Common Pitfalls in Research

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Steps of a research project

1. Identify the research question
2. Do a literature review
3. Choose a study design
4. Collect the data
5. Analyse the data
6. Writing and publishing
“Deciding on an answerable and relevant research question lies at the heart of all good research projects.”

Roger Jones, Editor, Family Practice

Jones R. Choosing a research question. Asia Pac Fam Med. 2003;2:42-4
“…much of current family medicine research is at the adolescent stage of development: growing fast, somewhat awkward, showing promise, but not really mature. Much of the research published in family medicine journals is surveys of practice, often comparing family physicians’ performance against guidelines (usually developed outside primary care). This navel-gazing research does little to change practice, and most practising family physicians do not look to their researchers for answers to their clinical questions. Thus, I believe that part of family medicine’s problem is that their researchers are not asking the right questions. We need to raise our sights to more clinically important questions.”

Tony Reid, Scientific Editor, Canadian Family Physician
Research question

Edward Huth, the distinguished editor of the Annals of Internal Medicine, recommended two crucial tests of any research question:

1. The ‘who cares?’ test
2. The ‘so what?’ test

Huth E. How to write and publish papers in the medical sciences. London: Williams & Wilkins, 1990
**Box 1. FINER criteria for a good research question**

| F | Feasible | Adequate number of subjects  
|   |         | Adequate technical expertise  
|   |         | Affordable in time and money  
|   |         | Manageable in scope  
| I | Interesting | Getting the answer intrigues investigator, peers and community  
| N | Novel     | Confirms, refutes or extends previous findings  
| E | Ethical   | Amenable to a study that institutional review board will approve  
| R | Relevant  | To scientific knowledge  
|   |           | To clinical and health policy  
|   |           | To future research  

Adapted with permission from Wolters Kluwer Health.

**Box 2. PICOT criteria**

| P | Population (patients) | What specific patient population are you interested in?  
| I | Intervention (for intervention studies only) | What is your investigational intervention?  
| C | Comparison group | What is the main alternative to compare with the intervention?  
| O | Outcome of interest | What do you intend to accomplish, measure, improve or affect?  
| T | Time | What is the appropriate follow-up time to assess outcome

[https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2912019/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2912019/)
Research question: POEMs

- 170 clinical research papers from four US family medicine journals (ArFM, FM, JABFP, JFP)
- POEMs = Patient-Oriented Evidence that Matters
  1. Did the authors study an outcome patients would care about?
  2. Does the article address a specific clinical question that you encounter frequently in your practice?
  3. Will this information, if true, require you to change your current practice?

<table>
<thead>
<tr>
<th>Relevance</th>
<th>Total (n=170)</th>
<th>Family Practice Institution (n=98)</th>
<th>Non-Family Practice Institution (n=72)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrelevant</td>
<td>91 (53%)</td>
<td>43 (44%)</td>
<td>48 (67%)</td>
</tr>
<tr>
<td>Relevant</td>
<td>34 (20%)</td>
<td>22 (22%)</td>
<td>12 (17%)</td>
</tr>
<tr>
<td>Highly relevant</td>
<td>45 (26%)</td>
<td>33 (34%)</td>
<td>12 (17%)</td>
</tr>
<tr>
<td>Highly relevant and valid (POEM)</td>
<td>22 (13%)</td>
<td>12 (12%)</td>
<td>10 (14%)</td>
</tr>
</tbody>
</table>

Relevant=criterion #2 only
Highly relevant=all three criteria

https://www.researchgate.net/profile/Allen_Shaughnessy/publication/15023612_Becoming_a_Medical_Information_Master_Feeling_Good_About_Not_Knowing_Everything/links/556eeb0408aeab777273514.pdf
Research is the systematic collection, analysis and interpretation of data to answer a certain question or solve a problem.

Extending the boundary of knowledge.

The challenge is to determine:
- What is already known.
- What is unknown but is worth finding out.
Know how to query databases

- PubMed, Scopus, etc

- MyMedR

Know how to manage references

- EndNote,
- Refworks
- Mendeley

Know how to critique original research

Know how to identify research gaps

- Scopus
- All = 60 millions
- Health sciences = 32%
- Malaysia\[Affil\] + Medicine = 38,159
- PubMed
- Malaysia\[AD\] = 34,885
- MyMedR
- All = 51,479
- Medical ≈ 50%
- Primary care <1000
Literature search: the pros and cons

Google/Google Scholar
- **Pros**
  - Comprehensive (incl gray lit)
  - Easier to get full text
  - Link to “cited by…”
- **Cons**
  - No quality filter (beware of predatory journals!)
  - Rank by “popularity”

PubMed
- **Pros**
  - Great search interface
  - Download citations
  - Restricted entry
  - Similar articles
- **Cons**
  - Restricted to limited set of journals
Literature search: adequate?

