Introduction to Research Methods

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What is research?

n. a careful search: investigation: systematic investigation towards increasing the sum of knowledge (Chambers).

Television programme

Cat food commercial

Incorporating a simple screening and treatment programme for subclinical vaginal infections into routine prenatal care early in the second trimester reduces the rate of spontaneous preterm deliveries by 50% in all weight categories (British Medical Journal 2004; ***329:*** *371-4)*

Scientific research

- **Generalisable**
- **Empirically verifiable, repeatable**
- **Transparency of decision making**
- **Builds on the work of others**
- **Generates new ideas for testing**

The scientific method:

1. Start with an idea or theory.
2. Devise an investigation to test the theory.
3. Carry out the investigation.
4. If the results do not support the theory, think of a new theory.

Why should we be interested in research?

Evidence-based health care

Paradigms of practice:

- **authority-based**
- **evidence-based**

Authority:

The opinion of the eminent practitioner, based on experience and the earlier authority of others.

Experience became more formalised, in the form of controlled experiment and formal data collection.

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Evidence:

Scientific data obtained by systematic research as the source of decisions about methods of diagnosis and treatment.

Attempt to synthesise all available evidence.

Levels of evidence:

- ❖ Paper reporting single study
- ❖ Review article
- ❖ Meta-analysis
- ❖ The Cochrane Collaboration

Types of health care research

Explanatory:

Theoretical research
Hypotheses

Does air pollution affect health?

Pragmatic:

Applied or policy research
Estimation

How many deaths each year are attributable to air pollution?

(May be none.)

Generating research questions

Start with a generalised, ill-focused question.

Does air pollution affect health?

Refine to a narrow, specific question: a hypothesis to test or a quantity to estimate.

Was there an increase in deaths following an air pollution episode in London?

Are daily rises and falls in air pollution accompanied by rises and falls in hospital admissions for asthma?

Generating research questions

Start with a generalised, ill-focused question.

Why has the incidence of lung cancer increased?

Refine to a narrow, specific question: a hypothesis to test or a quantity to estimate.

Do lung cancer patients have greater exposure to air pollution or cigarette smoke than do patients with other diseases?

Is the proportion of smokers who develop lung cancer over five years greater than the proportion for non-smokers?

Planning research

- What is the question: aims and objectives?
- Is the answer already known?
  --- literature review
- Research team
- Study population
- Study design, sample size
- Data collection --- what and how
- Data analysis
- Presentation

Planning continued

- Protocol
- Timetable
- Cost, funding
- Ethics committee
- Research governance
- Do the research!

The health care literature:

Written repository of healthcare knowledge.

- Scientific journals
- Books
- Conference proceedings
- Reports

Paper or electronic.

Journals:

General journals, e.g.:

- *Lancet*
- *British Medical Journal*
- *New England Journal of Medicine*

Specialist journals, e.g.:

- *British Journal of Obstetrics & Gynaecology*
- *Diabetic medicine*
- *Radiology*
- *International Journal of Nursing Research*

An example:

The British Medical Journal

BMJ

Contain:

- ❖ Research reports
- ❖ Correspondence
- ❖ Review articles
- ❖ Opinion
- ❖ Book reviews
- ❖ Eductional articles
- ❖ Obituaries
- ❖ Job ads

The structure of a paper

The scientific method:

1. Start with an idea or theory.
2. Devise an investigation to test the theory.
3. Carry out the investigation.
4. If the results do not support the theory, think of a new theory.

Plan of an investigation:

1. Define the general hypothesis to to be investigated
2. Define the specific objectives of the study
3. Design the study
4. Carry out the study and collect data
5. Analyse data
6. Draw conclusions
7. Publish results

Standard health care scientific paper:

- ❖ Summary or abstract
- ❖ Introduction
- ❖ Methods
- ❖ Results
- ❖ Discussion

The structure of a paper matches the plan of an investigation:

Plan of an investigation:	Layout of paper
1. Define the hypothesis	Introduction
2. Define specific objectives	Introduction
3. Design the study	Methods
4. Carry out the study and collect data	Methods
5. Analyse data	Results
6. Draw conclusions	Discussion
7. Publish results	Summary

To understand most research papers we must understand the principles of design and analysis.

Critical reading:

Research papers are written by fallible human beings. Most papers have flaws.

Flaws may be minor and not affect the conclusions at all, or they may lead the authors into serious error.

Purpose of critical reading:

a) Can the methods used produce useful information?
b) Do the conclusions drawn follow from the results of the study?

In this module:

Study designs:
qualitative and quantitative
observational and experimental

Getting data:
physical measurements
asking questions

Appraising evidence:
critical reading
systematic reviews

In the Applied Biostatistics module:

Analysing data:
computing
statistics

How to learn about research methods

Read research papers:

In your own field

British Medical Journal --- free online every week

Concentrate on Methods and Results

Ask "Why did they do this?"

"What is correct?"

"What could they have done intstead?"

"Do the conclusions match the methods and results?"