes; a reduced independency of the anaerobic energy supply; an improvement of the flow characteristics of the blood (decrease of the viscosity). In several systematic reviews the efficacy of exercise therapy in patients with intermittent claudication is examined. The training programs in most of the studies varied from only walking, active (leg) exercises or physical training and combinations of the three to training on a treadmill, possibly in combination with strengthening of the muscles.

In the review of Leng et al. ten studies are included.[11] In total almost 250 men and women with stable intermittent claudication are included. The follow-up varies from 12 weeks to 15 months. The used exercises vary, although all researchers recommend to exercise at least two times a week, preferably under supervision. Exercise therapy improves the maximum walking time (in minutes) significantly. The weighed mean increases after therapy with 6.51 minutes, the 95%-confidence interval is 4.36-8.[66] minutes. There is a mean improvement in walking capability of around 150 percent (range 74-230 percent). The maximum walking distance is significantly more improved by exercise therapy than by medication.[11] Walking exercise does not significantly improve the ankle-arm index.[11] Percutaneous Transluminal Angioplasty (PTA) initially results in an increase of the maximum walking distance. This increase, however, is not significantly greater than the improvement as a result of exercise therapy.[11] After PTA, however, the maximum walking distance gradually decreases again, while the maximum walking distance of patients receiving exercise therapy during this period gradually keeps on increasing. That is way after 12 months the maximum walking distance is significantly greater for patients receiving exercise therapy than for patients after PTA.[11]

There is no significant difference between the effect of vascular surgery and exercise on the maximum walking distance.[11] A vascular surgical intervention leads to a result faster but is more expensive[12] and is a greater risk for complications:[11] in 18 percent of the patients complications occurred.[11] After an operation the ankle-arm index significantly increases, training does not increase the ankle-arm index.[11]

Robeer et al. studied the efficacy of walking exercise in patients with intermittent claudication.[4] In this review 9 studies are included. All studies demonstrated an improvement of walking distance or walking time. The improvement in walking time or distance varies from 28-210 percent (mean 105; SD 55.8). Previous reviews[68,69] and a meta-analysis[38] confirmed the conclusion that walking exercise increase the walking distance in patients with intermittent claudication.

Smith et al. studied the efficacy of walking exercises in patients with intermittent claudication in a review, in which 11 studies were included.[70] They found that the maximum walking distance increases with 88-190 percent due to walking exercises.

Ernst states in his review that there can be no doubt about the benefit of exercising for patients with intermittent claudication, walking distances are doubled by exercise training.[69] During a two-months intensive exercise program the pain free walking distance increased with circa 100 percent, while no significant improvement was observed in the control group.[69]

In a meta-analysis Gardner and Poehlman found an increase of 179 percent of the walking distance until the onset of pain.[38] The distance until maximum pain increased with 122 percent.

The effects of randomized and non-randomized studies were pooled by Gardner and Poehlman. Also a control group (a non-exercising group) was not used in a lot of the included studies.[38]

Based on their systematic review, in which 125 studies were included, Cachovan et al. concluded that

Table 9. Assessment criteria with respect to the increase of the walking distances as a result of walking exercise.

Increase in walking distance	Assessment
< 50 percent	insufficient result
50 - 100 percent	moderate to fairly result
> 100 percent	good result

walking exercise is very effective for patients with intermittent claudication, stage II according to the classification of Fontaine.[55] On average, the pain free walking distance increased with 150 percent and the maximum walking distance with 200 percent. The best results are found when the exercise training is performed for at least three times a week, at least 30 minutes per training session, and for more than 6 months.

Based on the above the working group formulated the following recommendation:

Exercise training (level 1)
It is demonstrated that exercise training is an effective treatment for patients with intermittent claudication. Exercise training leads to a significant increase of the pain free and maximum walking distance. Quality of the publication found: A (Leng[11], Robeer et al.[4]), B (Gardner & Poehlman[38], Cachovan et al.[55]).

Based on the above study results and practical experiences, assessment criteria are formulated with respect to the increase of the walking distances as a result of walking exercise (see table 9).The increase of the walking distance is measured compared to the result of the first treadmill test, performed by the physical therapist.
At the moment there is not yet a generally accepted exercise program for patients with intermittent claudication with respect to form, content, intensity and duration. Until now there are just a limited number of studies which determine what an improved action radius means for the patient's quality of life.[4]
In the RCT of Regensteiner et al. the effects of exercise training on the functional status of the patients were studied.[71,75] They found that exercise training on a treadmill affected the functioning of the patient in daily life more than strength training of the leg muscles. The group which had done strength training, showed only progression in walking speed (measured with a questionnaire, Walking Impairment Questionnaire (WIQ)) and the scores for climbing stairs.
The group which exercised on a treadmill, demonstrated progression in the amount of daily activities measured with questionnaires and an activity monitor (the Vitalog). Furthermore, the general well-being improved, the ability to walk distances improved, and the energy consumption increased (with 48 MET-hour per week). Finally, it appeared that the number of active periods was increased with 5.4 per hour in the group which exercised on a treadmill. Further study on the effects of exercise training programs on the quality of life of the patients is definitely needed.[4]

Type of the exercises
Literature shows that walking exercise, often performed on a treadmill, has the best results in the increase of the pain free and maximum walking distances and times.[3,4,38,55,70,71] Programs focused on walking are more effective than strength training programs or programs combining strength training and walking.[13,38,72] According to Gardner & Poehlman[38] results of the stepwise multiple regression indicated that increase in the distances to onset and to maximal claudication pain during treadmill testing were independently related to three exercise components in the following order of importance: (1) claudication pain endpoint used during the exercise training program, (2) length of the program, and (3) type of exercise. Of particular importance, 89% and 87% of the variance in the increase in the distances to onset and to maximal claudication pain, respectively were explained by these three components. The third most effective program component for improvement in claudication pain symptoms was the type exercise, as it explained 12% and 19% of variance in the increases

in the distances to onset and to maximal claudication pain during treadmill testing, respectively.
Stepping and climbing stairs can be used as an alternative if there is no cardiac limitation (ischaemia, rhythm).[49,73] By using alternatives the exercise program knows some variation. There is one study reported also positive effects of exercises of the upper limbs, which is less painful for the patients.[74] More studies (RCTS) are needed before that kind or exercise therapy will be included in the recommendations of the guidelines.
Regensteiner et al. reported that strength training may lead to a specific performance improvement of climbing stairs and walking speed in patients with intermittent claudication.[75] It should be noted that the performance improvement was determined with a questionnaire (Walking Impairment Questionnaire). Walking (on a graded treadmill) is a very intensive activity for claudication-patients. Intensive exercise sessions, however, cannot be tolerated very well at the beginning of the therapy. Then, during the warming-up, physical therapist might use less aggravating exercises or activities, by which the body-weight need not be carried, like cycling.[50] The increase of the (pain free) walking distance is to an important extent attributed to local adaptations, such as an increase in the collateral flow, a redistribution of the current flow, and metabolic adaptations of the muscles fibers, decreased dependence of the anaerobic metabolism.[49] Local adaptations occur in the muscle fibers which are activated during the exercises. That is why those muscles, in which the claudication-patients experience the complaints, have to be activated during exercises.

Based on the above the working group formulated the following recommendation:

Walking exercise (level 2)
It is plausible that walking exercise is the most effective type of exercise for patients with intermittent claudication, classification of Fontaine stage II. Walking exercise leads to a significant increase of the pain free and maximum walking distance.
Quality of the publications found: B (Gardner & Poehlman38, Cachovan et al.55).

Length of the exercise program
With respect to the length of the exercise program, Hiatt states that a program of six months leads to a greater improvement than a program of three months.[3,72] Creasy demonstrated that the improvement of a nine-month program was again greater than that of a six-month program.[3,76] According to Gardner & Poehlman[38] the length of the program is the second most important training component. It explained 22 percent of the variance in the increase of the distance until the onset of pain and 28 percent of the variance in the increase of the maximum pain distance after training.

Based on the above the working group formulated the following recommendation:

Length of the exercise program (level 2)
It is plausible that training exercises for patients with intermittent claudication, classification of Fontaine stage II, are the most effective if the exercises are maintained for at least six months.
Quality of the publications found: B (Gardner & Poehlman[38], Hiatt[72], Creasy et al.[76]).

