Outline

• Definition of evidence-based medicine (EBM)

• History of evidence-based medicine and practice

• Steps in the EBM process

• EBM resources

• The future of EBM
EBM – What is it?

- EBM is the synthesis of information so that the best-informed diagnostic and treatment decisions can be made.
EBM and the Translational Continuum

- Basic Science Discovery
- Early Translation
  - Interventional development
  - Phase I/II trials
- Late Translation
  - Phase III trials
  - Phase IV trials
  - Production and commercialization
- Dissemination
- Adoption
“….the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.”

Integrating Clinical Expertise with Evidence

Source: www.slideshare.net Rani Gereige. Introduction to EBM
History of EBM

- Pierre Charles Alexander Louis (1787-1872)
- French physician
- Founder of the “numerical method” (medical statistics) in medicine and the champion of exact observation and conservative deduction in medical studies
- Investigated blood-letting and its timing for patients with pneumonia and looked at the outcomes of recovery and death
– Ernest Amory Codman (1869 – 1940)

– “The common sense notion that every hospital should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire “if no, why not?” with a view of preventing similar failures in the future.”

Reference: Codman, 1934
First Modern Randomized Trial

• 1948 - New method of conducting clinical trials first reported.

• Randomized trial of “Streptomycin Treatment of Pulmonary Tuberculosis.”

• Randomly allocating individuals after entry into the trial eliminates bias and provides a proper estimate of random error.

STREPTOMYCIN TREATMENT OF PULMONARY TUBERCULOSIS

A MEDICAL RESEARCH COUNCIL INVESTIGATION

The following gives the short-term results of a controlled investigation into the effects of streptomycin on one type of pulmonary tuberculosis. The inquiry was planned and directed by the Streptomycin in Tuberculosis Trials Committee, composed of the following members: Dr. Geoffrey Marshall (chairman), Professor J. W. S. Blacklock, Professor C. Cameron, Professor N. B. Capon, Dr. R. Cruickshank, Professor J. H. Gaddum, Dr. F. R. G. Heaf, Professor A. Bradford Hill, Dr. L. E. Houghton, Dr. J. Clifford Hoyle, Professor H. Raistrick, Dr. J. G. Scadding, Professor W. H. Tytler, Professor G. S. Wilson, and Dr. P. D'Arcy Hart (secretary). The centres at which the work was carried out and the specialists in charge of patients and pathological work were as follows:

**Brompton Hospital, London.**—Clinician: Dr. J. W. Crofton, Streptomycin Registrar (working under the direction of the honorary staff of Brompton Hospital); Pathologists: Dr. J. W. Clegg, Dr. D. A. Mitchison.

**Colindale Hospital (L.C.C.), London.**—Clinicians: Dr. J. V. Hurford, Dr. B. J. Douglas Smith, Dr. W. E. Snell; Pathologists (Central Public Health Laboratory): Dr. G. B. Forbes, Dr. H. D. Holt.

**Harefield Hospital (M.C.C.), Harefield, Middlesex.**—Clinicians: Dr. R. H. Brent, Dr. L. E. Houghton; Pathologist: Dr. E. Nassau.

**Bangour Hospital, Bangour, West Lothian.**—Clinician: Dr. I. D. Ross; Pathologist: Dr. Isabella Purdie.

**Killingbeck Hospital and Sanatorium, Leeds.**—Clinicians: Dr. W. Santon Gilmour, Dr. A. M. Reevie; Pathologist: Professor J. W. McLeod.

**Northern Hospital (L.C.C.), Winchmore Hill, London.**—Clinicians: Dr. F. A. Nash, Dr. R. Shoulman; Pathologists: Dr. J. M. Alston, Dr. A. Mohun.

**Sully Hospital, Sully, Glam.**—Clinicians: Dr. D. M. E. Thomas, Dr. L. R. West; Pathologist: Professor W. H. Tytler.
Paradigm Shift

• **Old view** of clinical medicine:
  – Understand basic mechanisms of disease.
  – Use individual clinical expertise or expert authority to treat the patient.

