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A primer for clinical researchers in the emergency department: Part VII.

Considering a research higher degree in emergency medicine – how does it work, where to start, what to consider.

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Abstract

In this series we address important topics for clinicians who participate in research or are considering research as part of their career path in emergency medicine. While much emergency research is successfully done by clinicians without a research higher degree (RHD), undertaking a master's degree or doctorate allows a research topic to be pursued in greater depth. It also provides a solid basis for a future research career in terms of research quality, advanced skills, academic progression and track record, as well as eligibility for grants and RHD supervision. The decision to undertake a RHD is not an easy one, and requires consideration of the time and cost involved, as well as the impact on a clinician's life plans. However, the expertise provided through a RHD often ultimately complements clinical training and establishes an excellent foundation for future research and career. This article provides an overview of RHDs and what to consider before embarking on one.

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Introduction

Without central data it is difficult to determine how many emergency department (ED) staff – medical, nursing and allied health – have research higher degrees (RHDs) in Australia and New Zealand. However, anecdotally, the number of RHDs in emergency medicine (EM) has increased and there appears to be increasing interest in considering an RHD at all levels of ED staff. Within Australia and New Zealand's paediatric emergency research network (Paediatric Research in Emergency Departments International Collaborative, PREDICT), from which this data is available from 14 paediatric EDs, the number of ED staff with RHDs has increased from two to 12 over the last decade. While RHDs seem to be increasing in Australasian EDs from a low base, overall there is concern in many countries, including in Australia and New Zealand, about a lack of clinicians with RHDs to provide training for the researchers of the future (1-5). In particular it's unclear what the best entry point for a research career pathway should be, at the level of medical students via combined MD/PhD programs or via pathways at the trainee or consultant/staff level (1). Factors likely supporting a physician choice of a career in research are research involvement and exposure, a positive atmosphere for research, the influence of mentors, role models, lower financial pressure, clear career pathways, career support for junior faculty and salary parity between clinical and academic roles (2,6,7).

While information on degree programs is available on university websites, it is difficult to find an overview that considers issues specific to active ED clinicians at trainee or senior level. This paper provides such an overview.

To undertake or not to undertake a research higher degree?

Why pursue an RHD? There are many, often complex, reasons why ED staff may want to undertake a RHD: it allows the in-depth study of a specific research topic and the opportunity to follow a passion; it equips the staff member with strong research skills; it may open a career in research, including an academic career; it provides eligibility to some competitive grant schemes and also the eligibility to supervise RHD students in the future; and staff may want to formalise current research activities within a RHD. RHDs are intellectually stimulating and often lead to connections with peers in other academic centres, often internationally, and in other disciplines such as statistics, economics, computer sciences or laboratory scientists. Other considerations include improved employment prospects in an increasingly competitive jobs market or to facilitate transition from a clinical to a non-clinical role.

Conversely there are many reasons why not to pursue a RHD. RHDs take up a large amount of time, often more than anticipated (see below under

“Amount of work”). This time commitment may have an impact on income, family life and other interests for up to two (part-time masters) or six years (part-time PhD) or longer. The financial cost of a RHD can potentially be high. As set out below, while the university fees for RHDs in Australia and New Zealand are generally modest, the impact on income during the degree can be considerable, particularly if undertaken full-time. With a full-time degree, a number of years of earning as an ED clinician may be forgone, though this is balanced by the advantage of completing the degree earlier. The overall income sacrifice with a part-time degree maybe less if clinical work remains unchanged. Competitive funding for salary replacement is available for both part-time and full-time doctoral students, but less so for masters degrees. Grants for RHDs are usually not equivalent to clinical salary; however, the gap is smaller in absolute terms for nurses, allied health staff and trainees, compared to senior medical staff. Further, it is possible that completing a RHD early in a career, or during training, may not have a significant long-term financial impact as the RHD may facilitate obtaining competitive clinical roles and earlier career progression.