Intensity of the exercises
Intensive exercises (such as walking) are the most effective in increasing the walking distance of patients with intermittent claudication. Gardner & Poehlman concluded, based on a meta-analysis, that the claudication pain endpoint is the most important training component.[38] It explained 55 percent of the variance in the increase of the distance until the onset of pain and 40 percent of the variance in the increase of the maximum pain distance after training. The findings of Gardner & Poehlman are confirmed

by Cachovan et al.[38,55] Based on this conclusion it is recommended to provide types of training, in which the calf muscles are seriously exercised, which means walking up to a score of 3 on a four-points scale.[50] This is ascribed by Leng et al..[13]
The intensity of the exercises is particularly prescribed on the basis of the pain score. Besides the pain score other parameters can be used such as oxygen uptake or heart rate, provided that it can be tolerated by the patient.
Walking exercise up to almost maximum pain can be performed in intervals, by which complete recovery can be permitted in the resting-period. This type of program can start with exercising 20 minutes (interval) at 40 percent of the VO_2 max. If data on the maximum oxygen uptake are lacking the heart rate reserve can be used to dose the intensity of the exercises. The heart rate reserve is equal to the maximum heart rate minus the heart rate at rest. If a patient's maximum heart rate is 160 beats per minute and the heart rate at rest 60 beats per minute, the heart rate reserve is 100.
With the help of the formula of Karvonen, the exercise heart rate can be calculated.
The exercise heart rate is the heart rate at rest plus a percentage of the heart rate reserve. An exercise heart rate for exercising with an intensity of 40 percent of the VO_2 max corresponds to 40 percent heart rate reserve. The exercise heart rate is equal to the heart rate at rest plus 40 percent of the heart rate reserve. In the example described above 40 percent of the heart rate reserve corresponds to an exercise heart rate of 60 + 40 = 100 beats per minute.
The program can gradually be expanded to 40 minutes at 70 percent of the VO_2 max or 70 percent of the heart rate reserve. Obviously on the condition that there are no signs of (cardiac) overload of the patient. To prevent cardiac overload a checklist can be used (see table 8).

Based on the above the working group formulated the following recommendation:

Intensity of the exercises (level 2)
It is plausible that training exercises for patients with intermittent claudication, classification of Fontaine stage II, are the most effective if the walking exercise is performed up to almost maximum pain (score 3 on the ACSM-scale for pain).
Quality of the publications found: B (Gardner & Poehlman[38], Cachovan et al.[55]).

Exercise frequency
Exercises which are performed at least three times a week have a greater effect on the increase of the (pain free and maximum) walking distance.[4,13,38,55]
Based on the above the working group formulated the following recommendation:

Exercise frequency (level 2)
It is plausible that training exercises for patients with intermittent claudication, classification of Fontaine stage II, are the most effective if the exercises are performed at least three times a week.
Quality of the publications found: B (Gardner & Poehlman[38], Cachovan et al.[55]).

Exercise length
An exercise length of at least 30 minutes per session is advised to achieve the greatest possible improvement of the walking distances.[4,13,38,55,56]

Based on the above the working group formulated the following recommendation:

Exercise length (level 2)
It is plausible that training exercises for patients with intermittent claudication, classification of Fontaine stage II, are the most effective if the exercise length is at least 30 minutes (per exercise session).
Quality of the publications found: B (Gardner & Poehlman[38], Cachovan et al.[55,56]).

Supervised versus non-supervised training exercises
Smit et al. state that supervised walking exercise is preferred for patients with intermittent claudication.[70] Leng et al. state that walking exercise that is supervised three times a week by physical therapists involve significant costs.[11] According to de Vries, however, the cost effectiveness of walking exercise is far more favorable than that of surgery. Nevertheless, the question to what extent supervised walking exercise programs are more effective than non-supervised exercise programs is justified. Until now, little is also known about the extent to which the supervision is most effective. Further research in order to determine

the extent of supervision is desired.[11] There are some studies performed in which the effects of supervised and non-supervised exercise training are compared. Regensteiner et al. compared the effects of a supervised exercise program (in hospital) with a home-based non-supervised exercise program.[52-54] A control group that did not exercise was not included in the study. The exercise program lasted for 14 weeks and during both programs the patients had to walk. Both groups performed 36 exercise sessions in circa 14 weeks. The exercise program performed at home by the non-supervised group consisted of walking as fast as possible for 35 minutes three times a week. It was advised to increase the exercise frequency to 50 minutes. A nurse called every week to assess the frequency and length of the exercises. The supervised group exercised three times a week in hospital. The exercises consisted of walking on a treadmill with an intensity that led to the onset of the complaints of pain. Also this group started with 35 minutes walking, which was increased to 50 minutes. The study showed that the supervised exercise program had a significantly greater effect on the pain free walking distance, the maximum walking distance, the VO_2-peak, the Respiratory Exchange Ratio (VCO_2/VO_2) and on the items (speed, pain score and distance) of the Walking Impairment Questionnaire and on one item (physical function) of the MOS (Medical Outcome Study).[52-54] Patterson et al. compared the effects of a supervised and a non-supervised exercise program too.[77] The programs lasted both twelve weeks. In addition both groups attended weekly educational meetings. The exercise sessions were lasting 20-60 minutes. In both programs a significant increase of the pain free and maximum walking distance was observed ($p<0.01$). In the supervised group, however, the increase of the pain free walking distance was significantly greater than in the non-supervised group (131 versus 337 meter, $p<0.04$). Also the increase of the maximum walking time was significantly greater in the supervised program than in the non-supervised program (207 percent versus 70 percent, $p<0.04$). The test results were maintained in the three months after the exercise program. There is insufficient information on the optimal extent of supervision, the number of exercise sessions that has to be supervised.

Based on the above the working group formulated the following recommendation:

Supervised versus non-supervised training exercises (level 2)

It is plausible that, with respect to increasing the pain free and maximum walking distance, supervised exercise programs are more effective than non-supervised exercise programs for patients with intermittent claudication.

Quality of the publications found: B (Regensteiner et al.[52-54], Patterson et al.[77]).

Conclusions regarding walking exercise

There is not yet a generally accepted exercise program with respect to form, content, intensity and duration for patients with intermittent claudication. As far as known the recommendations are formulated above. Besides that only limited research has been done until this moment in determining what the improved action radius means for the patient's quality of life.[4] In these guidelines the 'state of the art' is presented. Gardner & Poehlman[38] conclude that the following circumstances improve the walking distance the most while exercising patients with intermittent claudication: the type of exercise is walking; the length of the exercises is 30 minutes; the exercise sessions are three times a week; the exercise program will be followed for 6 months and the patient walks until (almost) maximum pain. Studies included in some reviews seem to justify this conclusion.[4,13,56].

In many cases the patient is also advised to exercise at home. Until now, there is no consensus about the number of exercise sessions that have to be performed under supervision.[13] Walking exercise after a vascular surgical intervention may also lead to an increase of the walking distance.[70,78]

Brandsma et al. recommend a secondary study to determine (1) the most effective and efficient form of walking exercise (duration, frequency, intensity, type of exercises), or general exercise programs which include walking exercise, (2) when the maximum effects of an exercise program are reached and on which level the patient has to maintain the exercises to prevent a decline in walking distance and (3) the well-being of the patient and to introduce the quality of life as an outcome measure.[3]

b Increase the maximum aerobic capacity

To increase the maximum aerobic capacity the patient has to exercise at least 2-3 times a week for at least 20-30 minutes with an intensity of at least 50-60 percent of the maximum aerobic capacity (VO_2max). When the data on maximum oxygen uptake are lacking, one might also take 50-60 per cent of the heart rate reserve, 60-70 per cent of the maximum heart rate or the RPE-score of 12-13 on the Borg scale. This may also take place in intervals with exercise intervals of at least 3-4 minutes, alternated with for instance rest-periods of 3-4 minutes.
An activating program is a good supplement to the physical therapy treatment in order to increase the general aerobic capacity (see appendix 2). Studies showed that walking exercise may lead to a significant increase of VO_2max in patients with intermittent claudication.[52,54,70,79]
The increase of the general aerobic capacity can be achieved in different ways. Because of the specific complaints of patients with intermittent claudication and because of the fact that people usually move by walking, walking is a more functional way of exercising than cycling. Moreover the specific coordination of the gait can be practiced better during walking. Apart from walking, other activities in which large muscle groups are active and dynamic contractions are performed are suited to train the maximum aerobic capacity. Obviously, the physical therapist has to take the preference of the patient into account.
In this review of the evidence the basis of the advises to increase the general aerobic capacity are not extensively discussed, because these are described in great detail in the exercise-physiological literature.[39,42,43,49]

2 Decrease the subjective exercise limitation capacity

It is advised to pay attention to the psychological condition of the patient. Being actively involved in the treatment and meeting other patients with intermittent claudication can already have a positive effect on the patient's coping behavior. Within this treatment goal two subgroups can be distinguished, with clear difference in treatment.

a Increase the pain tolerance

Not every patient copes in the same way with his complaints. In some patients the pain will lead to a decrease in activities. During treatment the physical therapist will learn the patient not to stop at the onset of pain. Every time the patient has to learn to walk a bit further 'through the pain'. This is an aggravating activity for the patient, but anyhow exercises which provoke the complaints are imposed. Patients who have complaints of the calf muscles during exertion, have to walk, for instance, on a graded treadmill.
An increase of the (pain free) walking distance contributes to an improved psychological condition of the patient, because the patient will experience less participation problems.
Behavior-orientated rehabilitation principles (for example conform cardiac rehabilitation) can be applied in the treatment of patients who are dealing inadequately with their complaints. In this approach, the focus is on the situations in which the behavior occurs, not on the under-lying pathology (impairment). During treatment the patient learns to develop an adequate coping behavior related to intermittent claudication. In the behavior-orientated treatment an attempt is made to involve the surroundings (such as partner, employer) as much as possible in the treatment. In these guidelines the behavior-orientated principles are not addressed further.