• **New view** of evidence-based medicine:
  – Integrate clinical expertise with accumulating evidence from applied health research in order to update understanding.
  – Recognize the uncertainties associated with individual clinical management decisions, including patient values and preferences.
History of EBM (continued)

• Archie Cochrane (1909-1988)

• Effectiveness and Efficiency: Random Reflections on Health Services (1972)

• Because resources would always be limited, they should be used to provide equitably those forms of health care which had been shown in properly designed evaluations to be effective.

• Stressed the importance of using evidence from randomized controlled trials (RCTs) because these were likely to provide much more reliable information than other sources of evidence.
Hierarchy of Evidence

- Meta-Analysis
- Systematic Review
- Randomized Control Trial
- Cohort Studies
- Case Control Studies
- Case Series
- Case Reports
- Editorials, Opinions, and Ideas
- Animal Research
- In Vitro Research
- Experimental Studies
- Observational Studies
Cochrane Collaboration

• Founded in 1993 by Iain Chalmers and named after Archie Cochrane.

• International not-for-profit organization tasked with compiling and analyzing thousands of studies annually published in the medical literature.

• Currently more than 28,000 reviewers from more than 100 countries follow a well-defined process and research methodology to minimize bias and synthesize the results into systematic reviews in every area of clinical care.

Methodological Issues in Evaluation of Medical Intervention since 1950

1. Systematic reviews and meta-analysis
2. Publication bias
3. Undesired side effects
4. Fair comparators
5. Conflicts of interest
6. Reporting standards for
   1. RCTs (CONSORT 1996/2001)
   2. Non-pharmacological trials (CLEAR NPT 2005)
   3. Observational studies (STROBE 2007)

Reference: Trohler 2008
Expanded Definition of EBM

“Evidence-based medicine is the concept of formalizing the scientific approach to the practice of medicine for identification of “evidence” to support our clinical decisions. It requires an understanding of critical appraisal and the basic epidemiologic principles of study design, point estimates, relative risk, odds ratios, confidence intervals, bias and confounding. By using this information clinicians can categorize evidence, assess causality, and make evidence-based recommendations. Evidence-based medicine allows analysis of complicated materials so that we can make the best possible clinical decision for the population we serve”.

Why is there a need for EBM?

- Caring for patients requires clinically important information on diagnosis and therapy.
- Physician knowledge deteriorates with time since training.
- New evidence often changes clinical practice.
- There is an information overload – journals, citations, meetings and little time:
  - There is often a lag between the publication of research findings to implementation in clinical practice.
  - Not all studies are equally well-designed, conducted or interpreted.
Steps in the EBM Process

1. Start with the patient and a need for information. Formulate a focused, relevant question.

2. Search for the best evidence to answer the question.

3. Critically appraise the evidence to evaluate validity and usefulness.

4. Return to the patient and integrate the evidence (apply the results in practice).

5. Evaluate the clinical application of the evidence.
EBM Step 1: Formulate a focused, relevant question

Frame an *answerable* question (by searching the medical literature) derived from the case using the “PICO” format:

- **P**atient population: age, sex, disease symptoms

- **I**ntervention: treatment, prevention or diagnosis of disease (influencing etiology, prognosis, risk factors, cost-effectiveness)

- **C**omparison: of treatment, prevention or diagnostic method

- **O**utcome:
**Example**

<table>
<thead>
<tr>
<th>Table 2: PICO question of the patient</th>
</tr>
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<tbody>
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<td><strong>Patient or Population</strong></td>
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EBM Step 2: Search for the best evidence

Search for the top levels of evidence:

• Randomized clinical trials
  – Pubmed
  – Medline
  – Cinahl

• Systematic reviews
  – Cochrane Library [www.cochrane.org](http://www.cochrane.org)
    • Cochrane Database of Systematic Reviews
    • Database of Abstracts of Reviews of Effects (DARE)
    • Cochrane Central Register of Controlled Trials (CENTRAL)
  – ACP Journal Club
www.cochrane.org
ACP Journal Club
The Best New Evidence for Patient Care

ACP Journal Club summarizes the best new evidence for internal medicine from over 130 clinical journals. Once a bimonthly stand-alone journal, ACP Journal Club is now a monthly feature of Annals of Internal Medicine. Research staff and clinical editors rigorously assess the scientific merit of the medical literature as it is published and a worldwide panel of over 5000 physicians assesses the clinical relevance and newsworthiness of rigorous studies.

