

# Identifying the research question and planning the project

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This is the second paper on research in accident and emergency medicine. It discusses the potential for research in A&E medicine and how to identify a good research question.

This paper has the following objectives:

- to discuss the role of research in A&E medicine
- to propose the advantages of doing A&E research
- to explore which areas and types of study the A&E researcher is best placed to tackle
- to summarise what constitutes a good research question
- to describe approaches which may be used to plan a project

## THE CASE FOR RESEARCH IN A&E

During the course of the past few centuries, much of the practice of Western medicine has been based upon tradition and superstition rather than evidence. In medieval times, the practice of "bloodletting" was in widespread use for a variety of conditions, ranging from abdominal pain to pneumonia,<sup>1</sup> yet there was little or no evidence to support its use. With a better understanding of basic medical sciences (for example, anatomy, physiology, biochemistry) and clinical medical sciences (for example, pathology, microbiology, pharmacology), treatments were developed that had a theoretical scientific basis. Thus antibiotics should cure bacterial infections and external pressure in the form of a supporting bandage should control the oedema that follows a soft tissue injury. Unfortunately medicine has prided itself in the scientific basis of its practice without asking whether treatments work and large parts of the practice of modern medicine are still based upon unproven dogma. Realisation of this has resulted in the emergence of evidence based medicine.<sup>2–4</sup> Within A&E, even the most accepted aspects of practice (such as double tubular bandages for the management of sprained ankles) lack evidence of their value.<sup>5</sup> The absence of data on which to base current practice underlines the need for research in A&E medicine.

## THE POTENTIAL FOR RESEARCH IN A&E

A&E is unrivalled in hospital medicine in terms of both numbers of patients and the variety of clinical problems with which they present. As a result, there are unparalleled opportunities for clinically based research. These opportunities do not comprise solely the study of individual diseases or

symptom complexes, but also permit investigation of other areas, such as epidemiology, injury prevention, management, and organisational issues (for example, how to best structure and deliver emergency health care to a population).

The large number of patients presenting to even a small A&E department means that it is relatively easy to quickly recruit patients with common conditions early in their acute illness. Unfortunately, from the researcher's point of view, there is no control over either the timing or rate of presentation of patients with a certain condition—the study design therefore needs to be robust enough to identify and cope with this. For the study of less common conditions, it may be possible to collaborate with neighbouring A&E departments. Provided that certain conditions are met (for example, that all patients with a certain problem do present to A&E and can be identified), collaboration between departments may yield useful epidemiological information.<sup>6,7</sup> A&E trainees may take encouragement by noting that such studies do not necessarily require involvement of consultants to be valuable.<sup>6,7</sup>

Quite what counts as "research" is open for debate. While not generally accepted as being within the definition of research, simple observations of patients and their diseases have historically played an important part in shaping the understanding and management of many medical problems. Hence the continuing justification (in some quarters) for the "case report". Audit is the objective assessment of performance to discover if best practice is being followed either locally or nationally. If best practice is not being followed, changes in practice can be instituted and the process repeated. Audit cannot define best practice: this needs research. Medical research should not be about gathering data and trying to make sense of it but should take the form of a scientific experiment, with a hypothesis that is tested in a predetermined manner, yielding results that can be analysed to allow an interpretation of the validity of the hypothesis. Hypotheses about the best form of treatment are usually best tested with a randomised controlled trial but other methods including observational research and qualitative research may be used to test other types of hypothesis.<sup>8</sup> Some research questions may not even require new data to be generated, but may be answerable by analysing or combining existing data in a different way. Although there are potential difficulties using data from different studies that may use different methodology, this approach forms the basis of meta-analyses.<sup>9,10</sup>

A&E research is obviously best suited to areas of emergency health care. Long term follow up is not usually a feature of A&E work and may therefore be difficult to arrange. Specialists outside

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**Table 1** The merits of A&E research

Positive features	Difficulties
Large numbers of patients	Studying non-emergency illness
Wide range of clinical conditions	Performing laboratory research
Early access to acute illness	Obtaining research grants
Potential for epidemiological studies	Finding a project supervisor
	Lack of credibility of A&E research
	Continuing studies "out of hours"
	Defining entry criteria in prospective studies

A&E may believe themselves to be more expert and better placed to study many diseases—this does not apply simply to chronic problems, but also to acute ones as well. Such beliefs may also be shared by grant giving bodies, who may view A&E as a small specialty, focused exclusively upon providing an emergency service, rather than performing quality research. It may be difficult to find a suitable supervisor locally within A&E for certain large research projects. A solution to this may be to collaborate with specialists from other departments in both the planning and execution of research projects. This approach was adopted by emergency medicine specialists in the United States, before the emergence of academic centres of emergency medicine capable of independently winning large grants. Collaboration also enables the A&E researcher to introduce new ideas, experience and a fresh perspective to the research problem. With one or two notable exceptions, in order to pursue certain types of research (for example, laboratory based research) collaboration with others may be inevitable to achieve success.<sup>11–13</sup>