Based on the above the working group formulated the following recommendation:

Increase the pain tolerance (level 4)
The working group takes the view that increasing the pain tolerance, learning the patient every time to walk a bit further 'through the pain', has a positive effect on the maximum walking distance.

b Overcome the fear of physical exertion

In order to overcome the fear of physical exertion the working group advises to use the methods that are also used in cardiac rehabilitation.[41,42] The objectives are concretized as much as possible. For example: the patient is able to interpret his physical reactions well (according to the observations of the physical therapist); a patient indicates to be more conscious of the condition of his own body; a patient indicates during an interview or on a questionnaire to experience less or no fear in certain situations, for instance during heavy physical exertion.
Hereby, it is important that the patient feels safe. A

good interpretation of the physical reactions might contribute to this. A good interpretation of physical reactions is possible by recognizing the normal symptoms of physical activity and furthermore by recognize early the signs of cardiac overload (see table 8). It is recommended that the patient learns to assess the subjective overload with the Borg scale (see appendix 1). Most patients are able to use the Borg scale after five meetings.[80] In decreasing the subjective exercise limitation the activating program is important next to the physical therapy treatment (see appendix 2).

Based on the above the working group formulated the following recommendation:

Overcome the fear of physical exertion (level 4)
The working group takes the view that by overcoming the fear of physical exertion contributes to a decrease of the subjective exercise limitation.

3 Improve the gait pattern

Specific changes in the gait can be observed in patients with intermittent claudication when the pain complaints occur. Practical field studies show that in these patients demonstrate similarities in the changes in the gait that occur by pain.[65] An impaired arterial blood flow to the calf muscles induces the disorders in coordination. The patient will compensate. When patients have complaints for a longer period of time, the changes in the gait will not disappear just like that through exercises that are only focused on an increase of the pain free walking distance. Even after PTA and vascular surgery the changed gait might remain, even though an improved blood flow makes the compensation behavior redundant.
Specific walking exercise is aimed at improving the coordination and reducing the compensating mechanisms that occur during the pain.[81] There is weak scientific evidence that walking exercise leads to a reduction of compensating mechanisms and even the disappearance of these mechanisms.[65]
Walking exercise contributes to the mechanical efficiency of walking in patients with intermittent claudication.[38] Womack et al. found indications that walking exercise in patients with intermittent claudication may lead to an increased mechanical efficiency; the oxygen consumption while walking at constant speed (3.2 km/hour with no gradient) declined with 9.5 percent.[82]
Smit et al. indicate that walking exercise may lead to an improvement of the mechanical efficiency, a decrease of the energy consumption at a certain amount of physical exertion.[70] At a fixed amount of physical exertion walking exercise leads also to a lower pulse frequency and lower lactate concentrations in the blood.[70] An increased mechanical efficiency contributes to an improvement of the walking performances, an increase of the walking distance.
For patients with intermittent claudication walking exercises focused on improved coordination and increased efficiency is advised by the American College of Sports Medicine.[38,49]
Gait analysis may also show that the walking speed of the patient is too low. Strength training of the leg muscles, training of six groups of muscles three times a week, can contribute to an increase of the walking speed.[52-54]

Based on the above the working group formulated the following recommendation:

Improve the gait (level 3)
There are indications that walking exercise can contribute to an improvement of the efficiency of walking. Quality of the publications found: C (Womack et al.[82]).

4 Decrease of physical inactivity and risk factors for cardiovascular diseases

In all phases of peripheral vascular diseases reducing the risk profile forms the basis of the treatment.[5]
Treatment of patients with intermittent claudication decreases mortality caused by a myocardial infarction and CVA.
The morbidity and mortality can be decreased by means of different strategies, such as moving, stop smoking, anticoagulant medication, decreasing the cholesterol levels and intervene if there is a risk of cardiovascular disorder.[83]
Izquierdo-Porrera et al. found that exercise rehabilitation not only improved the functional performance capacity in patients with intermittent claudication but also had a positive effect on the risk factors for cardiovascular diseases.[79] An improvement of the LDL-cholesterol level (8 percent), the total cholesterol

level (5 percent) and systolic blood pressure (6 percent) was observed. The exercise program lasted for 6 months and existed of walking on a treadmill until almost maximum pain (score 3 on the ACSM-scale for pain). The duration as well as the intensity were progressively increased during the program.
In accordance with the usual approach in cardiac rehabilitation the physician who treats the patient may formulate one or more of the following subgoals:[41,42] the patient knows the nature of atherosclerosis and the risk factors; stops smoking; develops and maintains a physical active lifestyle; develops a healthy eating pattern.
The physical therapist primarily focuses on the decrease of the physical inactivity.
The objective hereby is that patient meets the Dutch Standard of Healthy Moving.[58] In these guidelines the basis of the influence of movement on the risk for cardiovascular diseases in general are not discussed. This is extensively described in the literature.
Although to stop smoking falls outside the professional scope of the physical therapist, the physical therapist will indirectly be troubled by it because smoking influences the exercise capacity of patients with intermittent claudication. Jongert et al.[80], Cahan et al.[84] and Gardner et al.[85] showed that smokers performed worse than non-smokers. Compared to non-smokers, smokers have more pain; the maximum pain occurs sooner (on average 1.37 minute sooner during walking); the pain remains longer (on average 2.21 minute longer); the VO_2peak is lower (8 percent lower); the pulmonary ventilation (Ve) is higher (13,5 percent higher) and the peripheral circulation is decreased.
Smoking increases not only the risk for cardiovascular diseases, but also the risk for a functional dependent lifestyle.
A lot of patients with intermittent claudication will (at he beginning of the therapy) not be able to perform the required length and amount of exercises in order to assess the risk profile for cardiovascular diseases. In any case not when they go walking. The working group recommends to offer these patients not only a treatment focused on increasing the (pain free) walking distance, but also forms of exercises that can be better tolerated, such as cycling. Through cycling an attempt can be made to reduce the risk factors. If there is an increase in walking distance, the cycling can, if preferred, be gradually decreased and the size of walking gradually be increased.

5 Improve specific activities
The history-taking and the functional assessment might demonstrate that the patient experiences problems while performing specific activities, such as standing on one leg or climbing stairs. These activities have to specifically exercised. Preferably as much as possible in a functional manner. It concerns exercise therapy preferably performed under supervision of a therapist. By performing this therapy attention has to be paid to the individual situation of the patient. Among others pay attention to the load-bearding capacity of the patient, strength, coordination, balance and use of medication. In these guidelines the content of exercise therapy is not further addressed, as this is considered known by the physical therapist. Strengthening the leg muscles, exercising six groups of muscles three times a week, may lead to an improvement of climbing stairs.[75] Regensteiner et al. exercised the m. tibilalis anterior, m. gastrocnemius, m. soleus, hamstrings, m. quadriceps femoris, m. gluteus maximus and m. gluteus medius. It was exercised on the six repetition maximum (the resistance that can be overcome maximally six times in a row).[75]

6 Provide information and advise
Providing good and adequate advice is an important part in the treatment of patients with intermittent claudication. Educating the patient forms the basis for the desired behavioral adjustments. It is a process, with a behavioral change as final step (final result). This final step cannot be achieved if the preceding steps have not been taken. The education consists of six steps, and per step attention is paid to the problems the patient experiences. The patient's need for advice, which becomes apparent during diagnosis, forms the basis for the patient's individual education plan. In providing information and advise current information material such as brochures and video material might be used.

C.4 (Final) evaluation
In addition to carrying out 'continuous' evaluation during treatment, thorough evaluation should take place after four weeks. This will be done based on the specified goals (in terms of improvement of the

Table 10. Example of a treatment scheme.

Phase	Frequency of treatment	Duration of phase	Number of treatments
Phase of starting	3 times a week	1 week	3
Phase of exercising	2 times a week	4 weeks	8
Phase of exercising on one's own	once a week	5 weeks	5
Phase of maintenance phase	once per 2 weeks	2 weeks	1
Phase of aftercare	once per month	6 months	6

impairments, disabilities and participation problems) and the level of activities of the patient. Evaluation of the treatment goals takes place by means of history-taking and measurements in the functional assessment. Appendix 3 describes, for each sub-goal, evaluation instruments and desired final results.
Central in the evaluation is the measuring of the effect of the treatment on the patient's quality of life. Based on the questionnaire Patient Specific Complaints the (improvement) of the functional status of the patient is determined in order to check whether the most important complaints of the patient with respect to physical activities are improved.
The duration and frequency of the treatment of patients with intermittent claudication are flexible. The treatment will end when the patient has achieved the specified goals, or when the patient has partially achieved the specified goals and the patient is expected to be able to achieve the treatment goals on his own.
Based on the evaluation, the treatment plan will be modified, if necessary. When complications occur during treatment the patient will (possibly) be sent back to the referring physician.
If the patient's condition did not improve the physical therapist assesses whether an improvement is expected in the period to come.
When the patient has not achieved the specified goals but is thought to have reached his maximum capacity, the treatment will also be ended and the patient will be sent back to the referring physician.
The final evaluation takes place after 12 weeks.
During this evaluation the results of functional assessments such as the treadmill test (pain free and maximum walking distances), gait analysis, risk factors for cardiovascular diseases, and psychological factors can be assessed. Appendix 3 might support the decision-making process during the final evaluation.

