EPISODE RESEARCH TRAINING

CKO-9

and

RESEARCH TRAINING INTERNSHIP

September 2020

CONTENTS

1 PREFACE

Scientific research is driven by scientific curiosity, by professional and social ambition, and – certainly in today's medicine – by evidence-based motives as well as by serendipity (i.e. making a fortunate discovery while looking for something else). So, there are many factors that influence the health care people receive following or during a visit to the doctor.
It often starts with discoveries made by scientists working in laboratories. Once scientists or medical-specialists spot the potential of the scientists' work, they begin to develop it further, with clear goals in mind: to help to cure or prevent disease. In some cases medical breakthroughs arise following a researcher's study of the spread of a disease between people or from the question whether it is desirable to implement a new treatment.

Medical-specialists have to deal with this continuous development in the field of medical knowledge. They have to keep their knowledge current and anticipate new insights and advanced technical possibilities. One of the important skills required in this process of advancement of knowledge is a critical attitude towards research practice. Furthermore, medical specialist themselves conduct experiments to aid and support these developments in scientific knowledge.

Medical-students have to familiarize themselves with this always changing and exciting world of scientific research. This acquaintance starts in Context, Science and Innovation (CSI) and continues in (research) Minors in the bachelor's phase. Their theoretical scientific training ends in the master's phase in Episode Research Training / Episode Onderzoeksstage in which they choose a Research Training Internship. This internship is further developed in CKO-9. This episode can take place in the final stages of their master's program, when they have already gained experience by training at various clinical departments or at the beginning, prior to their clinical internships, in case of a waiting period.

We hope that the CKO-9 course and the Research Training Internship that forms part of this episode will increase your enthusiasm for scientific work and form the kick off for a continuing research career in this exciting and important medical field following your graduation.

2 CHOOSING YOUR RESEARCH PROJECT

There is a wide range of research projects open to students when preparing for their Research Training Internship (RTI). These can be found in any department of the Radboud University Medical Centre (Radboudumc) or in many institutions elsewhere in the Netherlands and abroad. These may be projects in clinical specializations within or outside the hospital, in basic science subjects, in meta-medical domains, or in the behavioural sciences. In each and every case, the RTI must meet the following quality requirements:

- the internship plan must be approved by the Research Training Committee (RTC);
- the internship will be pre-trained in the CKO-9 course;
- the host organization for the internship must guarantee host supervision quality;
- the internship plan must make clear that the proposed time frame can be met and can be completed with a report;
- a senior member of staff, holding a doctorate degree and employed by the Radboudumc, must declare him/herself prepared to take on final responsibility for supervision and assessment (the Radboudumc final supervisor).

Research Training Committee (RTC)

The chair of the Research Training Committee: Professor J.P.H. Drenth
- phone 024-3616999
- email Joost.Drenth@radboudumc.nl

The managing director is dr. J.D.M. Otten

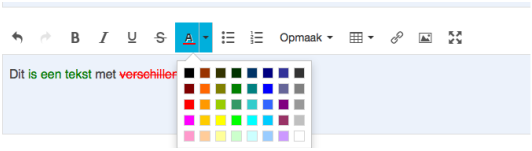
The Committee consists of 4 members, all of whom are qualified principle investigators and represent scientific disciplines ranging from applied medicine (causal and predictive research) to (molecular) life sciences.

Students are strongly encouraged to apply for an RTI abroad as this is in line with the University's pursuit of internationalization goals. A majority of medical faculty staff have contacts with leading research institutes elsewhere in the world. They are often prepared to assist motivated students in the organisation of an internship project abroad. These internships, however, are subject to the same quality requirements as internal RTIs or other external RTIs.
Students must be aware that RTIs abroad require more preparation and additional effort; often this requires a preparatory period of at least one year. The internationalization officer of the Radboudumc Education Institute has been specifically appointed to support students in preparing for these training programmes abroad.

2.1 Procedure

Before students embark on their RTI, they have to register their project plan for approval by the RTC. Registration for Episode Onderzoeksstage / Episode Research Training is done electronically via their Student Web Dossier. In their application students have to provide information about supervision arrangements and about the content of the project they intend to do. The latter implies that they give a concise project outline of (preferably) max 2 A4 (background, research question, study design, impact, plan of work, feasibility, literature). A template for the concise project outline has been included in the Appendices. It is necessary that the Radboudumc final supervisor formally agrees with this concise project plan. Agreement implies that not only the student, but the final supervisor is also acquainted with the Episode Research Training Course Book and that there is sufficient opportunity for achieving the general learning objectives of the internship in the 12-week period available. This forms the first quality control step in internship projects.

The application for episode Onderzoeksstage / Research Training must be uploaded in the webdossier before the start of the period preceding to the block-period in which students wish to enrol in the CKO-9 training period. This means six weeks before the desired start date of CKO-9 (see for start dates and deadlines the Radboudumc website).
Only if the final advisor has approved the application, the application is registered at StIP.
Because the supervisor must have the opportunity to review and potentially revise the proposal this means you have to start uploading even before the six weeks.
Students are informed about each step of the process by email. It is their responsibility to monitor the process and – if necessary – to remind the final supervisor that he/she still has to review the proposal in his/her IWOO-portaal.
After the proposal has been approved by the final supervisor, the RTC reviews the project plan and provides commentary if the project outline lacks information or is of insufficient quality. **If the RTC puts the proposal on hold, track changes in the initial proposal must be in red.**



Also, before approving an internship, the RTC verifies whether the conditions necessary for supervision have been met. Without approval of the RTC, students cannot embark upon the CKO-9 course nor on their internship. Please note: In case accreditation by Ethics Committee is necessary and NOT already obtained, the RTI cannot be approved by the RTC. Students can monitor the progress of the approval procedure via their Student Web Dossier. After formal approval, and after students have been assigned to the CKO-9 course, the quality control process has been completed. Please note: students may only embark on their RTI after they have completed the CKO-9 course.

If two students embark on an internship together, both students must submit their own application and their own (and hence not identical) project proposal.
In case of an internships not at Radboud University Medical Centre (abroad or external), written confirmation from the host institution is required specifying who will supervise the student at the host institution.

2.2 Selecting your project

First of all, students need to decide on the country, city, institution, and discipline in which they mean to take the RTI. Subsequently, they need to investigate the practicalities and verify whether their ideas are feasible.
When selecting an RTI, there are two routes for students to take: either they make a choice from the list of available projects on the web or they take the initiative to arrange an internship themselves. These two routes are described below.

Project proposals initiated by scientific departments
On the Radboudumc website students can find descriptions or suggestions for RTI projects.
Members of staff at scientific departments often frame project proposals that link to the research interests of that particular department. These proposals are sometimes readymade and allow students to make an immediate start. More commonly, however, project proposals contain a general outline and describe the research theme or research methodology in broad terms. In this case, it is up to students and their supervisors to formulate a concrete internship plan that is feasible in a 12-week period.

SELECTING A RESEARCH PROJECT FROM THE WEB-LIST

Student selects a project from the web-list and contacts the organization that offers an internship (often Radboudumc)
↓
Both host (or daily) supervisor and Radboudumc final supervisor confirm or deny student's placement.
↓
Student applies via Student Web Dossier for Episode Research Training / Episode Onderzoeksstage and provides information about his/her project plan which has been approved by Radboudumc final supervisor (see Appendices).
↓
Student checks whether the internship proposal has been approved by the RTC and when he/she is enrolled in the CKO-9 course.

Project proposals initiated by students
Students are at liberty to look for or formulate their own RTI position and find an appropriate host for internship and supervision. A common procedure is for students who are interested in a particular field to contact a department or a researcher to discuss the options for an RTI. They then jointly formulate an internship plan, which may match the framework of an ongoing research project. Next, the student needs to arrange host-based supervision that meets the regulations for supervision and assessment. Students then contact the Radboudumc supervisor, presenting an outline of the activities proposed to take place at the host organization and the supervision arrangements made with the host institution. The Radboudumc supervisor then decides whether he/she is prepared to take on final responsibility for the internship. On acceptance, the student informs the host supervisor.

