Universiteit Leiden
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The clinician-scientist pipeline: undergraduate and postgraduate supply, leaks and perspectives

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Appendices

Supplemental material

PhD Portfolio

Dankwoord

Curriculum Vitae

Appendix A: Questionnaire postgraduate research engagement (translated to English)

[Chapter 2]

1. Have you conducted research after graduation?
O No, and I am not interested in doing research.
O Not yet, but I am intending to.
O Yes.

2. Did research engagement after graduation result in (a) peer-reviewed publication(s)?
O No
O Not yet, I am working on it.
O Yes.

3. How many peer-reviewed publications as a result of research conducted after graduation do you have and (if applicable) what is your position as author?

	0	1	2	3	4	≥5
First author	O	O	O	O	O	O
Second author	O	O	O	O	O	O
Co- author	O	O	O	O	O	O
Final author	O	O	O	O	O	O

4. Have you contributed to an oral or poster at a scientific conference as a result of research conducted after graduation. If not applicable, please tick '0'.

	0	1	2	3	4	≥5
First author	O	O	O	O	O	O
Second author	O	O	O	O	O	O
Co- author	O	O	O	O	O	O
Final author	O	O	O	O	O	O

5. Have you ever participate(d) in a PhD programme?
O No, and I am not intending to.
O No, but I would like to participate in a PhD programme in the future.
O Yes, I am currently participating in a PhD programme.
O Yes, but I prematurely quit the PhD programme.
O Yes, and I have obtained my PhD degree.

Appendix B: Questionnaire undergraduate mandatory research project (translated to English)

[Chapter 3]

1. Demographics (T0)
1. Gender:
   O Male
   O Female
   O Other

2. Age: … years

3. Department(s) of your research project:

4. Institute of your research project:

Please read the statements below and choose what applies to you.
5. I am doing my research project prior to my clerkships.
   yes / no

6. I did/am doing extracurricular research (e.g. Honours track) during my medical studies.
   yes / no

1.1 Demographics (T2)
1. The formal duration of my research project was:
O 18 weeks
O 23 weeks
O 28 weeks

2. Are you intending to publish your research project as scientific paper?
O No
O Most likely not, but I am not sure yet
O Most likely, but I am not sure yet
O Yes

3. Are you going to conduct (follow-up) research (e.g. a PhD trajectory or other research) at the department where you have conducted your research project (this can also be in cooperation with someone other than your research project supervisor)?
O No
O Most likely not, but I am not sure yet
O Most likely, but I am not sure yet
O Yes

4. What part of your internship (%) did you work at home due to COVID-19 restrictions?
   0% / 10% / 20% / 30% / 40% / 50% / 60%/ 70% / 80% /90% / 100%

2. Motivation for research (T0–T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'

1. I find doing research interesting.
2. I enjoy doing research.
3. I find doing research challenging.
4. I like solving puzzles and problems.
5. By doing research I can further develop myself
6. I think that doing research is good for my CV.
7. I think that by doing research I can distinguish myself from others.
8. I think that doing research helps me to get a good job in the future.
9. I think that doing research increases my chances to get in to the specialization I prefer.

3. Research Self-Efficacy (T0–T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. I think I am good at doing research.
2. I feel competent enough to do research.
3. I think I have the skills to be able to do research.

4. Research Perceptions (T0–T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. Scientific skills are important for the medical profession.
2. Scientific education is important to me.
3. I like scientific aspects of the curricular programme.
4. The medical curricular programme should be scientific.
5. Every doctor should be able to independently conduct research.

5. Autonomy (T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. The tasks I have to do during my research internship are in line with what I really want to do. . . . .
2. During my research internship, I often feel like I have to follow other people's commands. (R)
3. I feel like I can be myself at my research internship.
4. If I could choose, I would do things at my research internship differently.
5. During my research internship, I feel forced to do things I do not want to do. (R)
6. I feel free to do my research internship the way I think it could be done best.ree to do my research internship the way I think it could be done best.

6. Relatedness (T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. I don't really feel connected with other people at the department from my research internship. (R)
2. During my research internship, I feel part of a group.
3. I don't really mix with other people at my job. (R)
4. During my research internship, I can talk with people about things that really matter to me.
5. I often feel alone when I am with my colleagues.
6. Some people I work with are close friends of mine.
7. During my research internship, I feel part of the academic community of the hospital/institute.
8. During my research internship, I feel involved in the research culture of the department.

7. Academic career ambitions (T0–T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. In the future, I would like to do a PhD programme.
2. In the future as a clinician, I would like to have research tasks.
3. In the future, I would like to conduct research as part of my (clinical) work.