### WHY DO RESEARCH?

The aim of research is to contribute to medical knowledge. Depending upon the results, research has the potential to change current practice and improve health care on a large scale. "Improvements" may take a variety of forms, including a reduction in one or more of the following: death rate, pain, hospital stay, long term morbidity, hospital costs. The expectation that a single research project will permanently "change the world" is somewhat optimistic though a well designed project may add significantly to current knowledge and help to place another piece of a larger jigsaw puzzle. A project with widespread application may be of considerable general interest, particularly if it challenges widely held beliefs. Add a social, political or other controversial angle and the project may have a dramatic impact! The West of Scotland trainees' hypothermia study was published at a time of controversy about adding value added tax on to the cost of fuel—much media interest ensued.<sup>6</sup> Even if the immediate impact of a research project is not apparent, the individual researcher can benefit by improving their knowledge of a subject and allowing that knowledge to enhance patient care locally. A researcher will gain an understanding of research that will assist when critically appraising other people's research. Good research enhances the reputation of an individual or institution and may bring financial rewards to a department. However, good research is not easy and unless one has a genuine interest in the subject and enthusiasm for research, it will be difficult to take the project to a satisfactory conclusion. Badly done research not only wastes resources but generates confusion. Unless you have an interest in research, it may be better to gain an understanding of research methods and difficulties by participation in somebody else's project and choosing a different way to decorate your curriculum vitae.

### A GOOD RESEARCH QUESTION

The best research question comes from an enquiring mind that asks questions and is not afraid to question established

dogma. The answers to many of these questions may be found in the literature but others can only be answered by setting up a research project. Not infrequently, one investigation will raise as many questions as it answers and this leads to the next project. Pursuing several projects on a theme allows the researcher to develop an interest and become an expert in an area.

Ideally all research should be conducted by people with enthusiasm for and training in research. However, in reality doctors with no experience in research may wish, for a variety of reasons, to do some research. Originality is a critical element in a good research question and faced with an extensive array of previously published research, the new researcher may feel slightly bewildered when attempting to find an original and unanswered question. The new researcher may be advised to focus upon a small topic, or at least a small aspect of a large topic. This will make it easier to become fully aware of previous work on a subject and will ease the process of both performing and making sense of a literature search. Partly for these reasons, researchers usually confine their research to one or two areas.

When searching for a suitable topic for study, the A&E researcher can consider using one or more of the following approaches:

- Examine everyday aspects of standard A&E work and ask whether or not the currently accepted practice has a scientific basis. This approach has good potential to yield clinically relevant questions.
- Peruse papers in current A&E journals and consider whether any of the studies described raise questions that would be worthy of study.
- Peruse current journals, including non-A&E journals, to consider whether the ideas and methods used to tackle one problem could be applied to problems in other areas in A&E practice. For example, "near patient testing" was first developed in primary care, before its potential application in A&E was recognised and studied.<sup>14</sup>
- Liaise with people locally who are interested in research to consider whether there are opportunities to develop some of their previous work, or to apply some of their methods and/or expertise to a new problem in A&E practice.

Having identified an area for study, the researcher will need to formulate a specific question to be answered. It may be possible (and helpful) to divide clinical questions into three parts (the patient characteristic, the intervention, the outcome).<sup>15</sup> In order to be meaningful, the question needs to be carefully constructed, so that it focuses upon all the relevant issues and considers all the relevant outcomes.<sup>16</sup> For example, in an attempt to challenge the role of oral non-steroidal anti-inflammatory drugs (NSAIDs) in the management of sprained ankles, the researcher could ask: "in adults, is there a role for the use of oral anti-inflammatory drugs in the management of sprained ankle?" This question can be

### Characteristics of a good research question

- original
- of interest to the researcher and the outside world
- hypothesis can be formulated
- hypothesis can be tested
- study feasible in terms of time, ethics, money, materials, and expertise
- results potentially important and may change current ideas and/or practice
- potential to develop further projects with similar theme

approached in several different ways, according to which outcome is to be measured. Each outcome can be considered separately as a different question:

1 “does a particular oral NSAID provide better pain relief for a sprained ankle than placebo?”

2 “does a particular oral NSAID reduce swelling more than placebo?”

3 “does a particular oral NSAID result in more rapid functional recovery than placebo?”

4 “does a particular oral NSAID result in better functional long term outcome than placebo?”