DEVELOPING YOUR OWN INTERNSHIP

Student contacts the host organization to discuss options (can also be Radboudumc).
↓
Student presents a draft version of activities and arranges host-based supervision at the host organization of their choice.
↓
Student contacts a Radboudumc final supervisor.
↓
The Radboudumc final supervisor decides whether he/she is prepared to take on final responsibility for the internship and makes arrangements with the host tutor.
↓
Student contacts the host organization.
Host tutor confirms whether student can or cannot be accepted for an internship.
↓
Student applies via Student Web Dossier for Episode Research Training / Episode Onderzoeksstage and provides information about his/her project plan which has been approved by Radboudumc final supervisor (see Appendices).
↓
Student checks whether the internship proposal has been approved by the RTC and when he/she is enrolled in the CKO-9 course.

2.3 Supervision during the RTI; by whom?

A senior member of staff, holding a PhD and employed by the Radboudumc, has final responsibility for the RTI. This also applies to internships that take place outside Radboudumc. This Radboudumc final supervisor is also responsible for approving (or adjusting) the assessments of the first assessment protocol. His/Her assessment of the first assessment protocol is decisive.

Internal internship
RTI performed at Radboudumc must be supervised by a Radboudumc member of staff holding a doctorate. In everyday practice, non-PhD staff can also be involved in supervisory activities. In this case a senior member of staff holding a doctorate (the Radboudumc final supervisor) will be formally in charge of project supervision and will be responsible for approving the project proposal in advance, and/or approving (or adjusting) the daily supervisor's assessments of the first assessment protocol.
The (daily) supervisor holds regular supervisory meetings with students and provides day-to-day project supervision. The internship student takes the initiative for scheduling supervisory meetings. Should any problems occur, the Radboudumc final supervisor is the person that students can turn to, to discuss issues regarding their research tasks at the department. If this does not help to improve matters, or if the daily and final supervisor are one and the same person, students can contact the RTC.

External internship
In case of external internships (either in the Netherlands or abroad), supervision at the host institution needs to be guaranteed. The Radboudumc final supervisor who was responsible for initial project approval also has the final responsibility for supervision and makes sure that supervision at the host institution is practised

in the right way. He/she is also responsible for approval (or adjustment) of the host supervisor's assessments of the first assessment protocol.

Prior to the start of an external internship the Radboudumc supervisor needs to be convinced of the likelihood of the internship being completed successfully. In preliminary contacts, attention needs to be paid to the suitability of the internship topic, its feasibility, host supervision arrangements, and assessment procedures. The host institution agrees to provide the required supervision. In case of an internship abroad, travel, accommodation, and organizational issues involved need to be taken care of.

The host supervisor at the internship institution is responsible for supervision throughout the internship and holds regular supervisory meetings with the student. The daily supervision does not necessarily need to be provided by the host supervisor; they can delegate this task to qualified replacements. The internship student takes the initiative for scheduling supervisory meetings. In addition, the host supervisor is responsible for assessing the internship, both its final product and the process leading up to it. Should any problems occur, the host supervisor is also the person for students to turn to and discuss issues regarding their research tasks at the department. If this does not help to improve matters, students should first contact their Radboudumc final supervisor. If no solution is found, students can contact the RTC.

3 ORGANISATION EPISODE RESEARCH TRAINING

Episode Research Training / Episode Onderzoeksstage consists of two parts:
- The Central Clinical Education CKO-9 course 'Professionalising your approach to Medical Research'
- A twelve week Research Training Programme (Internship).

Coordination

The responsibility for the entire episode programme and its execution lies with Episode Research Training / Episode Onderzoeksstage Coordinator professor L.A.L.M. Kiemeney
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The final responsibility for the Central Clinical Education (CKO-9) lies with Executive Coordinator dr. J.D.M. Otten
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The final responsibility for the Research Training lies with the chair of the Research Training Committee professor J.P.H. Drenth
- phone 024-3616999
- email Joost.Drenth@radboudumc.nl

3.1 Learning Objectives

3.1.1 Central Clinical Education (CKO-9)

An inventory of the scientific topics of previous Nijmegen research internships shows that the majority of these projects can be classified as applied medical research. These studies provide quantitative evidence on the effect of medical interventions, and on the diagnosis, aetiology and prognosis of disease. The remainder of the projects can be classified as mechanism studies (how illnesses develop) and health care evaluations. The CKO-9 course deals with the aims, methodology and procedures associated with scientific research. Up to this point in the curriculum, students have engaged with other people's scientific work, but, in their 12-week RTI, they will conduct their own first scientific study based on their Plan of Work created during this course.

Central learning objectives
CKO-9 is a two-week basic training course preceding the internship. After completing the training course students are able to conduct their internship following the proposed Plan of Work.

Key Features
The course teaches you to:
- relate current medical research (literature) to your own research project
- motivate the rationale of your research and address the main research question
- follow pathways resulting in an efficient study design
- understand common study designs, meta-analysis, and qualitative studies
- define key variables and determine how to measure them
- consider the number of subjects / materials / tissues needed
- organize the data collection
- analyse data (computer lab with SPSS)
- organise, manage and report a Plan of Work.

3.1.2 Research Training Internship

The main objective of the RTI is for students to enhance the scientific understanding they gained in the Bachelor's cycle and in the CKO parts of the Master's cycle by deepening, widening, and applying their understanding to more specific and more complex situations. The internship should be considered an educational or learning activity, which is also true for preparing the research report: the internship is an exercise in performing research, not a test of researcher competence. This does not preclude certain students from actually achieving a more or less independent researcher level.

General learning objectives
The RTI comprises the following general learning objectives. Students can:

1. specify the motive for the study, the interests it serves, and the medical scientific context in which it fits (= CKO-9).
2. draft a definitive research proposal on the basis of the following skills:
   a. They can retrieve, critically read, and systematically review relevant literature.
   b. They can give greater precision or depth to the research question based on literature.
   c. They can formulate a study design that fits the definitive research question.
3. organize and execute the proposed study.
4. systematically analyse the data they have collected.
5. provide clear descriptions of their results and neat summaries in tables and figures.
6. point out errors of measurement and other limitations in the data they collected.
7. critically reflect on the study design and the results.
8. produce a written report that conforms to requirements:
   a. In terms of content (justification of the study design, clear description, analysis, critical reflection).
   b. In terms of form (carefully edited, trim layout, clear language, references).
9. deliver a concise oral presentation of research results to the department where the study was performed and engage in productive discussion of its results.

3.2 Personal learning objectives of the Research Training Internship

In addition to the general learning objectives, there may be specific and personal learning objectives related to a particular type of internship: for one type of internship students will need to compose a questionnaire for data collection purposes, and in another type, they will need to learn how to use a pipette; in one, they will need to recruit test subjects, in another, they will be working with experimental animals or with laboratory samples that have already been collected. Sometimes, they need to write an application to the Central Committee on Research Involving Human Subjects, and sometimes this will not be necessary. This shows how a range of personal learning objectives may be required on a case-by-case basis. Students have to include three specific learning objectives in their Plan of Work. It is important that students and their supervisors agree on both the general learning objectives as well as the personal learning objectives in advance: which specific skills must a student have developed when completing their internship?

3.3 Assessment

3.3.1 Assessment Central Clinical Education (CKO-9) course

During the CKO-9 course which lasts two weeks, students prepare a Plan of Work for their own RTI. This written plan is the final product of the CKO-9 course, to be assessed by the CKO-9 course lecturer on a pass-fail basis. In case of a fail, the course coordinator will ask students to revise their plan; students can only officially embark on their RTI when they have produced the desired result.
As an additional course requirement, students must have discussed their Plan of Work with their supervisors, and these supervisors must have approved of the plan, considering it feasible and suitable to achieve the internship objectives. Also, the student's presence and dedication during the scheduled instruction activities have to be satisfactorily fulfilled (see also "Attendance and absence" in chapter 3).

3.3.2 Assessment Research Training Internship

The RTI will be assessed by two assessment protocols. These have been created to validate the reliability of the assessment procedure. If the first assessment is biased due to process aspects – for example the project-based collaboration between student and supervisor – the independent assessment of the written report by a second assessor may redress the balance.