A further argument to be considered is that high-quality research can be done without an RHD. There are numerous opportunities to improve research skills through short courses and online learning.

In our experience, clinicians who pursue a RHD are quite different from students within the traditional university model, who tend to be younger, and continue without interruption from a bachelors degree, to a masters and then a PhD, often without any professional work experience. Clinicians, having already had professional experience, typically have contemplated the advantages and disadvantages of undertaking a RHD for a number of years prior to starting. Their experience and maturity often comes with strong time management and other skills, such as increased resilience, that help them in undertaking a RHD. This experience and maturity is useful as research work in general, and RHDs in particular, come with rejection in various forms, be it study protocols, submissions for publications or grant applications.

Ideally trainees pursuing a higher degree, or a period of academic focus, should be able to exit and enter the training pipeline without impairing access to and their ability to complete clinical training (1). However, consideration must be taken to ensure that work on a higher degree, as well as the possible subsequent academic and research focus, does not impact on the maintenance of clinical skills. A further issue is that medical training is enhanced by moving institutions; this may clash with an universities requirement to be based at a certain location.

Types of research higher degrees

Higher university degrees are either by course work or research, although some combine elements of both. Examples of degrees by course work popular with EM clinicians are the Masters of Public Health (MPH), Masters of Epidemiology and Masters of Biostatistics. These degrees can provide an excellent basis for increased involvement in and understanding of research and data driven quality improvement projects. While centred around course work, these degrees usually also require a research project written up as a report or thesis. Some universities offer the majority of masters teaching remotely, e.g. the MPH at James Cook University, Queensland, or at the University of Auckland, which may be advantageous for clinicians, even those based locally.

RHDs often have limited, or no mandatory course work, with the major focus being on achieving a substantial body of original work and learning the critical skills needed to become independent researchers. The common RHDs are Masters of philosophy (MPhil), Doctor of Medicine (MD) or Doctor of Medical Science (DMedSc) and Doctor of Philosophy (PhD). DMedSc is often used at universities where medical students graduate with an MD.

As far as universities are concerned the timing of starting a RHD is crucial. In general, the research included in an RHD must be done during the student's candidature; work done prior to the official commencement date cannot be included. Conversely, starting too soon, before all elements needed for successful completion of the research are in place, may reduce available time for completion. This is important as most universities have a strict deadline for RHD thesis submission.

While most RHDs are based on research undertaken during candidature, some universities offer an RHD by combining previously published work into a thesis, often with introduction and linking chapters expanding on a theme. However, this option may only be available for staff members of a university.

Choice of research topic

Critical to the successful completion of a RHD is the choice of both topic and supervision. While there are a number of pathways, topics for RHDs undertaken by clinicians tend to be generated via three routes: exploration of a research topic in which the student has a specific interest; development of new skills in a particular area in which the student has a specific interest (e.g. basic science, knowledge translation, or health economics) - where the skills are more important than the topic; or further development of an existing research topic that already has competitive funding awarded to a supervisor. These methods are not exclusive and each has a number of advantages. Developing their own

research interest allows the student to build on previous experience and their passion about a specific topic and is a clear path to becoming a recognised leader in the field. However, the development of such projects often has a long gestation period, in some cases years, while funding is achieved, is often built around single centre projects and is primarily driven by a few individuals (student and supervisors). In contrast, topics developed from existing funding to supervisors have already crossed a major hurdle to clinical research and often involve a wider investigator team who have achieved the funding and thus have a vested interest in making sure the project is successful. These topics are often associated with multi-centre studies or large studies awarded competitive funding which may lead to publications in high impact factor journals. In undertaking such topics, students are exposed to a number of senior investigators in addition to their supervisors, and develop key skills in undertaking multi-centre research, which are useful to a pathway as an independent researcher. Regardless of how the research topic is generated, it needs to be achievable within the time frame of the RHD undertaken.