C.5 Aiming for independence of the patient

An important aspect in the treatment (to maintain the result) is stimulating the patient to develop an active lifestyle.
During the twelve weeks of physical therapy treatment, the patient and the physical therapist aim at a decrease of patient's dependence. Therefore the physical therapy treatments may gradually take place less frequently while the physical activities performed by the patient himself increase in magnitude. Finally, the patient has to be able (and dare) to perform the physical activities independently, that is without physical therapeutic support, in a responsible way.
There is no scientific basis for the extent of physical therapeutic support. The extent to which treatment is required depends on the individually specified treatment goals and the personal situation of the patient.
The treatment will be ended when the specified goals are achieved, or when the patient is able to achieve the treatment goals on his own, or when no progression can be expected. See the treatment scheme in table 10 for an indication.

C.6 Final evaluation, conclusion and reporting

At the end of the treatment episode, and (if necessary) during treatment, the referring physician will be informed about the treatment. Information will be given on the treatment goals, the treatment results, and the provided advises (see KNGF-guidelines entitled 'Communicating with and reporting back to primary care physicians').[86] For reporting see the KNGF-guidelines entitled 'Physical therapy documentation and reporting'.[2]
To ensure good communication and information exchange between physicians and physical therapist, the following five items can be helpful: Indication setting, Consultation, Referral, Contact during treatment, and Reporting.[87]

C.7 Aftercare

At the end of the therapy, the physical therapist should encourage the patient to stay active and continue the healthy lifestyle. At the end of the treatment period of twelve weeks (or sooner if the treatment goals are achieved) the physical therapist can coach the patient for 3-6 months. The patient performs an exercise program on his own and the physical therapist can evaluate and supervise the exercise progression on the basis of a journal which will be filled in by the patient (see appendix 4). In this way there is a greater chance that the patient will keep up an active lifestyle.
Over the long term, it is easier for patients to continue exercising if it is in a form that the patient enjoys and is carried out in a group setting. Therefore, the physical therapist informs the patient about the possible exercise activities (e.g. Sporty Walking, Corefit, Heart-in-Movement).

D. Legal status of the guidelines

These guidelines are not statutory regulations. They provide knowledge and make recommendations based on the results of scientific research, which healthcare workers must take fully into account if high-quality care is to be provided. Since the recommendations mainly refer to the average patient, healthcare workers must use their professional judgment to decide when to deviate from the guidelines if that is required in a particular patient's situation. Whenever there is a deviation from guideline recommendations, it must be justified and documented.[1] Responsibility, therefore, resides with the individual physical therapist.

E. Guideline revisions

These KNGF guidelines are the first such clinical guidelines to be developed for diagnosis, treatment and prevention in patients with intermittent claudication. Subsequent developments that could lead to improvements in the application of physical therapy in this group of patients may have an impact on the knowledge contained in these guidelines. The prescribed method for developing and implementing guidelines in general proposes that all guidelines should be revised a maximum of three to five years after the original publication. This means that the KNGF, together with the working group, will decide whether these guidelines are still accurate by 2007 at the latest. If necessary, a new working group will be set up to revise the guidelines. These guidelines will no longer be valid if there are new developments that necessitate a revision.

Before any revision is carried out, the recommended method of guideline development and implementation should also be updated on the basis of any new knowledge and to take into account any cooperative agreements made between the different groups of guideline developers working in the Netherlands. The details of any consensus reached by Evidence-Based Guidelines Meetings (i.e., the EBRO platform), which are organized under the auspices of the (Dutch) Collaborating Center for Quality Assurance in Healthcare (CBO), will also be taken into account in any updated version of the method of guideline development and implementation. For example, the stipulation that uniform and transparent methods are necessary for determining the amount of evidence needed and for deriving practice recommendations would constitute an important improvement.

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G. Literature

1 Hendriks HJM, Ettekoven H van, Reitsma ER, Verhoeven ALJ, Wees PhJ van der. KNGF-richtlijnen; Methode. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 1998.

2 Heerkens YF, Lakerveld-Heyl K, Verhoeven ALJ, Hendriks HJM. KNGF-richtlijn Fysiotherapeutische Verslaglegging. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 2003.

3 Brandsma JW, Robeer GG, Heuvel S van den, Smit B, Wittens CHA, Oostendorp RAB. Effectiviteit van looptraining bij claudicatio intermittens. Een methodologische beoordeling van gerandomiseerde klinische studies. Ned Tijdschr Fysiother 1997;107(5):128-33.

4 Robeer GG, Brandsma JW, Heuvel S van den, Smit B, Oostendorp RAB, Wittens CHA. Exercise therapy for intermittent claudication: a review of the quality of randomised clinical trials and evaluation of predictive factors. Eur J Vasc Endovasc Surg 1998;15:36-43.

5 Kaiser V, Hooi JD, Stoffers HEJH, Boutens EJ, Laan JR van der. NHG Standaard Perifeer Vaatlijden, NHG Standaarden I. Utrecht: Nederlands Huisartsen Genootschap; 1999.

6 Kitslaar PJEHM. Consensus diagnostiek en behandeling van arteriële claudicatio intermittens. Ned Tijdschr Geneeskd 1997;141(49):2396-400.

7 Harff EG. Algemeen en speciële pathologie [4e druk]. Lochum: de Tijdstroom; 1990. p. 114-8.

8 Jacobs MJHM. Looptraining bij patiënten met claudicatio intermittens.
In: Dekker JB, Aufdemkampe G, Ham I van, Meerwijk GM van, Vaes P. Jaarboek Fysiotherapie Kinesietherapie 1993. Houten: Bohn Stafleu van Loghum; 1993. p. 256-69.

9 Kooijman C. Pathologie voor Paramedische beroepen. Utrecht: Bunge; 1988. p. 78-80.

10 Andriessen MPHM. Het effect van looptraining bij patiënten met claudicatio intermittens, dissertatie, Groningen: Rijksuniversiteit Groningen, Meppel: K-Rips Repro;1986.

11 Leng GC, Fowler B, Ernst E. Exercise for intermittent claudication.
Cochrane Library 2002;2:1-13.

12 Vries SO de, Management strategies for intermittent claudication [dissertatie]. Groningen: Regenboog; 1998.

13 Leng GC, Fowler B, Ernst E. Exercise for intermittent claudication. Cochrane Library 2000;3:1-13.

14 Rutgers D, Meijer WT, Hoes AW, Bots ML, Hofman A, Grobbee DE. Prevalentie van perifere arteriële vaatziekte en claudicatio intermittens bij personen van 55 jaar en ouder: het ERGO-onderzoek. Ned Tijdschr Geneeskd 1998;142(52):2851-6.

15 Meijer WT, Grobbee DE, Hunnink MG, Hoffman A, Hoes AW. Determinants of Peripheral Arterial Disease in the Elderly, The Rotterdam Study. Arch Intern Med 2000;160:2934-8.

16 Stoffers HEJH, Rinkens PELM, Kester ADM, Kaiser V, Knottnerus JA. The prevalence of asymptomatic and unregognized peripheral arterial occlusive disease. Int J Epidem 1996;25(2):282-90.

17 Kannel WB. The demographics of claudication and the aging of the American population. Vasc Med 1996;1:60-4.

18 Oskam SK, Brouwer HJ, Mohrs J. Trans and interactional acces program for standard output of the transition project. Amsterdam: Department of General Practice; 1994.

19 Lamberts H, Oskam SK, Hofman-Okkes JM et al. Episode gegevens uit het Transitieproject op diskette, de gebruikersmogelijkheden. Huisartswet 1994;37:421-6.

20 Kwaliteitsinstituut voor de gezondheidszorg CBO. Diagnostiek en behandeling van arteriële claudicatio intermittens, consensus bijeenkomst Utrecht. Utrecht: CBO; 1997.

21 Ruwaard D, Kramers PGN [redactie]. Volksgezondheid Toekomst Verkenning. De som der delen. Amsterdam: Elsevier/Tijdstroom; 1997.

22 Fowkes FGR, Housely E, Cawood EHH, Macintyre CCA, Ruckley CV, Prewscott RJ. Edinburg Artery Study: Prevalence of asymptomatic and symptomatic peripheral artery disease in the general population. Int J Epidemiol 1991;20:384-92.

23 McKenna M, Wolfson S, Kuller L. The ratio of ankle and arm arterial pressure as an independent predictor of mortality. Atherosclerosis 1991;87:119-28.

24 Criqui MH et al. Mortality over a period of 10 years in patients with peripheral arterial disease. N Engl J Med 1992;326:381-6.

25 Smith I, Franks PJ, Greenhalgh RM, Poulter NR, Powell JT. The influence of smoking cessation and hypertriglyceridaemia on the progression of peripheral arterial disease and the onset of critical ischaemia. Eur J Vasc Endovasc Surg 1996;11:402-8.

26 Meijer WF Hoes AW, Rutgers D, Bots ML, Hofman A, Grobbee DE, Peripheral arteral disease in the elderly, The Rotterdam Study. Rotterdam; 1997.

27 Criqui MH, Denenberg JO, Langer RD, Fronek A. The epidemiology of peripheral arterial disease: importance of identifying the population at risk. Vasc Med 1997;2:221-6.