Mean number of useful but uncited references = 2.7

1. A rare case of a sharp foreign body on the vocal cord [8]
3. An elderly with a ‘bony’ smile [1]
5. Disease impact and needs of prostate cancer survivors in Malaysia [0]
7. Isolated unilateral sixth cranial nerve palsy – A rare presentation of dengue fever [1]
8. Should elderly live alone? Assessing the risk of falls among community-dwelling elderly [0]
9. Submandibular mass as a rare sole presentation of an advanced stage nasopharyngeal carcinoma [6]
10. The man with sweaty palms [3]
11. The views and experiences of Malaysian primary care doctors in managing patients with chronic low back pain: a qualitative study [0]
Study design

“But good design is more important; one can always re-analyse good data.”

James Young, Statistician, Statistical Advisor for the Swiss Medical Weekly, Basel, Switzerland

Study design

- What is their opinions/views?
  - Qualitative research
- How common is …?
  - Cross-sectional study
- Which test is better?
  - Cross-sectional study (diagnostic)
- What is the risk factor?
  - Case-control study, Cohort study
- Which treatment works best?
  - Clinical trial

http://www.cebm.net/study-designs/
Data collection

“The great popularity with questionnaires is they provide a ‘quick fix’ for research methodology. No single method has been so abused.”

Gillham B. Developing a questionnaire (real world research). London: Continuum, 2000
Data collection: *de novo* questionnaire

Questions should be

1. Appropriate
2. Intelligible
3. Unambiguous
4. Unbiased
5. Omnicompetent (capable of coping with all possible responses)
6. Appropriately coded
7. Piloted
8. Ethical

Designing a questionnaire

1. Decide what data you need
2. Select items for inclusion
3. Design individual questions
4. Compose wording
5. Design layout
6. Think about coding
7. Prepare first draft and pretest
8. Pilot and evaluate
9. Perform survey
10. Start again!


[http://www.bmj.com/content/307/6914/1264.full.pdf](http://www.bmj.com/content/307/6914/1264.full.pdf)
Data collection: pre-existing questionnaire

1. Could you use an existing instrument?
2. Are translated versions available?
3. Is the questionnaire sufficiently reliable and valid?
4. Is the questionnaire appropriate for the culture, language, educational level of your respondents?

**SF-36:** In the past 4 weeks...

a. Did you feel **full of pep**?

b. Have you felt so **down in the dumps** that nothing could cheer you up?

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1: Boynton PM. Administering, analysing, and reporting your questionnaire. BMJ. 2004; 328(7452):1372-5. [PMC420299]
2: Boynton PM, Greenhalgh T. Selecting, designing, and developing your questionnaire. BMJ. 2004;328(7451):1312-5. [PMC420179]
3: Boynton PM, Wood GW, Greenhalgh T. Reaching beyond the white middle classes. BMJ. 2004;328(7453):1433-6. [PMC421793]
Data collection: other tools

- Data = true measurement + error
- The World Hypertension League recommends that in community screening settings for noninvasive BP assessment, a semi-automated or fully automated oscillometric BP device that uses a range of upper arm cuffs be used wherever feasible.

Validation:
European Society of Hypertension International Protocol Association for the Advancement of Medical Instrumentation British Hypertension Society

Analysis

1. No a priori sample size calculation/effect-size estimation
2. Use of wrong statistical tests
3. Over-reliance on p value
4. Failure to use multivariate techniques to adjust for confounding factors


Eldridge S. Good practice in statistical reporting for Family Practice. Fam Pract. 2007;24(2):93-4 

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1119478/
Statistics: power and sample size

- 85 original studies in BJGP (Jan 1994 to June 1995)
- 48 (56%) underpowered
- 16 (19%) overpowered

The colour of sputum in 241 adults with URTI were compared with sputum culture.

- P value = 0.04
- Statistical significance vs clinical significance
- Sensitivity = 79% (95%CI 59-92)
- NPV = 94% (95%CI 88-98)