Supervision

Of equal importance to the topic of the RHD is the principal supervisor, the supervisory team and the research environment (8,9). Supervisors are critical in the success and failure of RHDs. Yet, supervision by clinician researchers in the setting of university affiliated teaching hospitals may be particularly challenging for RHD students due to the competing clinical, administrative and supervisory responsibilities which may impact on the student experience (10). There is no metric of what makes a good and successful supervisor. Past performance is often the best indicator available. Supervisors should be well supported by departmental infrastructure and grant funding. If possible, speak with past students about the strengths and weaknesses of a possible supervisor. Find out if past students finished their degrees, and within an expected time frame. Find out if the supervisor published in high quality journals and if the students were able to do the same. Were past students successful in obtaining grants and employment related to their research work? While it may be set out and closely regulated by a particular university it is important to understand the supervisory, clinical and non-clinical loads a particular supervisor carries. If they already have many students and multiple other commitments, this may impact on the time available for a new student. It is important to ask potential supervisor about planned sabbatical, long service leave or other planned absences. The early stages of doctoral work is often critical to set the student on

the right path in terms of direction of work, expectations and the link to the support a research institution and a research team can offer (8,11).

In addition there is a personal element to the choice of supervisor. Find out if colleagues can work with the supervisor. It is vital that the student and supervisor can work well together over what is a prolonged period. The clinician researcher as supervisor of professionally experienced RHD students may also challenge the traditional supervisory model of master/novice (10).

Time commitment

To understand the amount of work required for RHDs it helps to consider the amount of time generally required for different types of RHDs: a research masters degree usually represents one year full-time work (or 2 years part-time) with material developed for approximately 2 publications expected; a PhD is expected to represent 3 years full-time work (or 6 years part-time) leading to approximately 4 or 5 publications. In some institutions a MD degree is generally between these requirements and represents 2 years full-time work (or 4 years part-time) leading to 3-4 publications, although in other institutions is more similar in requirement to a PhD.

It helps to consider examples of successful RHDs to follow. In **Table 1** we show some actual examples of successfully completed PhD programs in the ED setting.

Planning and time management are cornerstones of a successful RHD. From the outside, and sometimes from the student perspective, RHDs can seem complex, amorphous, and without end in sight. It helps to have a clear idea of what the final thesis will look like as soon as possible. Although this may change with time, the division of the RHD into chapters and stages allows clear interim goals and breaks the work into manageable and clearly defined steps, particularly important for part-time students and clinicians undertaking research over a prolonged period. It is crucial, however, that they form a common theme and ideally build on one another.

Inclusion of published papers in thesis

While RHD regulations, particularly of the final theses, are specific to individual universities, research can usually be presented in chapters “with publication” or in “regular chapters” without publications. In general, the background and literature review and conclusion chapters have to be presented as regular chapters. Chapters with publication still require an introduction to place the publication in context and may include additional information on methodology or additional results that could not be presented in a publication, often due to restrictive publication word limits. Usually publications will be

embedded in a chapter as PDFs. Chapters with publications are often encouraged by universities and supervisors for a number of reasons: it helps focus the student's efforts on a concise and cohesive product, publication of the findings remain the ultimate aim, and the research product is peer reviewed which provides useful feedback for the student during the candidature. Moreover a thesis undertaken with publication is generally easier for examiners to assess and pass as external peer reviewers have already vetted the research. In general, not every chapter has to be done in the same way; chapter can be a mix of regular chapters and published papers (see **Table 1**).