First assessment protocol
The first assessment protocol (see Appendices) is used by the internship's daily or host supervisor. If this supervisor is not the same person as the Radboudumc final supervisor, the latter must express his/her (non-) agreement with the assessments of the former, and in case of non-agreement adjust the grade and motivate the grade change. Especially for foreign internships, adaptation of grades is often required, because foreign grading systems can deviate substantially from the Dutch system. The assessment of the Radboudumc final supervisor on the first assessment protocol is decisive.

The first assessment protocol distinguishes between assessment of students' overall performance (process aspects) and their achievements (learning outcomes), i.e. the degree to which they have accomplished the general internship learning objectives. These general learning objectives relate to aspects like the research rationale, study design, organization and execution, data analysis, discussion of results, and the written research report. The protocol also records specific internship learning objectives, which, however, do not contribute towards the final grade.

Second assessment protocol
An independent second assessor will be asked to assess the RTI report (product aspects) by means of a second assessment protocol. If the first assessment should be biased due to process aspects – for example the project-based collaboration between students and supervisors – the independent assessment of the written report by a second assessor may redress the balance. As the written report (product) may be considered an account of the students' learning, it may indirectly and implicitly reveal something about the general learning objectives of the internship. The report can be assessed *objectively* by this independent second assessor as he/she is unaware of students' and supervisors' day-to-day conduct throughout the internship. The protocol used in assessing the report deals with aspects of both content and form (see Appendices).

Final grade of the episode
As soon as the assessments have been recorded in the abovementioned protocols, the final grade of the RTI is determined by the chairperson or a member of the RTC. Only after a member of the committee has co-signed the final assessment form, will the final grade be valid.
The final grade of the internship is calculated as follows: the overall performance grade + the general learning objectives grade + 2 x the written report grade / 4. Each of these separate grades must be a pass for students to pass their internship. The RTC chairperson acts as the examiner on behalf of the Examining Board. If the assessments in the first protocol are not validated by the Radboudumc final supervisor or if the grades on both protocols are too far apart (with a gap of three points or more), it is up to the chairperson to decide on whether measures need to be taken. The final result is registered in OSIRIS, the student information system.

In accordance with examination regulations, this episode is given a single grade. The final grade is the same as the final grade awarded to the RTI. The grade will only be valid if students have passed their CKO.

The above is a paraphrase of the assessment regulations for Episode Research Training / Episode Onderzoeksstage. The full text of the episode assessment regulations can be found on the Episode Research Training BlackBoard page.

3.4 Evaluation

Radboudumc Health Academy (RHA) has developed a questionnaire to evaluate all components of the clinical Master phase. After finishing the RTI and submitting it via the Student Web Dossier, students receive an automatically generated email after one week to evaluate both the CKO-9 course and the RTI using our web-based questionnaire. It would be greatly appreciated if this evaluation is completed immediately after receiving the email.

4 TWO-WEEK CKO-9 COURSE

4.1 Professionalising your Approach to Medical Research

Over the last five years, more than 1,000 medical students have participated in and successfully completed the CKO-9 course. Their feedback:

Our intention, our wish:

> You are now nearing your choice of clinical specialisation. The CKO-9 course has been designed to demonstrate how medical research will guide and support you as a practicing specialist. Research forms the basis for creating new knowledge, which in turn leads to new or improved medical practice. By experiencing a professional approach to research, we hope that, in the future, a number of you will continue to be active researchers alongside your daily work in your chosen specialisation.

'Looking back at the CKO-9 course, I notice that I learned a lot. In the beginning, I honestly had no clue about how to start a research project. Now I have a clear plan of approach'

'I have more ideas about the possibilities and limitations of my research project. Now it feels like a personal piece of work.'

'I'm glad I took this intensive 2 week research crash course. I wanted to learn the basics quickly before I started my research internship'

'We learned to make a Plan of Work for a scientific research project. This will be very useful in the near future when I decide to do more scientific research elsewhere.'

4.2 Structure and Learning Components

4.2.1 Main Objective CKO-9

After completing this course you are ready to conduct your medical research internship following the proposed Plan of Work. To optimally benefit from your internship we have developed ten modules, which, together with lectures, four work groups and one computer lab on SPSS biostatistics, form the learning components of the research methodology course. ***You will find the CKO-9 course and its learning components on Brightspace, once you have been enrolled in CKO-9.***

Team of teachers

Course coordinator Central Clinical Education (CKO-9) dr. J.D.M. Otten
- phone 024-3616979
- email Hans.Otten@radboudumc.nl

The names of CKO9 teachers can be found in Brightspace.

4.2.2 Blended learning: The CKO-9 way of working

In CKO-9 we stimulate the use of peer review, which you will become familiar with in the first lecture. This formula is used in all workgroups and is strongly recommended, although not compulsory.
The benefits of peer review will become clear as you interact with your fellow students to prepare the workgroups by following the modules. Peer review through interaction with peers and the lecturer during the workgroups will re-enforce the process of critical reflection. This will help you to decide on the various aspects of scientific research and will eventually improve the products you make, leading to a considered plan of approach for your RTI.

The assignments start by reading chapters in the book of Zielhuis et al., which provide the theoretical background and an overview of the more practical skills necessary for fulfilling the course assignments. The course comprises of an interactive mix of teaching and learning: two interactive lectures, ten study assignments, four work groups which include peer and intervision elements, one computer lab session, and individual coaching & support throughout. These learning methods have been designed to help you understand and apply the principles and methods of predictive and causal research independently. At the end of the second week, you have to defend your written Plan of Work. The course text is in English, whereas the course itself will be given in Dutch.

COMPULSORY TEXTBOOKS

Zielhuis GA, Heydendael PHJM, Maltha JC, van Riel PLCM. *Handleiding Medisch-wetenschappelijk Onderzoek.* Zesde herziene druk. Amsterdam: Elsevier Gezondheidszorg, 2010, pp. 220.

Petrie A, Sabin C. Medical Statistics at a Glance. Oxford: Blackwell Publishing Ltd, 2009, 3rd edt.

Fletcher RW, Fletcher SW. Clinical Epidemiology: The Essentials. Philadelphia: Lippincott Williams & Wilkins, 2005, 4th edt.

ELECTIVE TEXTBOOKS ON

SPSS: de Vocht A. *Basishandboek SPSS 20.*Eerste druk. Utrecht: Bijleveld Press, 2012, pp. 255.

QUALITATIVE STUDIES: Lucassen PLBJ, Olde Hartman TC. *Kwalitatief onderzoek. Praktische methoden voor de medische praktijk*. Bohn Satfleu van Loghem. Houten 2007, pp.

META-ANALYSIS: Egger m, Smith GD, Altman DG. Systematic reviews in health care. Meta-analysis in context. London: BMJ Publishing Group, 2001, 2nd edt.

4.3 Attendance and absence

As participation in all scheduled instruction activities (lectures, seminars and computer lab) is compulsory, absence will be registered. If students are unable to attend compulsory course components, they must inform the course coordinator (via BlackBoard) who will decide whether their absence is permitted or not. If a student's absence is legitimate, the coordinator will assess whether lost ground needs to be made up by means of an assignment. If students are absent without leave or show lack of commitment, they will fail the CKO-9 course.

5 TWELVE-WEEK RESEARCH TRAINING

5.1 General information

Besides practical professional training, scientific education is an important component of a medical study programme. It involves gaining knowledge of scientific methods and a series of skills, for example an investigative and inquisitive mindset, the power of precise formulation, and having an orienting mindset exploring disciplines other than your own. Together, these elements foster the development of a scientific attitude.

Having received scientific training in the Bachelor's cycle (MPV, optional courses, and 5BOSA8) and in the Master's cycle (CKO and CKO-9), students complete their scientific training in the Research Training Internship (RTI). This internship takes place in the final stages of the Master's phase - generally in the final six months - when they have already gained experience at various clinical departments. However, when students are on a residency waiting list, they may opt to take their RTI prior to CKO-1.
In all cases, students must contact the host organization well before the start of the internship to discuss the starting date and other important matters.

It is important that students submit major changes in the approved project plan to the Research Training Committee (RTC) after receiving confirmation of the Radboudumc final supervisor. If the student doubts whether the changes are minor or major, it is advisable to submit the project plan to the RTC to prevent problems with the assessment later on.