8. Final statements (T0–T1–T2)

Students received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. If the research internship would not have been part of the curriculum, I would like to participate in extracurricular research.
2. In my opinion, research internships belong in the medical curriculum.
3. My view on research has changed because of my research internship. (T2 only)

Appendix C: Medical PhD programme questionnaire
[Chapter 6]

General situation

(1) Are you aware of national guidelines for PhD programmes in your country?
(if yes: could you please provide link/ document)
(2) Does your institution have guidelines for PhD programmes?
(if yes: could you please provide link/ document)
(3) Can you give an estimate of the ratio between medical students/doctors with and without a PhD degree?
(4) Does this significantly differ between medical specialties?

Prior to entry

(1) What is the position (e.g. before, during or after medical school) of a PhD training programme in the educational system or clinician–scientist career pathway?
(2) How do people get into a PhD training programme? Are there entry criteria (e.g. completed a master's degree)?
(3) Please share your thoughts about what motivations medical students/doctors mainly have when participating in a PhD training programme.
(4) What is the value of a PhD training programme in the medical field?
(5) Which ambitions do participants may have regarding an academic career?

During the programme

(1) Has the PhD training programme a fixed duration? If so, how long? (years) If not, how does a programme typically last?
(2) Is it a paid job? please elaborate, and if yes, how are PhD training programmes funded in general?
(3) Can you describe what a PhD training programme looks like regarding (core) activities (e.g. research only or for example also educational activities/requirements or traineeship)?
(4) What does the supervisory team look like? Please elaborate.
(5) What is the role of this team ideally?

Thesis and defense

(1) Are there requirements with respect to thesis content (e.g. published articles, number of chapters, pages etc)?
(2) Who are typically in the defense committee?
(3) How many members are on the committee?
(4) Is the time for defense fixed? If so, how long does the defense last? If not, what is range of the defense duration (min–max in hours)?
(5) Can the candidate fail? Please elaborate.
(6) What title do you get after successfully finishing a PhD? What is the value of this title for future career?

To finish…

(1) Is there anything else we should know about the system of PhD training programmes in your country?
(2) Do you have suggestions for other sources of information or references which could be useful for us?

Appendix D: PhD questionnaire

[Chapter 7]

[Some questions were conditional and only displayed depending on answers given]

1. Demographics

1. What is your age?

2. To which gender identity do you most identify?
   - O Men
   - O Female
   - O I'd rather not say
   - O Other

3. Which institution are you connected to?

4. What job position did you had prior to your PhD trajectory?
   - O Medical students (e.g. MD-PhD track) and I still had/have to graduate as junior doctor
   - O Graduated without working experience as medical doctor
   - O Graduated with working experience as medical doctor
   - O Doctor in training (hospital based specialty)
   - O Doctor in training (non-hospital based specialty)
   - O Specialist (hospital or non-hospital based)
   - O Others, namely…

5. What type of PhD-programme do/did you follow in the main part of your PhD programme?
   - O MD-PhD trajectory as medical student (e.g. Honours programme)
   - O Paid PhD trajectory as doctor not in training or specialist
   - O Resident with training temporarily interrupted for a paid PhD trajectory
   - O Unpaid PhD trajectory as junior doctor, resident, or specialist
   - O Resident in training in a residency combined with PhD trajectory
   - O Other situation, namely…

6. When did you start your PhD trajectory (month-year)?

7. What was the formal end date of your PhD trajectory (month-year)? This can also be in the past when your formal PhD trajectory has expired.

8. To what specialty/specialties is your PhD trajectory connected?

9. How many papers for your thesis have been published so far?

10. What type of research are you doing?
    - O Fundamental research
    - O Clinical research
    - O Public health and primary care
    - O Epidemiological research
    - O Others, namely…

11. Which specialty did you prefer most with regard to your future career as a doctor when you started your PhD? If you did not have a clear preference or did not aspire a career as a doctor at that time, you can also fill that in.

12. Which specialty do you prefer most at the moment with regard to your future career as a doctor? If you did not have a clear preference or did not aspire a career as a doctor, you can also fill that in.

13. Are you assured of a specialty trainings position or are you currently in training?
    - O No, not yet
    - O Yes

14. In which specialty are you working as specialist or resident?

15. So far, I am on schedule with my PhD trajectory (compared to the current official end date).

16. I expect that I will be (further) delayed during my PhD trajectory.

2. Expectancy for success

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

1. I think I have the skills to be able to do research as a PhD candidate.
2. I feel competent enough to do research as a PhD candidate.
3. I think I am good at doing research.