Table 1: Examples of thesis structures for Research Higher Degrees

Example 1:

Chapters of a PhD focused on a randomised controlled trial (RCT)

1. Background, including literature review (regular chapter)
2. Methods and protocol (regular chapter)
3. Retrospective observational study (PDF of published paper)
4. Prospective observational study (PDF of published paper)
5. RCT (PDF of published paper)
6. Health economic analysis of RCT (regular chapter)
7. Development of a grading system (regular chapter)
8. Concluding chapter (regular chapter)

Example 2:

Chapters of a PhD focused on an observational study

1. Background, including literature review (regular chapter)
2. Methods (regular chapter and PDF of protocol paper)
3. Systematic review (PDF of published paper)
4. Main results observational study (PDF of published paper)
5. Secondary result of observational study (PDF of published paper)
6. Secondary result of observational study (regular chapter)
7. Concluding chapter (regular chapter)

Example 3:

Chapters of an MD focused on an observational study

1. Background, including literature review (regular chapter)
 2. Methods (regular chapter)
 3. Retrospective observational study (PDF of published paper)
 4. Prospective observational study (PDF of published paper)
 5. Development of a decision rule (regular chapter)
 6. Concluding chapter (regular chapter)
-

Policy and process

Enrolling in an RHD program is a complex administrative process, varying from university to university. Students should ask supervisors and universities about the regulations early in the process. In general there are set requirements to fulfil prior to enrolment. For a PhD, most universities require a bachelor and masters degree with substantial research components. However, most universities also have regulations that allow clinicians with high grade averages achieved during bachelor degrees, or non-research masters, access into PhD programmes, particularly if they already have evidence of research experience (usually in the form of publications) and other post graduate qualifications (fellowship exams of medical colleges). Regardless, students will need to provide referee reports unless they recently graduated from the same university and will need the endorsement of prospective supervisors. An independent selection committee, often within the university department, faculty or even central university, considers the application based on the prospective student's prior academic track record (and professional qualifications), understanding of the research question, performance at an interview (if required by the university), motivation and capacity to complete the course, relevant prior research and/or professional experience, scope and timeframe of the planned research within the university regulations, and the referee reports. The selection committee generally also has to approve the proposed supervisory team. For non-native English speakers there are language requirements.

Universities have processes during candidature to ensure the student, the supervisors and an advisory committee charged with the oversight of the RHD degree are making appropriate progress. It is usually the responsibility of the student to make sure deadlines are met and supervisors and advisory committee members are available.

For doctoral degrees at one year full-time equivalent (2 years when part-time) students usually need to confirm their candidature in a public forum. Confirmation is a major milestone to evaluate the progress of the project (is the project clearly defined, coherent and feasible), identify any problems, and help set the direction for successful completion.

Universities require regular documented progress reviews where students meet with supervisors and the advisory committee to discuss and assess the progress (**Figure 1**). These meetings encourage discussion between the student and their advisory committee, monitor the progress and identify problems and support the timely completion of the thesis.

A number of institutions require students, towards the end of their RHD to present and defend their work at a completion seminar in a public forum within a specified time period prior to submission of the thesis.

The requirements for thesis submission are set out in detail in universities' regulations, and need to be followed to the letter. They include maximum word limits; approximately 30,000 to 50,000 words for a masters thesis and 80,000 to 100,000 words for a PhD thesis.

Research theses are examined by independent experts in the field, often with universities requiring at least one international examiner. Following this, some universities require students to undertake a viva exam to defend their thesis (this is usually not required in those that have a public process at completion). Students can expect questions on any aspects of their research and the broader field. Following examination theses are either passed, passed only following completion of variable levels of amendments or revisions, not awarded the degree but allowed to resubmit or not be awarded the degree and not allowed to submit for re-examination. The latter is exceptionally rare.

Getting started

Finding supervisors can be easy or very difficult. Supervisors need to have the university specific approval to supervise (in general have a RHD themselves, be affiliated with or employees of the university and have successfully supervised students in the past), need to have the capacity to do so, and have expertise in the topic or research technique of interest. Supervisors should be supported through grants, infrastructure or dedicated non-clinical time to undertake the supervision, as it can be an extensive time commitment. Minimum supervisory meetings are set by universities but generally mandate at least monthly meetings with the student, although most supervisors would meet more frequently during most of the candidature.