Coordination

The final responsibility for the Research Training lies with the chair of the Research Training Committee professor J.P.H. Drenth
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The Research Training takes 12 consecutive full-time weeks, a period which the medical faculty considers a minimum requirement for achieving the objectives that have been set. The internship must be completed within this period, including the report and assessment by the supervisor. If students should wish to pursue their research projects on a voluntary basis after this period, they are at liberty to do so, if their research interests do not interfere with their residency or their exams. The number of credits awarded to the RTI will remain the same.

Extended RTI
There is an option for students to take an extended RTI, in which the internship is extended by a maximum of three months and replaces their optional residency. Application in advance is required.
If students indicate, in advance, that they would like to take an extended RTI which does not replace their optional residency but is in addition to it, this can be referenced on their degree certificate.
If students wish to take an extended RTI (with a maximum duration of three months, replacing their optional residency), they must provide a motivation in their project outline. This motivation should contain information on how the extended length of the internship will be reflected by increased complexity of the project and the final product. Obviously, if students want to take an extended internship in addition to the regular curriculum, they must also provide a motivation in advance.

Exemption in special cases.

The scientific internship is a compulsory exam component for all students. However, those who have performed scientific work at a level that clearly meets the requirements of the RTI may be exempt from the RTI. The main requirement for exemption is that students should have produced an approved dissertation leading to a *doctoraal(Master's)* examination on a topic or subject that is relevant to medicine.

Granting exemptions is the exclusive privilege of the Examining Board in Medicine, based on advice from the Research Training Committee (RTC). An application for exemption addressed to the Examining Board in Medicine must be made in writing, stating reasons and submitting the appropriate evidence (report and assessment).

5.2 Supervision; what does it mean?

Supervision Protocol
It is self-evident that, in supervision, matters of content need to be dealt with. These might relate to topics such as inevitable time constraints, making content choices, mastering the necessary research skills, the availability of materials, etc. Time devoted to supervision by supervisors may vary, but a minimum time investment of 30 to 40 hours must be expected. During the initial and concluding stages, a great deal of supervision time will be required in particular.
During supervision of the final projects, students meet up with their host supervisor several times. It is up to students to take the initiative to arrange supervisory meetings. In addition, students must also make sure that their supervisor receives the relevant information in writing several days prior to the meeting, in order for him/her to be able to prepare for the meeting properly. After the meeting has taken place, students write a concise report of the major observations, conclusions, and appointments. This report is a memory aid for both students and supervisors. In case of an internship outside Radboudumc, the student should also send a copy of the report to the Radboudumc final supervisor to keep him/her informed of the student's activities at the host institution.

The following delineation of six supervisory meetings is merely a suggestion and does not need to be strictly adhered to. This description is to illustrate to students that they may expect regular supervision and to emphasize that they themselves are expected to carefully plan and prepare supervisory meetings.

Introductory meeting
During their CKO-9 course, students have contacted their internship supervisor to make sure he/she agrees with the process of research topic development during the CKO-9 course. This contact may lead to an introductory meeting. If this is impossible, an introductory meeting should be scheduled at a later time.
During this introductory meeting, the following points need to be raised:
- organizational matters, such as: contracts, the Radboudumc supervisor, day-to-day supervision at the host institution, facilities at the host institution and time frame. These matters should have been arranged in advance, but need to be checked during this meeting;
- the final products that are to be handed in (report, paper, oral presentation) and any possible additional details, such as the language of the report;
- supervision: what arrangements have been made?;
- personal learning objectives: how can they be achieved?;
- important information on the day-to-day activities at the host institution;
- information about the research topic that is important for students to have in advance. In summary: preparing the research topic.

First meeting: the research plan (general learning objectives 1 and 2)
In the very early stages of the internship, the provisional research plan (i.e. the final product of the CKO-9 course) needs to be finalized. First of all, students need to reconsider the motive of their study. What is its relevance? In which medical scientific context does the study fit? If necessary, students need to trace, critically read, and systematically review additional literature. They must re-examine and improve their research question and work towards a fitting study design. This stage is all about writing a sound and detailed research plan, which includes a time frame. Students hand in this plan to their supervisor several days before their supervisory meeting is scheduled.
Topics for discussion during this meeting may include:
- the plan's strong and weak points;

- unfeasible aspects of the plan and suggestions to improve these;
- appointments.

Students write a concise report of this meeting.

Second meeting: making the study design more concrete (general learning objectives 2 and 3)
You are in the final stages of developing the study design. The choices you have made previously now need to be justified. New choices have to be made regarding the operationalization of the major variables. Several days before the meeting is scheduled, students hand in the required information to their supervisor in writing. Topics for discussion at this meeting may include:

- the fit between the study design and the research question; is the design complete?;
- the suitability and quality of the measurement instruments that will be used;
- a data collection strategy;
- organizational aspects of data collection;
- appointments.

Students write a concise report of this meeting.

Third meeting: data analysis and description of results (general learning objectives 4, 5, and 6)
Several days before the supervisory meeting is scheduled, students hand in a partial report including data and results. Topics for discussion at this meeting may include:

- data analysis;
- description of the results;
- appointments.

Students write a concise report of this meeting.

Fourth meeting: first draft of the research report (general learning objectives 7 and 8)
Several days before the meeting is scheduled, students hand in a first draft of their report. Topics for discussion at this meeting may include:

- the structure of the report;
- the contents of the report;
- the results and statistics;
- the discussion, conclusions, critical reflection on design and results;
- language: clarity, unambiguousness, reasoning, and style.

Students write a concise report of this meeting.

Fifth meeting: second draft of the research report (general learning objectives 7, 8, and 9)
Several days before the meeting is scheduled, students hand in the second draft of their report, having processed any remarks made during the previous meeting. Topics for discussion at this meeting may include:

- the processing of remarks made during the previous meeting;
- extra attention has to be paid to the discussion, the conclusion, and placing the conclusions in a wider perspective;
- agreements about finishing the report;
- agreements about the oral presentation to be given at the host institution.

Students write a concise report of this meeting.

Sixth meeting: final meeting (general learning objectives 7, 8, and 9)
Before this final meeting, the supervisor has examined the final draft of the research report. The oral presentation at the host institution has been given. This final meeting deals with:

- discussion of the oral presentation;
- assessment of the internship, report and oral presentation;
- evaluation of the internship;
- any further positive criticisms relating to the internship, supervision, etc;
- the future: paper or follow-up study.

When the final meeting has taken place, it is the responsibility of the student to make sure that the Radboud final supervisor – if this is not the same person as the (daily or host) supervisor – is presented with a copy of the report and expresses his/her (non-) agreement with the assessments of the (daily or host) supervisor. In case of non-agreement the Radboudumc final supervisor adjusts the grade and motivates the grade change. Especially for foreign internships, adaptation of grades is often required, because foreign grading systems can deviate substantially from the Dutch system.

The RTC does not play a direct role in the actual supervision of RTI; it has a conditional and monitoring role. By making sure that expedient procedures are in place and by spot-checking these procedures, the committee aims to make sure that proper student supervision during the RTI is guaranteed. If there are any problems during the internship, the committee is available for mediation and, if necessary, correction.

5.3 Writing your research report

All students finalize their Research Training with a written report, preferably in English. This report may be a research report or a draft paper. In case of a twin internship, both students must produce their own individual written report corresponding to their individually submitted project proposals.

ADDITIONAL TEXTBOOK

A very useful guide to performing medical research is:

Overbeke AJPM, Gijn J van, Walvoort HC. *Publiceren in biomedische tijdschriften. Een praktische handleiding.* Houten: Bohn, Stafleu & Van Loghum, 1999, pp. 220.

The results of scientific research are commonly reported in journals. Describing scientific results requires proficiency in precise and concise writing. Reporting the results of the RTI is therefore an excellent opportunity to practise this skill. This is why students are expected to produce a concise report, regardless of whether they choose to hand in a draft paper or a research report.

5.3.1 Research report

Students need to bear in mind that an exhaustive or lengthy report causes a reader to exasperate and generally does not contribute to a favourable assessment. The maximum length of the text is 5,000 words (appendices and reference list included). The number of words must be stated on the title page.