28 Mueller-Bühl U, Diehm C, Sieben et al.. Prävalenz und risicofactoren von peripheren-arterieller verschlusskrankheit und koronarer herzkrankheit. VASA 1987;Suppl;21:1-45.

29 Bowlin SJ, Medalie JH, Flocke SA, Zyzanski SJ, Yaari S, Goldbourt U. Intermittent claudication in 8343 men and 21-Year specific mortality follw-up. Ann Epidemiol 1997;7(3):180-7.

30 Bernards JA, Bouwman LN. Fysiologie van de mens. Utrecht: Bohn Scheltema en Holkema;1994.

31 Cronenwett JL, Warnerr KG Zelenock GB et al. Intermittent claudication: current results of non-operative management. Arch Surg 1984;119: 430-6.

32 Cox GS, Hertzer NR, Young JR et al. Non-operative treatment of superficial femoral artery disease: long-term follow-up. J Vasc Surg 1993;17:172-82.

33 Dormandy J et al. Fate of the patients with chronic leg ischaemia. J Cardiovasc Surg 1998;30:50-7.

34 Rose GA, Blackburn H, Gillum RF et al. Cardiovascular survey methodes. Geneve: WHO; 1982. p. 162-5. In: Kaiser V, et al.. NHG Standaard Perifeer Vaatlijden, NHG Standaarden I. Utrecht: Nederlands Huisarsten Genootschap; 1999.

35 Hertzer NR. The natural history of peripheral vascular diseases, implications for its management. Circulation 1991;83(2 suppl): 112-9.

36 Bonsema K, Kaiser V, Stoffers HEJH. Perifeer arterieel vaatlijden. Huisarts en Wetenschap 1990;33(11): 440-6.

37 Leng GC, Fowler B, Ernst E. Exercise for intermittent claudication. Cochrane Library 1999;4:1-12.

38 Gardner A, Poehlman ET. Exercise rehabilitation programs for the treatment of claudication pain. JAMA 1995;274:975-80.

39 McArdle WD, Katch FI, Katch V. Exercise physiology, energy, nutrition and human performance. Philadelphia/London: Lea & Febiger; 1991.

40 Vogels EHHM et al. KNGF-Richtlijn Hartrevalidatie. Supplement bij het Ned Tijdschr Fysiother 111;3;2001.

41 Kruijsen HACM et al. Richtlijn Hartrevalidatie, deel I. Den Haag: NHS/NVVC; 1995.

42 Kruijsen HACM et al. Richtlijn Hartrevalidatie, deel II. Den Haag: NHS/NVVC; 1997.

43 Jongert MWA, Oudhof J, Koers H. Sport en bewegen voor hartpatiënten anno 2000. Geneeskunde en Sport 2000;33(6):36-43.

44 Stoffers HEJH, Legemate DA, Prins MH. Niet-invasieve diagnostiek bij perifeer arterieel vaatlijden. Hartbulletin 1997;28:190-4.

45 Stoffers HEJH, Kester ADM, Kaiser V, Rinkens PELM, Kitselaar, PJEHM , Knottnerus JA. The Diagnostic Value of the Ankle Brachial Systolic Pressure Index in Primary Health Care. J Clin Epidemiol 1996;449(12):1401-5.

46 Vecht RJ, Nicolaides AN, Brando et al. Resting and treadmill electrocardiographic findings in patients with intermittent claudication. Inter Agio 1982;119-21.

47 Köke AJA, Heuts PHT, Vlaeyen JWS, Weber WEJ. Meetinstrumenten chronische pijn, deel 1, functionele status. Maastricht: Pijnkenniscentrum; 1999.

48 Ubels FL. Non-invasive vascular measurements in diabetes mellitus and dyslipidemia [dissertatie]. Groningen: Rijksuniversiteit Groningen; 2001.

49 Gardner AW. Peripheral Arterial Disease. In: ACSM's Exercise Management For Persons With Chronic Diseases And Disabilities Book. Champain: ACSM; 1997; 64-8.

50 ACSM. Guidelines for Exercise Testing and Prescription. Philadelphia/London: Lea & Febiger; 2000; 209.

51 Gardner A, Skinner J, Cantwell B, Smith L. Progressive vs Singlestage treadmill test for evaluation of claudication. Med Sci Sports Exerc 1991;23(4):402-8.

52 Regensteiner JG. Exercise in the treatment of claudication: assessment and treatment of functional impairment. Vasc Med 1997;2:238-42.

53 Regensteiner JG, Gardner A, Hiatt WR. Exercise testing and excercise rehabilitatin for patients with peripheral arterial disease: status in 1997. Vasc Med 1997;2:147-55.

54 Regensteiner JG, Meyer TJ, Krupski WC, Cranford LS, Hiatt WR. Hospital vs home-based exercise rahabilitation for patients with peripheral arterial occlusive disease. J Vasc Diseases 1997;48(4):291-300.

55 Cachovan M, Rogatti W, Woltering F, Creutzig A, Diehm C, Heidrich H, Scheffler P. Randomized reliability study evaluating constant- load and graded-exercise treadmill test for intermittent claudication. J Vasc Diseases 1999;50(3):193-200.

56 Cachovan M. Methoden und Ergebnisse eines kontrollierten Gehtrainings bei Patienten mit PaVK. Z ärztl Fortbild Qual Sich 1999;93:626-32.

57 Gardner A, Ricci MA, Case TD, Pilcher DB. Practical equations to predict claudication pain distances from graded treadmill test. Vasc Med 1996;1:91-6.

58 Coumans B, Leurs MTW. Richtlijn Gezond Bewegen. Geneeskunde en Sport 2001:34(4):142-6.

59 Gardner A, Womack C, Sieminski D, Montgommery P, Killewich L, Fonong T. Relationship between free-living daily physical activity and ambulatory measures in older claudicants. Angiology 1998;49(5): 327-37.

60 Montgomery P, Gardner A. The clinical utility of a six-minute walk test in peripheral arterial occlusive disease patients. JAGS 1998; 46:706-11.

61 McCully K, Leiper C, Sanders T, Griffin E. The effects of peripheral vascular disease on gait. J Gerontology 1999;54A(7):B291-B294.

62 Scherer SA, Bainbridge JS, Hiatt WR, Regensteiner JG. Gait characteristics of patients with claudication. Arch Phys Med Rehabil 1998;79(May):529-31.

63 McGrae-McDermott M, Mehta S, Liu K, Guralnik JM, Martin GJ, Criqui MH, Greenland P. Leg symtoms, the ankle-brachial index and walking ability in patients with peripheral arterial disease. J Gen Intern Med 1999;14:173-81.

64 Newman AB. Commentary on 'The effects of peripheral vascular disease on gait'. J Gerontology 1999;54A(7):B295-B296.

65 Boxma E, Jansen A, Menkema Y, Vlemmix L. Claudicatio intermittens: de ontwikkeling van een meetinstrument om de compensatiemechanismen tijdens het lopen te observeren [scriptie]. Leiden: Hogeschool Leiden; 1994.

66 Burgt M van der, Verhulst F. Doen en blijven doen. Patiëntvoorlichting in de paramedische praktijk. Houten: Bohn Stafleu van Loghum; 1996.

67 Dijkstra A. Het veranderingsmodel als leidraad bij het motiveren tot en begeleiden van gedragsverandering bij patiënten. Ned Tijdschr Fysiother 2002;112(3):62-8.

68 Radack K, Wyderski RJ. Conservative management of intermittent claudication. Ann Int Med 1990;113:135-147.

69 Ernst E. Exercise the best therapy for intermittent claudication. Br J Hosp Med 1992;48;6:303-7.

70 Smit AJ, Kuipers W, Wittens CHA. Looptraining. Hartbulletin 1997; 28(december):204-207.

71 Brandsma JW, Robeer GG, van den Heuvel S, Smit B, Wittens CHA, Oostendorp RAB. The effect of exercises on walking distance of patients with intermittent claudication: a study of randomized clinical trials. Phys Ther 1998;78(3):278-86.

72 Hiatt WR. Superiority of treadmill walking exercise vs strength training for patients with peripheral arterial disease. Circulation 1994;90:1866-70.

73 Christman SK, Fish AF, Frid DJ, Smith BA, Bryant CX. Stepping as an exercise modality for improving fitness and function. Appl Nurs Res 1998;11(2): 49-54.

74 Walker RD, Nawaz S, Wilkinson CH, Saxton JM, Graham Pockley A, Wood RFM. Influence of upper- and lower-limb exercise training on cardiovascular function and walking distances in patients with intermittent claudication. J Vasc Surg 2000;31(4):662-9.

75 Regensteiner JG, Steiner JF, Hiatt WR. Exercise training improves functional status in patients with peripheral arterial disease. J Vasc Surg 1996;23(1):104-15.

76 Creasy TS, McMillan PJ, Fletcher EWL et al. Is percutaneous transluminal angioplasty better than exercise for claudication? Preliminary results from a prospective randomized trial. Br J Vasc Surg 1990;4:135-40.

77 Patterson RB, Pinto B, Marcus B, Colucci A, Braun T, Roberts M. Value of a supervised exercise program for the therapy of arterial claudication. J Vasc Surg 1997;25(2):312-9.