Universities will often provide practical checklists of issues to consider at the beginning of a RHD. The list of questions to be discussed should include the research proposal, the research plan with time lines, how supervisors and students should communicate, the thesis format, expectations in terms of attendance of meetings, workspace and facilities required, specific training required, authorship and intellectual property of any work products, means of conflict resolution and available resources for the student. Guidance how to get started can be found in graduate student handbooks (see list of online RHD handbooks at end of the article). A recently published review on how to go about setting up a postgraduate research project will also be useful for future RHD students (11).

Administrative considerations

The Australian Government currently provides funding to Australian universities to cover the cost of research degree places for Australian citizens and permanent residents. For students in Australia wishing to pursue a RHD without being a permanent resident or citizen the annual cost for pursuing a RHD can be very high. Within New Zealand costs are generally the same for citizens and foreign students, with universities having scholarships available for local candidates that cover tuition costs.

Many universities have specific residency requirements mandating the presence of a student on campus, e.g. a requirement to spend at least 12 months full-time equivalent advanced study and research on campus. This can be an important consideration for students planning to enrol at a university outside their place of residence or if they are planning a relocation for training or another purpose during candidature.

Obstacles and how to overcome them

In clinical studies recruitment may be below expected levels. Reasons include overoptimistic estimation of target population or other unforeseen obstacles. If prospective recruitment depends on clinical ED staff a number of strategies can be used to increase recruitment such as rewards systems, regular updates and inclusion as investigators. Another strategy to increase recruitment is the inclusion of other EDs. However, multicentre projects greatly increase the complexity of studies in terms of administration, ethics and other approvals and oversight.

Some clinicians will be able to pursue a RHD without additional external funding, for many it will not be financially possible to do so without external funding. As a first step ED clinicians should negotiate with their heads of department to maximise any non-clinical time for academic pursuits; there is often more flexibility in the system than expected. Further, there is clear interest for departments in having staff with RHDs and of supporting staff desires for additional post-graduate education, career advancement and personal growth. Next, students should explore local sources for RHD funding through universities, research institutes and hospitals. The National Health and Medical Research Council in Australia and the Health Research Council in New Zealand both offer PhD scholarships to help support clinical RHD students. Local and national scholarships often have specific requirements in terms of employment time restraints which may be difficult to fulfil for ED clinicians. There are a number of philanthropic organisations which may also help fund a RHDs. Within

the ED setting externally sourced funding for the project can sometimes be used as leverage to negotiate increased non-clinical time for the student.

Dos and Don'ts

Dos

- Know your topic and read the literature in your immediate area and around it. You cannot make an original contribution unless you know the topic of interest inside out.
- Learn how to write in 'scientificese', which is different to creative or other kinds of writing. Use every opportunity to write and have it corrected by people who you trust. Universities often provide free courses for post-graduate students. Beyond participation in publications, other opportunities for academic writing include participation in the development of guidelines and policies.
- Get to know the facilities and resources your university offers and do this early. It is tragic if students realise critical support programs only at the end of their degrees.
- Research is a team sport. Find and build your team under the guidance of the supervisors.
- Whenever possible, break research work into smaller units with achievable targets.
- Set up meetings with supervisors and advisory committee well in advance.
- Communicate with the whole team in terms of research meetings and key administrative issues. Minutes of meetings should be emailed out soon after.
- Keep a lab book or electronic log of your work, plans and results. Back this up regularly.
- Understand the life plans of your supervisors. This will avoid disruptive unexpected sabbaticals or leave periods.
- Carefully plan the attendance of important courses during the RHD- too early and an important skill (e.g. a statistics course, development of a data base) may have degraded by the time it is needed; too late and the course may be fully booked.
- Be aware of the local idiosyncrasies individual universities require at various stages of the RHD process and follow the requirements.

- Develop a relationship with a biostatistician who will contribute to the project.