The RTI report may be written in Dutch or English.

The RTI report must include the following elements:
- a full title page (title, author, supervisor(s), department, internship period, duration of internship, date of the report);
- structured summary (aim, method, results, discussion) not exceeding one page;
- contents including page numbers;
- orderly structure (see below) (example: background, research question, method, statistical analysis, results, discussion, putting your own results in a wider perspective);
- tables and figures, if applicable (always containing a number and title);
- footnotes and references.

There are several ways to structure a report. An example is given below.
- Summary
  This is a brief but complete description of all important elements (max. one page). It includes the aim, place where the study was performed, research design, methods, results, and conclusion(s).
- Contents
- Preface
- Chapter 1: Introduction
  The introduction outlines the motive for the study. It also details the wider framework by briefly summarizing the literature relevant to the research question. The introduction ends with the formulation of the research question.

- Chapter 2: Research question
  This chapter expands on the research question, paying attention to bottlenecks, preconditions and any additional questions. This is also where you define the concepts.
- Chapter 3: Method
  This chapter describes exactly how the study was designed. It deals with the following issues:
  study design;
  population or materials investigated;
  techniques and instruments used;
  interventions or more general determinants;
  method of analysis.
- Chapter 4: Results
  The results are presented in this chapter.
- Chapter 5: Discussion
  This chapter deals with the following issues:
  linking the results to the research question;
  any methodological limitations in the design or the execution of the study;
  discussion of the results in light of previous research;
  any recommendations.
- References
  References must be presented in line with journal regulations (See Zielhuis et al. p. 170). Use one style consistently throughout the report.
  Example 1:
  Zielhuis G.A., Heydendael P.H.J.M., Maltha J.C., Riel P.L.C.M. van (2010). Handleiding medisch-wetenschappelijk onderzoek. Utrecht: Wetenschappelijk uitgeverij Bunge.

  Example 2:
  Taylor S.E. Hospital patient behavior: reactance, helplessness or control? Journal of Social Issue (1979); 35: 156_184.
- Appendices
  For example: measurement instruments, letters, additional tables and graphics, glossary, etc.

5.3.2 A draft paper

If students choose to write their final report in the form of a draft paper , their contribution is likely to be part of a team effort, as there are often multiple authors. To make sure that the student's contribution is acceptable, students are required to be either the 1st or the 2nd author of the draft paper. The RTC prefers a (first) draft article over a final version. Not only because there is usually insufficient time to develop a final version (see deadline), but also because a draft version provides more insights into what students *themselves* are able to do, i.e. what they have learned. Also, in addition to the draft article, the RTC requires a process description (max 2 A4) in which students describe the research activities that they have performed themselves and evaluate how this went. Both files must be in ***one*** final report, including a table of contents with page numbers, followed by the process description and the draft paper.

The draft paper must be structured like a research paper (i.e. abstract, introduction, methods, results, discussion, conclusions). Maximum length is about 3,000 words, however author guidelines of the preferred scientific journal is decisive (in general and for the word count). The number of words must be stated on the title page.

5.4 Uploading the report and assessment

After completing the internship, the final report (research report or draft article plus the process description) must be uploaded via Student Web Dossier preferably **on the last day of your internship** (a maximum of 3 months delay is allowed). **For internships starting from 1 January 2018 the maximum allowed delay is 4 weeks.** After uploading the final report, the following people will assess the work:

1. the (daily or host) supervisor. This person assesses the student's performance based on the first assessment protocol, including the general learning objectives stated in his or her assessment and the report (general learning objective 8);
2. the Radboudumc final supervisor. This may be – but need not be – the same person as the (daily or host) supervisor. This Radboudumc final supervisor must also indicate whether he/she accepts the assessments of the (daily or host) supervisor;
3. StIP and the second assessor. StIP will check the final report for plagiarism. If plagiarism is not found, StIP forwards the research report or the draft paper plus process description to a second assessor appointed by the RTC. **Considering their possible graduation date, students are advised to bear in mind that assessment by this second assessor may take a number of weeks. Students are therefore advised to hand in their internship report at least six weeks before the results meeting of the Board of Examiners (uitslagvergadering van de Examencommissie) of their choice.**

5.5 Faculty and university awards

In order to promote students' motivation, Radboud University and Radboudumc award a number of prizes to the best internship reports or Master theses of that academic year.

a. The Radboud University Student Prize (€ 1000) is awarded by the University to one student of each faculty. This prize is awarded based on the recommendation of the Radboudumc's Board of Directors.
b. Faculty student prizes of € 350 each (one for medicine, one for dentistry and one for biomedical health sciences) may be awarded by the Radboudumc's Board of Directors based on the recommendation of the Commission Master Awards.
c. Faculty incentive prizes of € 125 each (one for each study program) may be awarded by the Board of Directors based on the recommendation of the Commission Master Awards.

Award candidates can be presented to the Commission Master Awards by the internship supervisor and/or the Radboudumc final supervisor by submitting a written motivation, including two copies of the reports concerned.

The Committee Master Awards assesses all registrations and advises the University Council on the allocation of the awards. The Commission consists of eight members (all in the possession of doctoral degrees) of the scientific staff of the Faculty of Medical Sciences, selected from departments that are involved in the three study programs.

6 APPENDICES

6.1 Registration

6.2 Project Outline Template and tips

6.3 Two examples

6.4 1st Assessment protocol

6.5 2nd Assessment protocol

Registration CKO9 & Research Training GNK

Radboudumc

Persoonsgegevens

Student number

Internship before/ after coschapper

☐ after ☐ before

Name and initials

Co groupnumber

Algemene stagegegevens

Host institution

If not Radboudumc also city &

Country

Department

Host supervisor (as well in case of Radboudumc as non-Radboudumc)

Radboudumc final supervisor (first assessor)

Discipline

Title of research internship

Nature of the study

☐ Patient file study ☐ Systematic review and/or meta-analysis ☐ Other i.e.:

☐ Laboratory study ☐ Data collection in study subjects

To complete: Fill in more information and read explanation

☐ 12 week starting date finishing date

☐ Extended internship starting date finishing date

For extended internship, I wish to receive extra credits ☐ 4 weeks ☐ 8 weeks ☐ 12 weeks

I will use these to compensate optional internships in epi 10: ☐ nee ☐ yes, 4 weeks ☐ yes, 8 weeks ☐ yes, 12 week

☐ CKO9 in week 3 en 4 in periode: in year of study 20 – 20

Background/research question/design/rationale/concrte activities and timetable/ feasibility and literature

Please, provide all extra information requested and provide a project plan (max. 2 A4) according to the desired model (title, background, research question/hypothesis ,design/population/ n subjects/variables, rationale, detailled plan of work, timetable , feasibility and literature).

The undersigned hereby declare that they have read the content of the coursebook Episode Research Training and also declare that this internship offers sufficient opportunity to achieve the general learning objectives of the research internship.

Signature student

date

Signatue of Radboudumc final supervisor

date

Check by Studie Progress Monitoring dept.

Admission requirements Research Internship at start before CKO1v

☐ fail: date ☐ pass: date

COMPLETING THIS EXTRA INFORMATION IS OBLIGATORY (more choices possible).

Internship is based on: ☐ (Only) existing material
☐ Gathering new material

Accreditation by Ethics Committee is: ☐ Necessary ☐ Not necessary
☐ Already approved

Activities to be performed by student:

- ☐ Acquisition of study subjects
- ☐ Taking measurements on study subjects (patients, animals etc.)
- ☐ Taking measurements on (bio)material
- ☐ Taking interviews
- ☐ Encoding interviews
- ☐ Learning specific (lab) skills
- ☐ Attending policlinic / operations with regard to the study
- ☐ Preparing an accreditation by the Ethics Committee
- ☐ Analysing already prepared data
- ☐ Building own data files
- ☐ Simple statistic analyses (descriptive, T-test etc.)
- ☐ Advanced statistic analyses supported by a statistician (e.g. multivariate analysis etc.)