78 Lundgren F, Dahllöf AG, Schersten T, Bylund-Fellenius AC. Muscle enzyme adaptations in patients with peripheral arterial insufficiency: spontaneous adaptation, effect of different treatments and consequences on walking performance. Life Science 1989;77:485-93.

79 Izquierdo-Porrera AM, Gardner AW, Powell CC, Katzel LI. Effects of exercise rehabilitation on cardiovascular risk factors in older patients with peripheral arterial occlusive disease. J Vasc Surg 2000;31(4):670-7.

80 Jongert MWA, Benedictus J, Dijkgraaf J, Koers H, Oudhof J. Het gebruik van de Borgschaal bij bewegingsactiviteiten voor hartpatiënten. Bunnik: Hart in Beweging; 2002.

81 Booys M de, Zenderen B van, Zwiebel F. Looptraining: Lopen, lopen, lopen. Bunnik: Vereniging van Vaatpatiënten; 1994.

82 Womack C, Sieminski D, Katzel L, Yataco A, Gardner A, Improved walking economy with periferal arterial occlusive disease. Med Sci Sports Exerc 1997;29(10):1286-90.

83 Davies A. The practical management of claudication. BMJ 2000;321:911-2.
84 Cahan MA, Montgomery P, Otis RB, Clancy R, Flin W, Gardner A. The effect of cigarette smoking status on six-minute walk distance in patients with intermittent claudication. J Vasc Diseases 1999;50(7):537-46.
85 Gardner A, Womack CJ, Montgomery PS, Franklin D, Killewich LA. Cigarette smoking shortens the duration of daily leisure time physical activity in patients with intermittent claudication. J cardiopulmonary Rehabil 1999;19:43-51.
86 Verhoeven ALJ, Heuvel CMF van den. KNGF-richtlijn Informatieverstrekking Huisarts. Amersfoort: Koninklijk Nederlands Genootschap voor Fysiotherapie; 1997.
87 Heuvel CMF van den, Vogels EMHM, Wams HWA. Verslag van het HOF-project: Handreikingen voor huisartsen, oefentherapeuten Cesar, oefentherapeuten-Mensendieck, fysiotherapeuten. Amersfoort: Nederlands Paramedisch Instituut; 1999.

Appendix 1

Measuring instrument Patient Specific Complaints

- Let the patient name the three most difficult, most important and most frequently performed activities or movements that the patient finds hard to do. They have to be activities or movements that are important but inevitable for the patient.
- Let the patient describe the chosen activities as detailed as possible. Try to quantify as much as possible in terms of duration, distance, repetitions, etcetera.
- Ask the patient to score the three activities or movements on difficulty in performing on the Visual Analogue Scale (VAS).
- To evaluate the effect of therapy, the scores of the three mentioned activities can be used. The effect is always expressed as the difference in score between the first and the second measurement. For example: first measurement of 70 mm (measured from the left), second measurement of 30 mm, the effect-score will then be 40 mm. Note: the length of the VAS is exactly 100 mm.

Three activities (difficult to perform and occurring often) are, arranged in order of importance:

1. .....
2. .....
3. .....

.....

Problem: Walking for 30 minutes
How difficult was it to perform this activity the past week?
Do you put a line on the left side than the walking was easy to do

No problem at all ——|—————————— impossible

Do you put a line on the right side than the walking was hard to do

No problem at all ——————————|—— impossible

Date …. / …. / ….

Problem 1
How difficult was is to perform this activity the past week?

No problem at all ———————————— impossible

Problem 2
How difficult was is to perform this activity the past week?

No problem at all ———————————— impossible

Problem 3
How difficult was is to perform this activity the past week?

No problem at all ———————————— impossible

Example

Questionnaire for the need for information

With the help of the questionnaire it can be assessed whether the patient needs information and on which subject. Based on the results the physical therapist can make a personal information plan for the patient.

Instruction

Mark on the following list the subjects for which you already received information. Did you already receive all the necessary information, mark this on the list by putting a cross. Don't do this if you want some more information on a subject, even if, in the past, you received already some information on this subject.

Subject

- ☐ Information on the disorder: on peripheral arterial diseases, intermittent claudication(causes, symptoms)?
- ☐ Prognostic factors: the course of the disorder.
- ☐ Risks for CVA, myocardial infarction.
- ☐ What happens during physical activity, what causes the complaints?
- ☐ Ways to establish the diagnosis.
- ☐ Ankle-arm index, Doppler-echocardiographs, duplex-angiographs, magnetic resonance-angiographs.
- ☐ Treadmill test: what is it and for what purpose is the test performed?
- ☐ Therapy: different possibilities, walking exercise, PTA, bypass-surgery.
- ☐ Information material, such as brochures and video material.
- ☐ Exercise principles: what are the most important exercise principles?
- ☐ Exercise effects: which can be expected?
- ☐ Exercise goals: what is attempted to achieve with the exercises?
- ☐ Exercise methods: which forms of physical exertion/activities are useful?
- ☐ Walking exercise: instructions with regard to the intensity (condition, posture, pain threshold, signs of overload, speed, distance, duration, footwear, pack), aids (such as pedometer), coaching.
- ☐ Principles of exercise tolerance and exercise limitations.
- ☐ Daily variations in exercise tolerance (for example variations in pain free walking distance).
- ☐ Pain scales: how do I indicate how much pain I feel?
- ☐ Risk factors cardiovascular diseases, decrease risk behavior (among others stop smoking).
- ☐ What can I do as a patient and what is the value of a healthy lifestyle.
- ☐ Diary.
- ☐ Signs of overload (of heart or muscles and joints).
- ☐ Feet and skin care (including taking care of wounds), footwear.
- ☐ What to do and what not?
- ☐ Questions often asked.
- ☐ Notification at thrombosis clinic, necessary or not?
- ☐ Medication (kind, dosage, side effects).
- ☐ When to contact the primary care physician?

ACSM-scale for pain for intermittent claudication

- ☐ Grade 1: light discomfort or onset of pain on modest level (present, but minimal).
- ☐ Grade 2: moderate discomfort or pain of which the patient's attention can be diverted, for example by conversation.
- ☐ Grade 3: intense pain (almost grade 4) from which the patient's attention cannot be diverted.
- ☐ Grade 4: excruciating and unbearable pain.

Borg RPE-scale

The Borg RPE-scale (Ratings of Perceived Exertion) is a subjective index.[1] It is an aid to estimate the extent of exertion, the level of the load and the fatigue on a scale from 6 to 20 (see table 11). In addition to a series of numbers the scale includes a short description of the exercise intensity at the odd numbers. The descriptions are short and concise (for example 'very light' or 'very heavy'). These are the 'verbal anchors' that relate the (objective) score to the (subjective) observation. Exercise is necessary to enable calibration, to make clear which objective score relates to which subjective experience.

The use of the Borg RPE-scale enables to recognize the exercise intensity.[2] The Borg-scale increases linearly with exertion intensity, heart rate and oxygen uptake. The name already indicates that the RPE-scale

Table 11. The Borg-scale, a scale for the heaviness of the physiacal exercise load

Exercise load	Borg score
extremely light	6
	7
	8
very light	9
	10
fairly light	11
	12
fairly heavy	13
	14
heavy	15
	16
very heavy	17
	18
extremely heavy	19
	20

rates the subjectively perceived exertion. This subjective experience can not be ascribed to a specific aspect of the exercise load, for example to the respiration, the lactate concentration or the oxygen uptake. The observation of exertion is a combination of different forms of sensations (from different peripheral muscles, respiration, temperature regulation, etc.). Apart form the sensoric information, there are also memories of work situations and the accompanying emotions. Motivation and emotion during exercising can also influence the perception and performance. Thus, the score on the RPE-scale expresses the 'total' subjective load.

The quality and standardization of the instruction influences the reliability of (the use) of the Borg-scale. That is why it is advised to provide the following standard instruction when patients use the Borg-scale. *Indicate during the physical movement how hard this is. The experienced load depends mainly on the extent of the exertion, tiredness of the muscles, and the feeling of exhaustion. Look at the ratings on the scale. Give a rating of 6 to 20, in which 6 means no load at all and 20 means maximum exertion. Try to describe your feelings honestly, without considering how heavy the load really is. Do not overestimate neither underestimate. Only your own feeling is important in this, not what other people indicate. Look at the scale and descriptions, and choose a number (6-20).*

A minority of the people (5-10 percent) has difficulties to understand the scale. The ratings on the RPE-scale of these people are not reliable and valid. Despite practicing they will not be able to use the RPE-scale properly. Apart form that mistakes occur that can be ascribed to improper use of the scales. A good instruction of the scale to the user is indispensable. This means that the physical therapist has to know the backgrounds of the RPE-scale well. In addition sufficient practicing by the patients in using the scale is necessary. At least five practice sessions are needed to learn to use the scale properly.

Literature

1 Jongert MWA, Benedictus J, Dijkgraaf J, Koers H, Oudhof J. Het gebruik van de Borgschaal bij bewegingsactiviteiten voor hartpatiënten. Bunnik: Hart in Beweging; 2002.