3. Values

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'completely disagree' – 7 'completely agree'.

The statements below are about the possible perceived value of a PhD (trajectory). To what extent do you think these values are assigned to a PhD in the medical field?

1. A PhD trajectory improves the quality of clinical work as a doctor.
2. By doing a PhD trajectory, you develop relevant skills that you would not have been able to develop without a PhD.
3. A PhD offers advantages for your further career as a doctor, even if you doNot continue in research.
4. A PhD increases the chance of future jobs (e.g. specialty training, fellowship).
5. Only with a PhD degree do you have a chance to get into specialty training in the specialty that I aspire.
6. A PhD increases the chance of staying involved in scientific research.
7. A PhD is an important step towards a career as a medical researcher.
8. A PhD trajectory is valuable for the network within the field.
9. A PhD trajectory is valuable for the social contacts it can bring.
10. Completing a PhD programme is something to be proud of.
11. A PhD trajectory makes you more resilient as a person.
12. A PhD trajectory offers an opportunity for personal growth in dealing with challenges and boundaries.

13. With a PhD trajectory, you contribute to the quality of healthcare.
14. A PhD programme has societal relevance.
15. Programme directors in my (preferred) specialty field attach value to a PhD in selection procedures.
16. Within my (preferred) specialty field, colleagues attach value to a PhD.

4. Motivation

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'Not applicable at all' – 7 'Fully applicable'.

Indicate to what extent the motivations below apply to you at this time in your PhD programme. I am doing a PhD…:

1. For the satisfaction I feel when I surpass myself in my PhD activities (e.g. work, presentations).
2. For the satisfaction I have in facing challenges in my PhD trajectory.
3. For the pleasure I feel in accomplishing my PhD project (e.g. thesis).
4. Because I find doing a PhD interesting.*
5. Because the subject of my PhD project is close to my heart.*
6. Because my PhD is consistent with my values (e.g. curiosity, ambition, success).
7. Because my PhD is a fundamental part of who I am and my identity.
8. Because my PhD meets my goals and my objectives in life.
9. Because it suits me to finish what I started.*
10. Because I want to improve my skills in my field of study.
11. Because it is important for me to advance knowledge in my field of study.
12. Because I have the opportunity to take my first steps in research (e.g. publications, collaborations) while benefitting from supervision.
13. To thoroughly explore whether a future career as a clinician-scientist suits me.*
14. Because as a doctor (in training) I do not yet feel sufficiently competent in doing research.*
15. Because my supervisor would be disappointed or angry if I gave up.
16. Because I have made commitments that I must fulfil (e.g. with funding agencies, employers, collaborators, a research director).
17. Because I do not want to be perceived as a quitter.
18. To show others that I can do this.*
19. For the prestige associated with a PhD.
20. To increase the chance of future clinical positions (e.g. training place, fellowship, place in partnership).*
21. Because others advise me to do a PhD project (e.g. programme directors).*
22. To distinguish me from others.*
23. Because many colleagues around me are doing a PhD.*
24. Because I have already invested so much in it (time, energy) that I really want to finish it.*
25. Because the secondary employment conditions appeal to me (e.g. no shifts etc).*
26. To not work in the clinic (yet) for a period of time.*
27. Because I am not sure yet in which clinical job or specialty (e.g. specialty training) I want to continue.*
28. I wouldn't pursue a PhD if it didn't affect the chances of being selected (e.g. for specialty training or other desired job positions).*

** Added items to original Motivation for PhD Studies Scale (MPhD)*

5. Work Engagement

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'Not applicable at all' – 7 'Fully applicable'.

Indicate to what extent the following statements apply to you in this phase of your PhD:

1. My PhD trajectory inspires me.
2. I am enthusiastic about my PhD trajectory.
3. I am proud on the work that I do during my PhD.
4. When I get up in the morning, I feel like going to work.
5. At my work, I feel bursting with energy.
6. At my job, I feel strong and vigorous.
7. I feel happy when I am working intensely.
8. I am immersed in my PhD.
9. When I am working, I forget everything else around me.

6. Drop-out intentions

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'Not applicable at all' – 7 'Fully applicable'.

Indicate to what extent the following statements apply to you in this phase of your PhD:

1. If I could choose again, I would start a PhD programme again. *(R)*
2. I expect to finish my PhD. *(R)*
3. I feel pressure to finish my PhD.
4. I am considering quitting my PhD trajectory.