EXPLANATION AND INSTRUCTIONS CKO9

- In CKO9 you will prepare your internship by expanding your research question, methodology, statistics, etc. CKO always precedes the internship, however, the internship does not need to follow immediately.
- The CKO9 course is offered in weeks 3 and 4 of each period.
- Enrolment in CKO9 is conditional upon:
  1) completion of your residency or waiting for CKO1v to start while already assigned to a residency group; *and*
  2) you having already arranged an internship position; *and*
  3) having obtained approval of your internship proposal.
- **Enrolment in CKO9 is also conditional upon you having signing up well ahead of time;** this means you must have registered by the 1st day of the period preceding the CKO9 period in which you want to participate. For example: if you wish to participate in CKO9 in weeks 3 and 4 of period 2, your registration form must be handed in on day 1 of period 1 at the very latest.
- It is possible to do an extended research internship (4, 8, or 12 week extension). If you wish to receive additional credits for the extended internship, please indicate this on your registration form. If you wish to use these credits to compensate one or several optional residencies in Episode 10, you should also indicate this separately. Once started, internships cannot be turned into extended internships and any additional internship time will not earn you extra credits.

GENERAL LEARNING OBJECTIVES of the research internship

1. Students can specify the motive for their study, the interest it serves, and the medical scientific context it fits into.
2. Students can propose a definitive study design on the basis of the following skills:
   2A - Students can retrieve, critically read, and systematically review relevant literature;
   2B - Students can fine-tune/extend the research question based on literature;
   2C - Students can frame a study design that fits the definitive research question.
3. Students can organize and carry out the proposed study.
4. Students can systematically analyze the collected data.
5. Students can lucidly describe the results and neatly summarize them in tables and figures.
6. Students can indicate errors of measurement and other limitations of the collected data.
7. Students can reflect critically on their study design and results.
8. Students can produce a written research report that is in line with requirements.
9. Students can orally present the outcomes of their study to members of the at which the study was performed, and are able to engage in a fruitful discussion about these outcomes.

PERSONAL LEARNING OBJECTIVES of the research internship

In addition to general learning objectives, there may be personal learning objectives relating to particular types of internships. For example one type of internship may require students to compose a questionnaire for data collection purposes, whereas another type requires the recruitment of test subjects. A range of specific learning objectives may be called for on a case-by-case basis. It is important for students and their supervisors to agree in advance about the specific learning objectives: which specific skills does the student need to complete their internship? Formulate your personal learning objectives by following the SMART criteria.

Template Project Outline - Research Training Internship

(preferably max. 2 A4 , incl. timetable)

Tips on page 26 - 27
Examples on page 28 -31

Title *Tip A*

Background of the research (based on 1-2 key publications) *Tip B1-B2*

Research question / Hypothesis *Tip C*

Study design / study population / number of subjects / variables (including primary outcome) *Tip D1-D8*

Rationale (Why is the research important? / How can the knowledge be of use? / What is the scientific/clinical/societal impact)? *Tip E*

Detailed plan of work: specification of students' activities and completed timetable (* see at bottom) *Tip F*

Feasibility? Any problems anticipated? If so, which? *Tip G*

Reference list of literature (1-2 key publications) *Tip H*

* TIME TABLE Research Training Internship (do not include CKO9!)

Please mark applicable activities with an 'X') and, if necessery, expand the table with more relevant activities (and weeks).

Week	1	2	3	4	5	6	7	8	9	10	11	12
Study of literature												
Technical instruction / practise technique / learning specific lab skills												
Preparation, logistics (A)*												
Taking measurements (B)*												
Data analyses / statistics (C)*												
Write introduction												
Write method												
Write results												
Write discussion												
Prepare presentation												
Oral presentation at host department												
Miscellaneous :												
Miscellaneous :												

* A Please specify A (for instance: draw sample, invite/recruite subjects, etc.)

* B Please specify B (for instance: extract data from records, conduct interviews, perform other measurements on study subjects, perform measurements on (bio)material, etc.)

TIPS ON WRITING THE PROJECT OUTLINE

Title	*Tip A: Provide a succinct, short and catchy title*
Background	*Tip B1: Establish the project in 3-4 sentences, describe the research field and provide the information that led up to the research question*
	Tip B2: Establish background information further, focus on the unmet needs and describe which elements are worth to study
Research question	*Tip C: Formulate the most important research question, by establishing a hypothesis that can be tested, if possible*
Study design	*Tip D1: Label the type of study*
	Tip D2: Describe the main characteristics of the study population
	Tip D3: Describe major inclusion and exclusion criteria
	Tip D4: Give an accurate description of the control population
	Tip D5: Provide a detailed description ofyour most important outcome measure
	Tip D6: Define the secondary outcome measures
	Tip D7: Describe the rationale for the sample size of the study (power calculation)
	Tip D8: If you already know which statistical analyses you are going to perform, please describe
Rationale	*Tip E: Why should you perform this study? What is the importance and significance of this study proposal?*
Plan of work	*Tip F: Describe the specific activities that you will carry out and complete the time table*
Feasibility	*Tip G: Show that you have really put thought into the project and its feasibility. Explain potential difficulties that you may encounter and potential solutions*
Literature	*Tip H: 1-2 key publications*

Example 1 - Project Outline Research Training Internship

Department: Vascular Surgery, Catharina Hospital Eindhoven

Title

Gait analysis in patients with peripheral arterial disease.

Background

Patients with peripheral arterial disease (PAD) often present with intermittent claudication. This typical pain in the leg musculature during ambulation decreases in rest. Patients with PAD show reduced strength in the lower extremities, lower physical activity levels, limited walking performance and reduced health-related quality of life.[1,2] Previous research described reduced step length and decreased walking speed during over ground walking measures after ischemic pain was induced on a tread-mill.[2-4] Sufficient gait analysis during the development of ischemic pain on a tread-mill is lacking. Since tread-mill walking consumes significant more energy compared to over ground walking,[5] continuous measurement on a tread-mill could monitor specific changes during walking in similar circumstances as supervised exercise therapy. The Optogait is an advanced instrument for quantifying spatiotemporal gait parameters and allows for continuous measurements during treadmill walking. It has already been used in healthy adults and patients with a total knee replacement.[6] Proper gait analysis could contribute to the development of improved treatment regimes.

Research question/hypothesis

Do patients with PAD have a shorter step length compared to healthy controls?.

Design

We will perform a prospective case control study including 200 patients with PAD and 200 healthy controls. Patients diagnosed PAD (Fontaine-score of II and ankle-brachial index of <0,9) will be recruited from our outpatient department. Patients will be excluded if they have comorbidities that are expected to interfere with their walking performance, including amputation, osteoarthritis, pulmonary disease, heart failure or use of walking aids. A total of 200 healthy controls (ankle-brachial index >0.9) without any significant comorbidities interfering with their walking performance (aforementioned) will be recruited. Our primary outcome is step length as assessed with Optogait. Secondary outcome measures are walk cycle time, stance time, swing time (in which the foot is suspended and proceeds in the air), stride length, cadence (steps/min), walking speed, single and double support phase.
We expect that patients with PAD will have a 8% shorter step length and a sample size of 200 patients per arm is needed to detect a significant difference between the both groups (power: 80%; α: 0.05).

Rationale

By providing data on gait pattern characteristics we will be able to develop an optimized treatment protocol for patients with PAD to improve overall walking performance. Ultimately, this will lead to an improvement of health-related quality of life.

Plan of work

1. Patients will be recruited from the vascular surgery outpatient clinic of Catharina Hospital in Eindhoven.
2. After their visit at the outpatient clinic, patients will undergo gait analysis on a tread-mill in a test laboratory in the same hospital. Patients will be transported by wheelchair or asked to rest at least twenty minutes after their walk through the hospital before they are tested.
3. Gait analysis is performed and the patients will be asked to walk as far as possible on their preferable walking speed. Patients are instructed to inform the researcher about the onset of pain. The Optogait monitor will be used to measure the data mentioned above.
4. The same gait analysis will be performed on 30 healthy subjects, after PAD is excluded by a normal ankle-brachial index.
5. Outcome measurements will be analyzed using SPSS.