2 Borg G. Borg's Perceived Exertion and Pain Scales. Human Kinetics: Champaign, IL; 1998.

Gait analysis list Nijmegen

Name: ..... Date: ..... / ..... / .....
Performed by: .....
Affected side zijde: left (.....) right (.....) Step frequency: : ..... steps/minute

				STANCE FACE			SWINGFACE		Priority
	Item	**Question**		*Early*	*Middle*	*Late*	*Early*	*Late*	
General	1	*Is the stance phase shortened?*	Left		yes / no				yes / no
			Right		yes / no				yes / no
Trunk	2	*Falls the trunk evidently before the hips?*				yes / no			yes / no
	3	*Falls the trunk evidently behind the hips?*				yes / no			yes / no
	4	*Is there a lateral flexion?*	Left		yes / no				yes / no
			Right		yes / no				yes / no
	5	*Is there too little arm swing?*	Left		yes / no			yes / no	
			Right			yes / no			yes / no
Pelvis	6	*Is there too much backwards rotation*	Left		yes / no			yes / no	
			Right			yes / no			yes / no
Hip	7	*Is there too little extension?*	Left			yes / no			yes / no
			Right			yes / no			yes / no
Knee	8	*Is there too little extension?*	Left					yes / no	yes / no
			Right					yes / no	yes / no
	9	*Is the flexion lacking?*	Left	yes/ no					yes / no
			Right	yes / no					yes / no
	10	*Is there too little flexion?*	Left	yes / no					yes / no
			Right	yes / no					yes / no
	11	*Is there too little extension?*	Left		yes / no				yes / no
			Right		yes / no				yes / no
Ankle	12	*Is there too little plantar flexion?*	Left			yes / no			yes / no
			Right			yes / no			yes / no
	13	*Is there too little dorsal flexion?*	Left		yes / no				yes / no
			Right		yes / no				yes / no

Explanation

- Encircle a (yes) at the appropriate item if an abnormal phenomenon is observed.
- Encircle a (no) at the appropriate item if an abnormal phenomenon is absent.
- In the column 'Priority' a (yes) will be encircled if a change of the observed phenomenon by means of walking exercise is absolutely necessary for that part of the gait.
- In de column 'Priority' a (no) will be encircled if improvement of this phenomenon is found less important in providing walking exercise.
- The limited dorsal flexion should especially be observed in the middle of the stance phase. A limited dorsal flexion may lead to a shortened contra-lateral swing phase.

Standard values of the gait					
	STANCE PHACE			SWING PHASE	
	early 0-10%	middle 10-35%	late 35-60%	early 60-70%	late 70-100%
Trunk	above the hip			above the hip	
Pelvis	**backwards rotation** 5° to 'neutal'	'neutral'	**backwards rotation** until 5° extension	**forwards rotation** 5° to 'neutral'	**forwards rotation** until 5°
Hip	**'no' movement** stays in about 25° flexiion	**extension** 25° flexion to 'neutral'	**extension** 'neutral' to 10° extension	**flexion** 10° extension to 15° flexion	**flexion** 15° flexion to 25° flexion
Knee	**flexion** from 0° extension to 20° flexion	**extension** from 20° flexion to 'neutral'	**flexion** from 'neutral' tp 50° felxion	**flexion** from 50° felxion to 70° flexion	**extension** from 70° flexion to 0° extension
Ankle	**plantar flexion** from 'neutral' to 10° plantar flexion	**dorsal flexion** from 10° plantar flexion to 10° dorsal flexion	**plantar flexion-** from 10° dorsal flexion to 20° plantar flexion	**dorsal flexion-** from 20° plantar flexion to 'neutral'	**'no' movement** stays about 'neutral'

Short manual

- Only clearly abnormal phenomenon are tested.
- L (left), R (right), L + R (left and right) or O (normal) can be scored.
- The minimum speed is hundred steps per minute.
- The analysis takes preferably place on the basis of video-frames with the possibility of freeze frames.

The specific characteristics of a dynamic gait are:

- The step frequency is between 110-125 steps per minute.
- There is a flexion in the knee at the beginning of the stance phase.
- There is a heel rise before the contra-lateral leg has heel contact.
- The trunk is before or above the hips/feet.
- The arms sway relaxed, alternating backwards and forwards (as a resultant of the rotation of the trunk).

Agreement on the above is important, because in normal gait also a distinction can be made between:

- A more static gait.
- A more passive gait.

The specific characteristics of a more static gait are:

1. A step frequency of 100-125 steps per minute is possible.
2. The movement behavior of the knee is in the beginning of the stance phase less dynamic, possibly leading to fixation in extension in the early stance phase (0-10 percent walking cycle).
3. First contact with the floor will be with the whole foot.
4. Heel rise is often too late or absent.
5. The trunk is behind the hips.
6. The range of movement of the arms are less in length but alternating. There is less relaxation.
7. The range of movement of all joints can be abnormal (see standard values).

The specific characteristics of a passive static gait are:

1 A step frequency is less than 100 steps per minute.
2 In the early stance phase flexion of the knee is absent. Often there is a extension or hyperextension.
3 First contact with the floor will be with the whole foot.
4 There is no (active) heel rise.
5 The trunk is behind the hips.
6 The arms move along less.
7 The different joints show abnormal range of movement (see standard values).

Appendix 2

Activating program

The activating program is developed to be performed independently by the patient (in addition to the physical therapy treatment). The objective is that the patient meets to the Dutch Standard of healthy Moving (Exercise Guidelines).[1]

The program is structured gradually. At first the size will be increased, later the intensity will be increased. In the first weeks the patients have to learn to feel of the subjective symptoms of the load during physical activities. The usage of the Borg-scale and the ACSM-scale for pain can be learned in this period. In the first weeks the patient can also gain experience in the use of a diary. Because the patient has to develop permanently an active lifestyle it was deliberately chosen not to begin with a too intensive program. In the first weeks the patient can gain positive experiences during the program because he does not have to walk too far 'through the pain', at least not in the part of the program that the patient performs independently. The intensive exercises are in the first weeks supervised by the physical therapist. On those days that the patient will be treated by the physical therapist, the patient has to walk by himself only once (apart from the treatment).

Patients with a low exercise tolerance could choose to start with one exercise session a day. By doing so one extra week will be added at the beginning of the program (week 0). In week 2 one can start exercising twice a day.

For patients for which a decrease of the risk factors for cardiovascular diseases is an important treatment goal, one can choose to cycle 15 minutes in addition to the walking during the first 6 weeks of the program. The cycling will only be done on those days that the patient is not treated by the physical therapist. The intensity of the cycling is at 40-50 percent of VO_2 max or 40-50 percent heart beat reserve or Borg score 11-12. By adding cycling to the program, it is possible to increase the total size of exercising (in the stage in which the patient is not capable to walk a long time in succession). From week 7 on two different exercise sessions are performed daily. The first exercise session will be focused on decreasing the risk of cardiovascular diseases, while the second exercise session will be focused on increasing the maximum walking distance.

When, through circumstances, a patient is not able to exercise a week, the patient goes one week back in the program. Thus, if the patient has missed week 5 through circumstances, the training start again at week 4.

The level of stepping into the program depends on the results of the treadmill test according to table 12. An example of the activating program is shown in table 13.

Literature

1 Coumans B, Leurs MTW. Richtlijn Gezond Bewegen. Geneeskunde en Sport 2001:34;4:142-6.

Table 12. Assessment of the level of stepping into the program based on the maximum walking distance in a treadmill test.

Maximum walking distance in a treadmill test	Number of the week of stepping into an activating program
≤ 100 m	1
≤ 200 m	2
≤ 250 m	3
≤ 300 m	4
≥ 300 m	5

Appendix 3

Evaluation measuring instruments

Subgoal	Endresult	Evaluation-instrument
1. Decrease the objective exercise limitation		
a increase the maximum (pain free) walking distance	The patient can walk further (pain free and maximum walking distance increase with 100%).	• treadmill test
b increase the exercise capacity	The maximum aerobic capacity is increased.	• Maximum exercise test (possibly symptom limited) • assessment of VO_2 max (performed by medical specialist)
2. Decrease the subjective exercise limitation		
a increase the pain tolerance	The patient can and dares to walk through the pain until a score of 3-4 on the ACSM-scale for pain.	• history-taking • observation • ACSM-scale for pain • history-taking
b overcome the fear of physical exertion	The patient is not afraid anymore to exert himself.	• observation • Borg-scale
3. Improve the gait	The patient shows a more effective gait pattern.	• video-frames • gait analysis list Nijmegen
4. Decrease the physical inactivity	The patient shows a more active lifestyle: he exercises at moderate intensity at least 5 times a week for 30 minutes; score of 11-12 on the Borg-scale, 40-50% VO_2 max; 40-50% heart beat reserve (conform the Dutch Standard of Healthy Moving).	• diary • history-taking • risk profile of cardiovascular disease
5. Improve specific activities	The patient is capable of performing the activities better.	• history-taking • observation
6. Provide information/advise	The patient has insight in the (causes of) the disorder, the health problem, the course of the disorder and the prognostic factors. The patient recognizes the importance of an active lifestyle.	• history-taking • questionnaire

Appendix 4

Diary

The exercise diary is an important aid in the supervision of your movement activities. On the basis of your diary the physical therapist will be able to assess your progressions and to prevent overload. Based on the diary it can also become clear if the exercise load has to be adjusted. Finally the diary provides clear information on the way you cope with your complaints and if you have developed an active lifestyle.