7. Clinician-scientist Career Ambitions

PhD candidates received the instruction to score items on a 7-point Likert scale, defined as 1 'Not applicable at all' – 7 'Fully applicable'.

Indicate to what extent the following statements apply to you in this phase of your PhD:

1. After my PhD, I would prefer to be affiliated as a doctor at an academic medical centre or other institution where research has a primary focus.
2. I consider my PhD to be a specialisation in science, without necessarily pursuing an academic career in the long term.
   [Reflected item]
3. As a doctor, I want to continue doing *little to no* scientific research after my PhD.
   [Reflected item]
4. As a doctor, I want to combine scientific research and clinical tasks after my PhD.
5. As a doctor, I mainly want to do research after my PhD.
6. I would like to work as a post-doc in the future.

Appendix E: Interview Guide (translated to English)
[Chapter 8]

1. Introduction interview
- Introduction interviewer
- Explaining methods (timeline construction)
- Repeat information stated in the pre-sent information letter (e.g. privacy regulation, etc.)
- Informed consent (recording interview and use of anonymised data in research paper)

2. Start of the interview
2.1 Prior to starting a PhD trajectory
a. At which medical school did you study? If applicable; What job(s) did you have after graduation and before starting your PhD trajectory? When did you decide you wanted to pursue a PhD? And how did you find your current PhD program?
b. What were your motives to initiate a PhD several years ago? What expectations did you have of your PhD program? What was your view on doing a PhD? What was (less) appealing? *[motivations & values]*
c. At that time, did you already have some ideas about what career you aspired after your PhD? If so, what ideas did you have regarding your career after your PhD? Did you (already) have a preferred specialty in mind? Did you (already) have ideas about applying for future job positions? (How) Did science play a part in your career ambitions? What role for science did you see in your future career? *[ambitions]*

2.2 Construction of timeline during the PhD trajectory
1. Explaining the timeline and different colours of post-its for different phases.
2. Interviewee is writing remarkable, important and meaningful events or experiences on the post-its.
3. Hereafter, the interviewee puts the post-its on the timeline in chronological order. The higher a post-it is pasted on the Y-axis, the more positive the participant looked back on it.

2.3 Discussing and reflecting on the PhD trajectory timeline
2.3.1 Start of the PhD trajectory
a. You just started your PhD trajectory. Can you tell me something about this time? What were your first impressions? Was it what you expected it to be? *[potential in-depth questions regarding work/life factors, support (team), autonomy, research topic and content, culture]*
b. Can you tell me something about what you wrote on these post-its? How do you think this experience or event might have impacted your motivation for your PhD programme and your (academic) ambitions after your PhD?
c. Overall, how do you look back on this initial phase now?
[when only a few post-its have been pasted, potential deepening questions can be: what did you like, like less/dislike, or find difficult? Did your motivation, job satisfaction and/or ambition changed in this initial phase, if so, how come? What were your ambitions for the future at that moment? Looking back at that time, do you wanted things to be different? Is there any advice you would like have to have given yourself at that time?]

2.3.2 Mid-stage of the PhD trajectory
a. We are now continuing to the mid-phase of your PhD trajectory. Can you tell me something about this time? *[potential in-depth questions regarding work/life factors, support (team), autonomy, research topic and content, culture]*
b. Can you tell me something about what you wrote on these post-its? How do you think this experience or event might have impacted your motivation for your PhD programme and your (academic) ambitions after your PhD?
[potential in-depth questions can be: Were there times when you had serious doubts about whether you were being able to or wanting to finish your PhD? When was it? Where did these doubts came from? If not spontaneously addressed: How would you describe the relationship with your supervisors? How was the collaboration? What role did they fulfill in your trajectory?]
c. Overall, how do you look back on this mid-phase of your PhD trajectory now?
[when only a few post-its have been pasted, potential deepening questions can be: what did you like, like less/dislike, or find difficult? Did your motivation, job satisfaction and/or ambition changed in this mid-phase, if so, how come? What were your ambitions for the future at that moment? Looking back at that time, do you wanted things to be different? Is there any advice you would like have to have given yourself at that time?]

2.3.3 Final stage of the PhD trajectory
a. We are now progressing to the final and current phase of your PhD trajectory. Can you tell me something about this time?
[potential in-depth questions regarding work/life factors, support (team), autonomy, research topic and content, culture]
b. Can you tell me something about what you wrote on these post-its? How do you think this experience or event might have impacted your motivation for your PhD programme and your (academic) ambitions after your PhD?
[when only a few post-its have been pasted, potential deepening questions can be: Can you tell me something more about how you are doing in this phase? What are your expectations? Do you have any doubts about finishing your PhD trajectory? What in particular motivates you in this phase of your PhD trajectory? Are there things you find difficult at this time? What are your ambitions for the future (after your PhD)? (How) Does science play a part in your career ambitions? What role for science do you see in your future career?]