These questions are used to generate hypotheses, for example, “a particular oral NSAID provides better pain relief for a sprained ankle than a placebo”. Statistical tests usually aim to disprove a negative and so for testing, these research hypotheses need to be turned into a “null hypothesis”, for example, “a particular NSAID does not provide better pain relief for a sprained ankle than a placebo”.

Each of these hypotheses could be tested using a prospective study in which patients were randomised into two groups, such that patients in each group received (blinded) either a NSAID or placebo. The outcome measure being studied would then be assessed by an investigator (who was also blinded according to which drug each patient had received) using a validated scoring system.

However, having the answer to only one of these questions would not empower the researcher to call for a change in the current practice of the use of NSAIDs for ankle sprains, without the answer to the other three and without repeating the studies using a variety of NSAIDs.

If research indicates that there is a role for NSAIDs for ankle sprains in adults, this will generate four similar questions based on the general hypothesis that “NSAIDs are more effective than analgesics in patients with a sprained ankle” and four more questions about the role of NSAIDs in children with ankle sprains. A health economist could also ask the question “is the use of NSAIDs cost effective in the treatment of sprained ankles?” (They are unlikely to do so in this circumstance but might ask the question if a more costly treatment such as physiotherapy was advocated).

### THE LITERATURE SEARCH

Having decided upon an area of interest to research, or a specific question to investigate, finding out what has already been published on the chosen subject is a key step. All too often, an enthusiastic researcher launches headlong into a project without having completed this step, only to find, after much work, that the study has been done and published before, on a larger scale and with a more rigorous design. Such efforts result in disillusionment and do not progress the cause of medical science.

Well read colleagues or experts can be useful sources of background information and can often instantly cite relevant papers. Indeed, experts have been shown to be capable of citing references that would otherwise be missed during a

### Sources of information

- colleagues, mentors, experts, conferences
- review articles
- Medline
- Cochrane Library
- Index Medicus
- textbooks

standard literature search.<sup>17</sup> References in textbooks are (understandably) dated, thereby considerably limiting their use as a source of current evidence and information. Recent articles in peer reviewed journals, on the other hand, may prove to be good sources, although it is as well to bear in mind that many authors tend to quote selectively from the literature in order to support their data and conclusions. Similarly, the effects of possible publication bias and/or covert duplicate publication need to be considered.<sup>18 19</sup>

Most researchers rely upon the massive Medline database, compiled by the National Library of Medicine of the United States. Medline is available in a variety of forms, but it is undoubtedly most conveniently accessed via the internet, allowing rapid downloading of references to disk or home computer. Using Medline is relatively straightforward and is described fully elsewhere.<sup>15 20</sup> To make full use of the database, it is essential to take great care in choosing search terms.<sup>20</sup> Even then, there is a good chance that a number of relevant articles will not be identified in a Medline search. Even using optimistic estimates, only about two thirds of the medical literature is indexed by Medline—it is often important to search other databases. These might include EMBASE (the European equivalent of Medline), which is particularly useful for its coverage of drug and therapeutic journals, BNI (the British Nursing Index), or psychiatric databases such as PSYCHLIT or PSYCHINFO. These databases may be accessed online or by CD ROM.

Alternative strategies to consider include exploring the Cochrane Library.<sup>21</sup> This includes the Cochrane database of Systematic Reviews, the Database of Abstracts of Reviews of Effectiveness (DARE), and the Cochrane Controlled Trials Register. The Cochrane Review Methodology Database, also part of the Library, is a useful tool for anyone contemplating a review.

### DEVELOPING THE QUESTION: REFINING THE HYPOTHESIS

Having completed the literature search, the relevant papers need to be carefully read. They will help provide the answer as to whether the proposed question has been addressed previously or whether it is completely original. Ideas of how to refine the research question or of further questions may emerge. Previous papers may also allow an insight into the feasibility of possible studies and they may provide assistance with methodological problems. Additionally, the literature will identify names and addresses of other people interested in the same subject and may raise possibilities for collaboration. Experts in a field are usually flattered to be asked for advice: too often research is seen as competitive and ideas are kept secret leading to flaws in the research question and methods not being detected until it is too late.

The researcher will be in a position to decide whether or not to proceed with the original research question. If not, consideration needs to be given to the possibility of pursuing a slightly different question.

Once a decision to attempt to undertake a study has been made, further consideration will need to be given to a number of issues, including:

- ethical problems including ethical approval

- research study design and methodology including practicalities of recruiting and follow up of patients
- statistical considerations
- funding

These issues will be considered in subsequent articles in this series.

## CONCLUSIONS

The case for undertaking research in the A&E setting is overwhelming. Given the breadth of clinical conditions presenting to A&E departments, it is clear that there is enormous potential to perform worthwhile research. A&E specialists of the future face important challenges in being able to identify firstly, what research questions need to be answered and secondly, how to set about answering them.

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