UpToDate® is the premier evidence-based clinical decision support resource authored by physicians to help healthcare practitioners make the best decisions at the point of care. By combining the latest clinical knowledge with cutting-edge technology, UpToDate changes the way clinicians practice medicine and has become an indispensable part of clinical workflows in institutions and practices worldwide.
EBM Step 3: Critically appraise the evidence

1. Are the results valid?
   • Was there random assignment of patients to treatment groups?
   • Were the groups similar at the start of the trial?
   • Were the groups handled and followed in the same way?
   • Were patients, physicians and evaluators kept “masked” to treatment assignment?
   • Were outcome measures objective?
   • Were all patients who entered the trial accounted for by the end of the trial?
     – Was follow-up complete?
     – Were patients analyzed in the groups to which they were randomized ("intent to treat “ analysis) ?
EBM Step 3: Critically appraise the evidence

2. What are the results?

• How large is the estimated treatment effect?
  – Continuous outcome (e.g. duration of diarrhea)
    • Difference in means
  – Dichotomous outcome (e.g. mortality)
    • Risk difference
    • Relative Risk

• How precise is the estimate of treatment effect?
  – Depends on sample size as well as variability
  – 95% confidence interval for treatment effect
Critical Appraisal Tools

- Articles
- Checklists
- Websites

Welcome to the CASP UK Website

CASP stands for Critical Appraisal Skills Programme. Critical appraisal is the process of carefully and systematically examining research to judge its trustworthiness, and its value and relevance in a particular context. CASP provides resources and learning and development opportunities to support critical appraisal skills development in the UK.

On this website you can find out about the CASP approach, download the CASP checklists, and find out what sort of workshops we offer to help improve your appraisal skills. You can even commission one for your workplace – CASP has a long track record of delivering tailored workshops for the Department of Health, NHS organisations, professional networks and communities, third sector and commercial organisations.

Checklists

**NEW TRAINING DATES**

Booking is now open for this 3 day critical appraisal course.

Download the CASP critical appraisal checklists:

- CASP Randomised Controlled Trial
- CASP Systematic Review

Workshops

Network News

Tweets by @CASPUK

Interested in commissioning a workshop? We can tailor workshops to your own specific needs and deliver them in your workplace. Please contact...
EBM Step 4: Integrate the evidence

Can the results be applied to this patient?

1. Is my patient sufficiently similar to those in the trial?
2. Do the outcomes make clinical sense to me?
3. Is the magnitude of benefit clinically worthwhile for my patient?
4. What are the treatment drawbacks (benefits versus harms, costs)?
5. Does the treatment fit in with my patients’ benefits and values?

Reference: Hywel Williams, 2011 evidencelive.org
Back to the Example

• Discuss the evidence with the patient.
• Consider side effects, socioeconomic issues, ethical issues, religious issues
  – Cost of probiotics
  – Availability and acceptability in the diet

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EBM Step 5: Evaluate the clinical application of the evidence.

- Need to ask whether answerable questions have been formulated, best evidence is found quickly, is effectively appraised and whether it is integrated with clinical expertise and patient preferences and values in a way that leads to a rational and acceptable management strategy.

- Need to evaluate the approach at frequent intervals and decide whether Step 1 through 4 need to be improved.
Evidence-Based Information Cycle

The Evidence-based Information Cycle is a framework for understanding the process of practicing evidence-based care.

ASSESS clinical or policy problems and identify key issues;
ASK well-built questions that can be answered using evidence-based resources;
ACQUIRE evidence using selected, pre-appraised resources;
APPRAISE the validity, importance and applicability of evidence that has been retrieved;
APPLY evidence to clinical or policy problems.

http://www.cche.net/usersguides/ebm_tips.asp
Does Practicing EBM Improve Patient Care?

- Random sample of 146 patients cared for by 33 internal medicine attending physicians; 87% received EBM treatments.
- After physicians committed to a specific diagnosis and treatment plan, investigators performed standardized literature searches and provided the results to the attending physicians.
- Attending physicians changed treatment for 18% of the patients as a result of the literature searches.
- Panels of peer reviewers judged the quality of care to be improved in 78% of these patients for whom treatment was changed.