MONTH: _____ **DIARY OF:** _____

Week: _____	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saterday**	**Sunday**
Date							
Night's rest							
Weight							
Activity: walking or something else, namely							
Number of walking periods*							
(Mean) duration of the walking periods*							
Number of resting periods							
(Mean) duration of the resting periods							
Total walking duration*							
Number of steps**							
Borg-score (6-20)							
Maximum pain score (1-4) until maximum pain							
Number of times walked until highest pain score							
Special circumstances							
Feeling afterwards Other remarks							

* *or distance in meters*

** *if known*

Explanation

Date: Fill in the current date.
Night's rest: Point out how your night's rest was: good/ sufficient/ moderate/bad.
Weight: present your weight in kilograms (until 0.1 kg precisely); weigh yourself in the morning after getting up.
Activity: walking or something else, namely …. Describe which activity you have done.
Number of walking periods*: Indicate the total number of periods that you walked today. Not the activities of daily life are meant, but only the walking periods performed (outside) as part of the walking exercise.
(Mean) duration of the walking periods*: Indicate the mean duration of the walking periods that day.
Number of resting periods*: How often did you have to rest as a result of your complaints?
(Mean) duration of the resting periods*: What was the mean duration of the resting periods.
Total walking duration*: How long did you walk today in total?

Number of steps*: This can only be filled in if you use a step-counter: How many steps did you take during the walking exercise?
Borg-score: The Borg-score is an aid to estimate the subjective load, the level of exertion, on a scale of 6 to 20. Indicate how heavy the load is during walking. This can only be done if you are familiar with the usage of the Borg-scale.
Maximum pain score until maximum pain: Indicate the maximum pain score that you achieved during walking. Make use of the following four points-scale: grade 1: light discomfort or onset of pain on modest level (present, but minimal); grade 2: moderate discomfort or pain of which the patient's attention can be diverted, for example by conversation; grade 3: intense pain (almost grade 4) from which the patient's attention cannot be diverted; grade 4: excruciating and unbearable pain. (The maximum pain score you achieved during exercising on the day concerned is meant.)
Number of times walked until maximum pain score: How often did you walk today until the maximum pain score that you achieved today during walking?
Special circumstances: If there were special circumstances you can describe them here, such as:

- injuries or complaints;
- abnormal weather conditions;
- powerful wind, rain, iciness;
- extreme temperatures or humidity.

Feeling afterwards: How did you feel when the walking exercise was over? Have you had complaints after the exercise and how severe were these complaints?
Other remarks: Here you can describe everything that you find important and that is not yet written down.

** These items are about what you really have done, not what you planned to do.*

Appendix 5

Education plan for patients with intermittent claudication

Education is necessary to come to a behavioral change

The treatment of patients with intermittent claudication intends to decrease the complaints as well as reduce the risks for atherosclerosis.1
On indication of the referring physician the physical therapist focuses on combating the physical inactivity. Therefore a structural behavioral change is needed. To enable the patient to achieve the desired behavioral change, education (by providing information and advise) is essential. The patient's readiness to change his behavior is determined by an interplay between attitude (how does the patient perceive the change in behavior?), social influences (how do others perceive the change in behavior?), the patient's perception of his own efficacy, his self-efficacy (will it work to change the behavior?) and the expected outcomes (what are the results for the patient of the behavioral change?).

Steps in the patient education plan

Van der Burgt and Verhulst emphasize that a behavioral change can only be achieved after fulfillment of a number of conditions first.2 In the process they distinguish six steps, with a behavioral change as the final step. This final step cannot be taken if the preceding steps have not been taken.

Step 1: Being open

The physical therapist adapts the methods used to suit the perceptions, expectations, questions and concerns of the patient. Important are the patient's main concerns and which concerns limit the patient's ability to be open to new information on behavioral change? It is possible that the patient is aware of the positive consequences of the behavioral change, but that he has no positive expectations of the behavioral change. It is possible that the patient thinks that the benefits do not apply to him. It is also possible that the patient thinks he is not capable to show the desired behavior.3

Step 2: Understanding

Information must be presented in such a way that the patient will understand it and remember it. It is important: not to provide too much information at one time; to decide which information is needed first and what can be saved for later; to repeat the message in another form, or to explain the message by using aids (leaflets and videos). The physical therapist should monitor whether or not the patient has understood the information provided.

Step 3: Wanting

The physical therapist should determine what (de) motivates the patient to act. Here it is important: to determine how significant performing the exercises is to the patient; to find out whether individuals in the patient's environment encourage or discourage the patient; and to determine whether the patient feels that he can influence the situation. The patient tries to estimate his chance on success: will he be able to perform the desired behavior? The physical therapist offers support and provides information about different options and alternatives. Achievable goals are set by the patient and physical therapist.

Step 4: Being able

The patient must be able to perform the desired behavior. Necessary functions and skills must be practiced. It is important that the physical therapist determines which practical problems the patient expects and decides how they will be overcome.

Step 5: Doing

This step covers the actual performance of the new behavior. The physical therapist makes a clear, concrete and realistic agreement with the patient and sets concrete goals. If possible, positive feedback is given.

Step 6: Keep on doing

The patient must to continue to perform the learned behavior after treatment has ended. During therapy, the physical therapist will discuss with the patient whether continuation is possible. It is important to know what the possibilities are, what encourages the patient, and whether there are any short-term or

long-term gains. The physical therapist should determine what helps the patient get back on track after a 'dip' in motivation.
It is important that certain characteristics of the patient are taken into consideration, such as:
255.locus of control: the degree of influence the patient believes he has over the situation;
1.attribution: the factors that the patient believes are having an influence on his life situation.
1.Coping: how the patient reacts to important incidents in his life;
2.Emotional state: the patient's current emotional state may temporarily prevent him or her being open to new information. Emotional state may also determine the way the patient deals with the situation.

A professional approach to providing patient education involves understanding all factors that can have a positive or negative influence on bringing about the (desired) behavioral change.

Analysis of the need for information
Formulating the education plan starts with an analysis of the patient's need for information, which was identified during history taking. This is about what the patient already knows and which information the patient still needs or needs again.

Information by the physical therapist
The physical therapist is primarily focused the subjects which are important for the physical therapeutic diagnosis, the treatment, and what is necessary to develop an active lifestyle. In addition the physical therapist checks if the patient needs information on other areas to prevent that important subjects are not sufficiently addressed.
Subjects that should certainly be addressed by the information of the physical therapist are:

- what happens during exertion that induces pain during walking;
- walking exercise, goal, instructions (intensity, condition, posture, pain limit, signs of overload, speed, distance, duration, footwear, pack), aids (such as step-counter), coaching, pain free walking distance (variations),exercise tolerance/exercise limitations, if necessary medication (kind, dosage, side effects), notification at thrombosis clinic;
- information material, such as brochure/video material
- exercise principles;
- exercise effects and exercise goals;
- exercise methods;
- pain scales;
- risk factors cardiovascular diseases, decrease risk behavior;
- what a patient can do on his own and the value of a healthy lifestyle;
- Dutch standard of Healthy Moving;
- diary;
- signs of overload (heart, muscles and joints);
- feet and skin care;
- influence of smoking on the physical performance ability, the maximum (pain free) walking distance;
- do's and don'ts;
- FAQ's (Frequently asked questions)
- when the patient has to contact the primary care physician.

Other information
In addition to the list above there are subjects that should be addressed but which are not directly related to the physical therapeutic activities. The physical therapist assesses on the basis of a checklist if the patient needs information on the following subjects:

- Information on the disorder; what is peripheral arterial diseases, intermittent claudication (causes, symptoms);
- prognostic factors, course of the disorder;
- risks for CVA, myocardial infarction;
- diagnostics;
- ankle-arm index, Doppler-echocardiographs, duplex-angiographs, magnetic resonance-angiographs;
- treadmill test;
- therapy: different possibilities;
- walking exercise, possibly in combination with medication;
- percutaneous transluminal angioplasty
- surgery.

For this information a good agreement with other disciplines is necessary.

Realization of the information process
It depends on the subject if the information process will be individually or in a group. This will be assessed by the physical therapist. In general the information on the disorder, prognostic factors, diagnostics

and different treatment alternatives can be provided in a group. This can be realized in two sessions. Other forms of information, such as providing concrete guidelines or prescriptions and providing supervision, can better be realized individually.

Literature

1 Kaiser V, Hooij JD, Stoffers HEJH, Boutens EJ, Laan JR van der. NHG Standaard Perifeer Vaatlijden, NHG Standaarden I. Utrecht: Nederlands Huisartsen Genootschap; 1999.

2 McGrae-McDermott M, et azl.. Leg symtoms, the ankle-brachial index and walking ability in patients with peripheral arterial disease. J Gen Intern Med 1999; 19:173-81.

3 Newman AB. Commentary on 'The effects of peripheral vascular disease on gait'. J Gerontology 1999;54A(7):B295-B296.