See also timetable

Feasibility

This research internship is part of a larger study (PhD thesis). The study has been approved by the Ethical Board of the Radboud University Medical Center. I will be responsible for the measurement of 30 patients and 30 controls. That makes it possible for me to finish this project within 12 weeks time. Identifying controls could be difficult as we need to randomly select healthy individuals from the population, matched for possible confounders. Currently we are discussing the use of random volunteers from our personal inner circle versus partners of patients.

Reference list

1. Altered gait profile in subjects with peripheral arterial disease. Gardner AW, Forrester L, Smith GV. s.l. : Vascular Medicine, 2001, Vols. 6:31-34.
2. Relationship between temporal-spatial gait parameters, gait kinematics, walking performance, exercise capacity, and physical activity level in peripheral arterial disease. Crowther RG, Spinks WL, Leicht AS, Quigley F, Golledge J. s.l. : Journal of Vascular Surgery, 2007, Vols. 45: 1172-1178.
3. Peripheral arterial disease affects kinematics during walking. Celis R, Pipinos II, Scott-Pandorf MM, Myers SA, Stergiou N, Johanning JM. s.l. : Journal of Vascular Surgery, 2009, Vols. 49:127-132.
4. Peripheral arterial disease affects the frequency response of ground reaction forces during walking. McGrath D, Judkins TN, Pipinos II, Johanning JM, Myers SA. s.l. : Clinical Biomechanics, 2012, Vols. 27: 1058-1063.
5. Kinematic, kinetic and metabolic parameters of treadmill versus overground walking in healthy older adults. Parvataneni K, Ploeg L, Olney SJ, Brouwer B. s.l. : Clinical Biomechanics, 2009, Vols. 24:96-100.
6. Validity of the Optogait photoelectric system for the assessment of spatiotemporal gait parameters. Lienhard K, Schneider D, Maffiuletti NA. s.l. : Medical engineering & physics, 2013, Vols. vol:35 iss:4 pg 500-504.
7. Exercise Training for Claudication. Stewart KJ, Hiatt WR, Regensteiner JG, Hirsch AT. s.l. : New England Journal of Medicine, 2002, Vols. 347(24):1941-51.

TIMETABLE **Weeks**

	1	2	3	4	5	6	7	8	9	10	11	12
Project												
Finishing literature study	X	X										
Technical instruction/practice technique/learning lab skills	X	X										
Preparations, logistics, testing of equipment (specify under A.)	X	X										
Taking measurements (specify under B.)			X	X	X	X	X	X	X			
Statistical analysis							X	X	X	X		
Interpreting results									X	X		
Writing study report												
Writing introduction of study report	X	X										X
Writing methods			X	X						X		X
Writing results										X	X	X
Writing discussion										X	X	X
Presenting results												
Prepare oral presentation											X	X
Oral presentation at (host) department												X
Miscellaneous / other ……												
……												

A. Specification of study preparations: Installation Optogait and tread-mill, writing research protocol en patient information for approvement METC, start preparations for including patients at outpatient department, test analyses on tread-mill

B. Specification of study measurements: Patient recruitment, examination of gait pattern of patients and controls following a standardized research protocol, data extraction to SPSS/Excel.

Example 2 - Project Outline Research Training Internship

Department: Fysiology, Radboudumc, Nijmegen

Title

Influence of an (in)active lifestyle on vascular endothelial function in men with and without a history of myocardial infarction.

Background of the research

Worldwide cardiovascular diseases (CVD) are still a growing health problem and the leading cause of death. In 2012, CVD accounted for 17.3 million deaths. This number is expected to grow to 23.6 million deaths in 2030. One third to half of the CVD consists of coronary heart diseases[1, A] recent paper in *The Lancet* revealed that physical inactivity has overtaken smoking as the principal cause of cardiovascular death worldwide[2]. Although exercise seems to be a powerful tool to prevent CVD, not all cardio-protective effects of exercise are understood. Analyses of the literature support several potential mechanisms for the cardio-protective effects of exercise by an improved endothelial function[3]. However, a previous study revealed that healthy active individuals are not immune to CVD[4]. If differences are present in endothelial function between athletes with and without a myocardial infarction, it might provide new insight for a non-response to the cardio-protective effects of exercise. Therefore, the purpose of this study is to examine the differences in endothelial function in athletes with a history of myocardial infarction, healthy athletes, sedentary individuals with a history of myocardial infarction, and healthy sedentary individuals. I hypothesize that the healthy athletes will have a better endothelial function compared to the athletes with a myocardial infarction. In addition, I expect that athletes with a myocardial infarction and inactive subjects without a myocardial infarction will have a comparable endothelial function.

Research question (or hypothesis)

What are the differences in endothelial function between athletes with a history of myocardial infarction, healthy athletes, sedentary individuals with a history of myocardial infarction, and healthy sedentary individuals?

Study design

Study design: Cross-sectional observational study.

Study population: 40 male subjects, aged > 40 years. Based on physical lifestyle and history of myocardial infarction they will be divided into four groups (Table 1).

	Athletes	Sedentary individuals
History of myocardial infarction	Group A	Group C
Healthy	Group B	Group D

Table 1: *Schematic overview of the groups in the proposed study*

Power: Based on anticipated differences in %FMD between study groups (active *vs.* inactive) of 3.5% with a SD of 2.4,[5,6] a power of 90% and alpha 5% significance level, we calculated that $2*((1.65+1.28)^2*2.4^2)/3.5^2)=8$ subjects per group should be included. We will include 10 subjects per study group to prevent problems in case subjects quit the experiment.

Variables: Endothelial function of the brachial artery as measured by the flow-mediated dilation (FMD).

Study methods: The endothelial function of the brachial artery will be examined by inflating a blood pressure cuff around the forearm, distal from the imaged artery. Using echo-Doppler, the brachial artery baseline diameter and blood flow will be assessed. Subsequently, the blood pressure cuff will be inflated to 220 mmHg to block arterial inflow. After 5 minutes, the blood pressure cuff is released and hyperemic blood flow and changes in arterial diameter and flow will be assessed. These responses are commonly referred to as flow-mediated dilatation and represent a nitric oxide-mediated endothelium-dependent vasodilatation in the brachial and artery.

Primary outcome: To determine the brachial endothelial function measured by FMD of athletes with a history of myocardial infarction (A), healthy athletes (B), sedentary individuals with a history of myocardial infarction (C), and healthy sedentary individuals (D).

Analysis: Statistical analysis will be performed by two tailed ANOVA analysis and subsequent contrast analysis via Bonferroni.

Rationale

The findings of this study will enhance our understanding of potential underlying mechanisms of cardiovascular disease and myocardial infarction and the role of physical activity in prevention of myocardial infarction.

Feasibility

This is an ongoing study, in which three groups have been measured (A, B and D). During my internship, I will include physically inactive subjects with a history of a myocardial infarction (group C) and I will screen subjects to determine eligibility for the study. Although this is a common group of subjects, some difficulties and motivational problems to complete the study might occur. After the measurements of group B, I will analyze the data of all four groups and write a paper including all four groups. Since the Echo-Doppler measurements will be conducted by an experienced sonographer I will assist during measurements. I will also interpret the results.

Time table Research Training Internship

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Study of literature	X	X										
Learn how to assist and interpret measurements		X										
Preparations in advance (A)		X	X									
Taking measurements (B)				X	X	X	X					
Data analyses/statistics								X	X			
Write introduction	X	X										
Write method		X	X									
Write results								X	X			
Write discussion									X	X	X	
Prepare presentation										X	X	
Presentation to host department											X	X
Finish research report												X

*A: Invite/recruit subjects *B: The flow mediated dilatation (FMD) of the brachial artery.

References

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2. Lee, I.M., et al., Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet, 2012. 380(9838): p. 219-29.
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1st ASSESSMENT PROTOCOL
RESEARCH INTERNSHIP IN MEDICINE

Radboudumc

- *For host supervisor and to be completed by RUMNC supervisor in charge*
- *Assessment must be accompanied by an upload of the internship research report*

Student's name and initials	Student number

Title of the internship project

Internship start date	Internship end date	Report handed in on (date)

What was the nature of the research internship (please tick as appropriate)

- ☐ Mainly literature study
- ☐ Mainly study of patient file data
- ☐ Study of available patient-related data
- ☐ Study based on data obtained by student's measurements in patients
- ☐ Mainly laboratory study performed by student
- ☐ Other: ……..