Don't

- Start the degree before you have clearly mapped out a program- the clock starts ticking once candidature commences.
- Not understand the commitment and work required.
- Seek help early when you or your supervisors think there may be a problem, either work-related or personal

Other issues

Pregnancy and maternity leave are sometimes planned and sometimes unplanned events that occur frequently during RHDs. Universities generally set out clear policies for the impact on the candidature of students. The more time there is to plan with a supervisor what to do in case of an ongoing study the better. With some planning a RHD can work out well with maternity leave, e.g. if recruitment for a study can continue during a period of leave while the candidature is formally halted.

What to ask a potential supervisor

- What is their track record in terms of student supervision?
- What is their track record in the field of interest?
- What is their experience with a specific study design or population?
- What are their life plans in terms of sabbatical, long service leave, other absences?
- What is his/her current and planned supervisory load?
- How much time to they envisage they will have available for your supervision?
- What do they think about working with another prospective supervisor?

Why higher degree fail

Lack of understanding of the literature

Even though a detailed literature review, such as a systematic review of a specific topic, is part of the work undertaken as part of a RHD during candidature it is important to have a good understanding of the literature before embarking on an RHD. It is critical to understand what has already been done in a specific area of inquiry prior to commencing a degree to avoid duplication and to correctly formulate the research question.

Supervisors

As stated above good supervision is critical to the successful completion of a RHD.

Lack of material (data, participants)

It is important for RHDs that require the collection of clinical data to determine the sample size needed and to understand whether the data required are in fact available, that they are accessible and achievable within the RHD time frame. While detailed information may be limited prior to the candidature key parameters usually are which will allow an understanding of the available and accessible population.

Fatal design flaw

It is vital that the research team has expertise in the type of study planned and has a relevant track record. This avoids one of the most tragic failures of RHD work i.e. the design flaw of a major study which may only become apparent during peer review of a manuscript at the end of the project. Every RHD project should have input from a biostatistician at the design stage.

Conclusion

A RHD can be a great opportunity for ED clinicians interested in research. Embarking on such a degree should, however, not be done lightly.

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Competing interests.

FEB and SRD are Emergency Medicine Australasia section editors for Paediatric Emergency Medicine.

Figure 1

Confirmation, progress reviews and completions reviews for research higher degrees (example from University of Melbourne)

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Examples of Graduate Research Student Handbooks:

Graduate Research Student Handbook, Department of Paediatrics, University of Melbourne

https://medicine.unimelb.edu.au/_data/assets/pdf_file/0007/2773654/Student-Handbook-v1.2.pdf

Accessed on 8 June 2018.

Handbook for Doctoral Degrees
Monash University

<https://www.monash.edu/graduate-research/faqs-and-resources/content>

Accessed on 8 June 2018.

Postgraduate Research Handbook - UNSW Research - UNSW Sydney
University of New South Wales

https://research.unsw.edu.au/document/pg_handbook_0.pdf

Accessed on 8 June 2018.

RHD Handbook - Medicine Program - University of Queensland
UQ School of Medicine, Faculty of Medicine + Biomedical Sciences

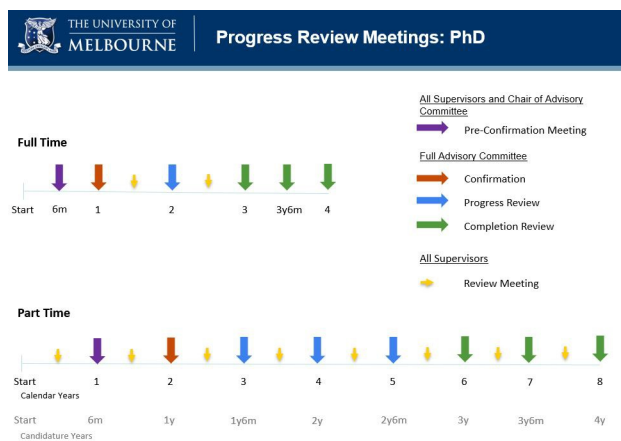
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