2.3.4 Finalizing the timeline of the PhD trajectory
a. Are there things you would like to add or have not discussed yet?
b. Can you summarize in a few sentences how your motivation and ambition has changed throughout your PhD trajectory? Can you also indicate what has been decisive for your motivation?
c. If you could give your younger self any advice at the time you started to consider pursuing a PhD, what advice would you have given yourself?

3. End of the interview

- Reflecting on the interview
- Repeat information about confidentiality, member check etc.
- Check contact information for future contact
- Thank you!

4. Check for interviewer

- Clarity (Do I get it? Only one interpretation possible?)
- Relevance (Does this answer the question?)
- Completeness
- Validity (interviewee's opinion)

Appendix F: Overview of all emerged themes and sub-themes

[Chapter 8]

Themes	Sub-themes
1. Initial motivation to start a PhD matters	1.1 As stepping stone towards a clinician-scientist career *1.1.1 Longing for extra (academic) challenges next to clinical tasks (e.g. due to the need 'to think out of the box' instead of following protocols)* *1.1.2 Develop research skills* *1.1.3 Would like to become an expert on and/or contribute to the research topic* *1.1.4 Research is important for being a good doctor* *1.1.5 Research might be more appealing than clinical work (only)* *1.1.6 To get into and get to know the academic world* 1.2 As stop-over for career orientation purposes *1.2.1 To buy time for future career steps e.g. specialty decision* *1.2.2 Preferring a PhD over working as DNIT for years* 1.3 As vehicle to get into future clinical job positions *1.3.1 Pursuing a PhD to get into the desired (sub)specialty* *1.3.2 Pursuing a PhD to increase chances to get into specialty training* 1.4 Others *1.4.1 It (i.e. PhD) came across my path* *1.4.2 A PhD degree can only benefit and won't harm you*
2. Autonomy, a matter of the right dose at the right time	2.1 Autonomy in research projects and initiatives 2.2 (Un)clarity in tasks and expectations 2.3 Need for more guidance 2.4 Pressure to publish (soown) 2.5 (Dis)Liking imposed (clinical) tasks 2.6 Autonomy in (daily) time management within work 2.7 Work life balance
3. PhD as proof of competence and/or as learning trajectory?	3.1 (Not) Feeling competent (enough) 3.2 Comparing to others 3.3 Urge to stand out and show your competence 3.4 Wants to do well in the eyes of others 3.5 Opportunity for education 3.6 Protected time to (further) develop skills and knowledge

4. It takes (at least) two to tango	4.1 (Lack of) Commitment and guidance from research team 4.2 (Lack of) Academic guidance 4.3 (Lack of) Mental and personal support 4.4 Supervisor (does not) make(s) time for me 4.5 (Lack of) Clear and constructive feedback 4.6 Credibility supervisor 4.7 (No) Click with supervisor(s) 4.8 Feeling alone in my projects 4.9 Conflicts of interest 4.10 Dependency relationship(s) 4.11 Role model 4.12 Same or different expectations 4.13 Trust in supervisor 4.14 Supervisor is open to my ideas 4.15 Team is proud of my work 4.16 Compassion of team when facing difficulties 4.17 Supervision matching needs 4.18 Feeling safe to talk about PhD struggles with team
5. Peers can make or break your PhD	5.1 (Lack of) Relatedness with peers 5.2 (Lack of) Shared experiences with peers 5.3 Peers became friends 5.4 Support from peers 5.5 Informal meetings and activities 5.6 Competitive environment
6. Strategies to stay or get back on track	6.1 Active solution-seeking approach *6.1.1 Switch to other supportive working environment* *6.1.2 Turning conflicts into positive learning experiences* *6.1.3 Transform own experiences into the ambition to do things differently in future academic career* 6.2 Accept that lows are part of a PhD journey *6.2.1 Having the end in view* *6.2.2 Last mile is the longest* *6.2.3 Finish what you have started* *6.2.4 Invested so much time, energy, and effort* *6.2.5 Take it as it comes* *6.2.6 Not feeling able to change difficulties* *6.2.7 Accepting although it was essentially not OK* *6.2.8 Not feeling safe to speak up*