EBM and Clinical Practice Guidelines

• Practice guidelines have been described as “an amalgam of clinical experience, expert opinion and research evidence.”

• In the past, practice guideline development has varied in quality and methods.

• Evidence-based guidelines have rigorous review methods and synthesis of higher quality primary research.

Breast Cancer Screening Guidelines

Current Guidelines

Breast Cancer Screening

Guideline: Screening Mammography for Women 40 to 49 Years of Age: A Clinical Practice Guideline from the American College of Physicians (2007)
Full text | Summary for Patients

Evidence Review: Screening Mammography in Women 40 to 49 Years of Age: A Systematic Review for the American College of Physicians
Full text
EBM and Quality Improvement

Resources

• Shared decision making resources
• Centre for Evidence Based Medicine
• Center for Health Evidence
• JAMA Evidence
• EvidenceLive
• James Lind Library
• More!
Shared Decision Making Resources

• Foundation for Informed Medical Decision Making
  http://informedmedicaldecisions.org/

• International Patient Decision Aid Standards (IPDAS) Collaboration
  http://ipdas.ohri.ca

• Ottawa Hospital Research Institute
  http://decisionaid.ohri.ca

• White River Junction VA Outcomes Group
  http://www.vaoutcomes.org/index.html
Welcome to CEBM
Welcome to the Centre for Evidence-based Medicine at the University of Oxford.
CEBM aims to develop, teach and promote evidence-based healthcare through conferences, workshops and EBM tools so that all healthcare professionals can maintain the highest standards of medicine.

Current Courses & Workshops
We offer a range of courses to clinicians and other healthcare professionals seeking to develop their EBM skills.

One day workshop on Evidence-Based Practice
26th June 2013 (1 day). Rowley House, 1 Wellington Square, Oxford, OX1 2JA
http://www.cche.net

About the Centre for Health Evidence

The Centre for Health Evidence (CHE) is a not-for-profit organization based at the University of Alberta. We are dedicated to helping health organizations and associations find and apply best evidence in daily practice. We work on a project basis, and use a variety of communication and information technologies to create decision support tools and services.

CHE Mission

The Centre for Health Evidence was established to help patients, practitioners, and policy makers:

Know what to do

because quality knowledge resources are assembled, integrated and packaged using simple, user-specific, Internet desktops

Do what is known

because online aids help users assess problems, ask questions, and acquire, appraise, and apply knowledge
The James Lind Library has been created to help people understand fair tests of treatments in health care. The principles of fair tests are explained in essays available in Arabic, Chinese, English, French, Russian, Portuguese and Spanish. In addition, three books written for the public are available here for free download. One of the books - Testing Treatments - is available in 2 editions and seven languages at www.testingtreatments.org.

To illustrate the evolution of fair tests of treatments, the James Lind Library also contains images of key passages from manuscripts, books, journal articles and other relevant material supplied mainly by the Sibbald Library of the Royal College of Physicians of Edinburgh. The JLL Bulletin contains original articles about the history of fair tests.

At 7.30 pm on Tuesday 9 August 2011 the James Lind Library’s ‘epidemiological sibling’ - the People’s Epidemiology Library - was launched officially at the Royal College of Physicians of Edinburgh.

The James Lind Library is dedicated to the patients and professionals who have contributed evidence about the effects of treatments in health care. For a full description of the James Lind Library, click here or here for Spanish. Comments are welcome, and should be sent to feedback@jameslindlibrary.org.

International Clinical Trials Day is celebrated every year in May, the month in which James Lind began a controlled trial comparing different treatments for scurvy (Lind 1753). To mark the anniversary this year, the European Clinical Research Infrastructures Network (ECRIN) has organised a meeting that will take place this year in Portugal.
The Future of EBM

- Treating the patient
  - Informed patient preferences and shared decision making

- Inclusion in medical school education

- Office decision aids and computer systems for decision support

- Development of clinical practice guidelines and policy

- EBM and quality improvement
Final Comments

• Traditional medical decision making (clinical judgment) is not sufficient.

• Evidence-based medicine provide the basis for clinical practice guidelines.

• Lack of evidence of effectiveness *does not* equal evidence of absence of effectiveness.

• Guidelines and performance measures will shape policy and optimize patient care in the years to come.