Supervisor's institution, department, and name	Name and phone no. of UMC supervisor in charge	
Supervisor's signature		

ASSESSMENT BY SUPERVISOR

A. Assessment of the student's PERFORMANCE in the research internship

1. Inquisitive and interested in topic and research

fail	*question-able*	*pass*	*fair*	*good*	*Very good*

2. Critical mindset in study design, implementation, and report

fail	*question-able*	*pass*	*fair*	*good*	*very good*

3. Organization and efficiency in designing and implementing the study

fail	*question-able*	*pass*	*fair*	*good*	*very good*

4. Time planning

fail	*question-able*	*pass*	*fair*	*good*	*very good*

5. Autonomy in performance

fail	*question-able*	*pass*	*fair*	*good*	*very good*

6. Commitment and participation

fail	*question-able*	*pass*	*fair*	*good*	*very good*

7. Openness to feedback/criticism and willingness to use it

fail	*Question-able*	*pass*	*fair*	*good*	*very good*

8. Adequately seeks assistance (well in time and not indolently)

fail	*question-able*	*pass*	*fair*	*good*	*very good*

9. Interaction with patients (if applicable)

fail	*question-able*	*pass*	*fair*	*good*	*very-good*	*Not appl.*

10. Interaction with colleagues during internship

fail	*question-able*	*pass*	*fair*	*good*	*very good*

A. GRADE for the student's PERFORMANCE in his/her internship on the basis of the above (half marks are allowed) (1 = unworthy of marking, 2 = very poor, 3 = poor, 4 = strongly insufficient, 5 = insufficient, 6 = sufficient, 7 = good, 8 = very good, 9 = excellent, 10 = outstanding)**.**	

Please continue with your assessment of the GENERAL LEARNING OBJECTIVES

B. Assessment of the GENERAL LEARNING OBJECTIVES of the research internship

To what degree has the student shown that he/she possesses the following skills?
Your explanation of these items is greatly appreciated (see next page under E).
If a learning objective has not been dealt with, we kindly ask you to indicate why, also under E.

1. Can indicate motive for the study, the interest it serves, and the medical scientific context into which it fits

fail	*question-able*	*pass*	*fair*	*good*	*very good*

2a Can retrieve, critically read, and systematically review relevant literature to formulate a definitive study design

fail	*question-able*	*pass*	*fair*	*good*	*very good*

2b. Can fine-tune/extend the research question using available literature to formulate a definitive study design

fail	*question-able*	*pass*	*fair*	*good*	*very good*

2c. Can frame a study design that fits the definitive research question

fail	*question-able*	*pass*	*fair*	*good*	*very good*

3. Can organize and implement the proposed study

fail	*question-able*	*pass*	*fair*	*good*	*very good*

4. Can systematically analyze the collected data

fail	*question-able*	*pass*	*fair*	*good*	*very good*

5. Can describe the results clearly and neatly arrange them in tables and figures

fail	*question-able*	*pass*	*fair*	*good*	*very good*

6. Can point out errors of measurement and other limitations in the collected data

fail	*question-able*	*pass*	*fair*	*good*	*very good*

7. Can critically reflect on the study's design and results

fail	*question-able*	*pass*	*fair*	*good*	*very good*

8a. Can produce a written report in line with content requirements. The quality of the report's content is:

fail	*question-able*	*pass*	*fair*	*good*	*very good*

8b. Can produce a written report in line with formal requirements (e.g. neat editing, layout, use of language, correct references, etc.). The formal quality of the report is:

fail	*question-able*	*pass*	*fair*	*good*	*very-good*

9. Can orally present the study's outcomes to member of the department at which the study was performed and engage in a fruitful debate on the subject

fail	*question-able*	*pass*	*fair*	*good*	*very good*

B. GRADE for ACHIEVING THE GENERAL LEARNING OBJECTIVES of the internship on the basis of the above (half marks are allowed)

(1 = no performance, 2 = extremely poor, 3 = poor, 4 = strongly insufficient, 5 = insufficient, 6 = satisfactory, 7 = good, 8 = very good, 9 = excellent, 10 = outstanding)**.**

*Please note: The **final grade** for this research internship will be determined by the Research Internship Committee, after the report has also been assessed by a 2nd assessor appointed by the Committee.*

Please continue with the SPECIFIC LEARNING OBJECTIVES

C. Evaluation of SPECIFIC LEARNING OBJECTIVES of the research internship

Please mention specific learning objectives and explain in your own words whether and why these have been achieved or not.

Learning objective 1:

Learning objective 2:

Learning objective 3:

D. Declaration of the Radboudumc FINAL SUPERVISOR

I Agree / Disagree with the assessments and grades given under A and B

- ☐ Agree with A and B (in case 9 or 10 please fill out "ad 1")
- ☐ Disagree with both A and B (fill out "ad 2")
- ☐ Partial agreement (fill out both ad 1 if applicable) and ad 2)

Ad 1. Agree with grading 9 or 10:
The research Training Committee strongly urges to only give grades 9 or 10 as an exception, and only in the case of outstanding quality. Please note: abroad the grading system often deviates from the Dutch one (higher grades abroad). If you agree with a 9 or 10, please state your reasons below.

Motivation:

Ad 2. Disagree with the grades of part A and/or B:
Please state your reasons for disagreeing with the grading of part A or B and bear in mind that abroad the grading system often deviates from the Dutch one (higher grades abroad). The Research Training Committee strongly urges to only give grades 9 or 10 as an exception, and only in the case of outstanding quality. Please give your grades.

	A	**B**
Your grades: Half marks are allowed		

Motivation:

NB: 1 = no performance, 2 = extremely poor, 3 = poor, 4 = strongly insufficient, 5 = insufficient, 6 = satisfactory, 7 = good, 8 = very good, 9 = excellent, 10 = outstanding

Please continue with Explanation / Other remarks and your signature

E. EXPLANATION of assessment of general learning objectives / Other remarks

Please indicate concisely and explicitly which *comments, advice, or areas for further development* you wish to point out to the student considering his/her prospective career. Please use the reverse side of this form if needed.

Signature of UMC final supervisor	**Date**	**Student's signature (seen by student)**

Radboudumc

2nd ASSESSMENT PROTOCOL
RESEARCH INTERNSHIP IN MEDICINE

- *To be completed by the 2nd assessor (appointed by the Research Internship Committee)*

Student's name and initials	Student number

Title of the research report

Name of 2nd assessor	Department	Phone number

ASSESSMENT OF THE REPORT

If one of the elements has not been dealt with in the report, we kindly ask you to indicate this in the *Remarks* section.

1. general report layout (title page, contents, numbering, notes, literature)

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

2. quality of figures, tables, and graphics

fail	*questionable*	*pass*	*fair*	*good*	*very good*

3. quality of the summary

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

4. quality of the introduction

fail	*questionable*	*pass*	*fair*	*good*	*very good*

5. justification and formulation of the research question

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

6. justification of the study design

fail	*questionable*	*pass*	*fair*	*good*	*very good*

7. clear description of materials and methods

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

8. clear description of analysis

fail	*questionable*	*pass*	*fair*	*good*	*very good*

9. clear description of results and conclusions

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

10. quality of discussion of literature

fail	*questionable*	*pass*	*fair*	*good*	*very good*

11. critical reflection on study and findings

Fail	*questionable*	*pass*	*fair*	*good*	*very good*

12. quality of written language

fail	*questionable*	*pass*	*fair*	*good*	*very good*

Remarks (e.g., regarding work load, innovativeness, risks taken, etc.)

Grade for the research internship REPORT **With a view to the above, grade given by 2nd assessor (half marks are allowed).** Give marks 9 or 10 as an exception, and only in case of outstanding quality. If do so, please motivate under "Remarks". 1 = no performance, 2 = extremely poor, 3 = poor, 4 = strongly insufficient, 5 = insufficient, 6 = satisfactory, 7 = good, 8 = very good, 9 = excellent, 10 = outstanding	

Signature of 2nd assessor	Date