Principles of Evidence-Based Veterinary Medicine

What is it & Why Does It Matter?
Evidence based medicine is 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.

David Sackett, DL. et al. Evidence based medicine: what it is and what it isn't
The integration of the best research evidence with our clinical expertise and our patient's unique values and circumstances.

Strauss, SE. et al. Evidence-based medicine: how to practice and teach EBM.
At its heart is the confidence in the scientific methodology that has developed over the centuries to enable us to distinguish what is likely to be true from what is likely to be false (or unproven).

Cockroft, P. Holmes, M. 
Handbook of Evidence-Based Veterinary Medicine
“[Science] is the worst form of [epistemology], except for all those other forms that have been tried.”
Child Mortality from 1751 to 2011 – Max Roser

Children dying before the age of 5 (per 1,000 live births)

- Sweden
- Germany
- United Kingdom
- India
- Ghana
- South Korea

1946: 387 out of 1,000 South Korean children died before their 5th birthday

Today: Fewer than 5 out of 1,000 South Korean children died before their 5th birthday

The author Max Roser licensed this visualisation under a CC BY-SA licence. You are welcome to share but please refer to its source where you find more information: www.OurWorldinData.org/data/population-growth-vital-statistics/child-mortality

Data source: UNICEF’s www.childmortality.org
Why do We Need EBVM?

• To prevent and correct our errors
• To improve patient care
• To meet our ethical obligation to our clients
Informed Consent

Information about the nature of the evidentiary record, or lack thereof, undergirding the physician’s recommendation could be viewed as an essential part of the informed-consent process because such information might significantly influence the patient’s decision to accept, reject, or negotiate around the physician’s advice.

## Alternatives to EBVM?

### Basis of clinical practice

<table>
<thead>
<tr>
<th>Basis for clinical decisions</th>
<th>Marker</th>
<th>Measuring device</th>
<th>Unit of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence</td>
<td>Randomised controlled trial</td>
<td>Meta-analysis</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Eminence</td>
<td>Radiance of white hair</td>
<td>Luminometer</td>
<td>Optical density</td>
</tr>
<tr>
<td>Vehemence</td>
<td>Level of stridency</td>
<td>Audiometer</td>
<td>Decibels</td>
</tr>
<tr>
<td>Eloquence (or elegance)</td>
<td>Smoothness of tongue or nap of suit</td>
<td>Teflometer</td>
<td>Adhesin score</td>
</tr>
<tr>
<td>Providence</td>
<td>Level of religious fervour</td>
<td>Sextant to measure angle of genuflexion</td>
<td>International units of piety</td>
</tr>
<tr>
<td>Diffidence</td>
<td>Level of gloom</td>
<td>Nihilometer</td>
<td>Sighs</td>
</tr>
<tr>
<td>Nervousness</td>
<td>Litigation phobia level</td>
<td>Every conceivable test</td>
<td>Bank balance</td>
</tr>
<tr>
<td>Confidence*</td>
<td>Bravado</td>
<td>Sweat test</td>
<td>No sweat</td>
</tr>
</tbody>
</table>

*Applies only to surgeons.
Alternatives to EBVM?

- Opinion-based medicine
  - Personal experience/anecdote
  - Expert opinion
  - Historical tradition
  - Habit
  - Haphazard use of scientific evidence
In My Experience

DANGER  DANGER
As near as my husband and I can figure, your book, Baby and Child Care, has become the Modern Bible of American Parenthood.

Baby and Child Care is the Bible in my household. I do not know of any book which I admire more.

By 1973 Baby and Child Care had gone through 201 printings and sold over 23 million copies; been translated into 29 languages; For two decades it sold about a million copies a year.

Every time the supply [of the book] runs out I get verbal and written pleas not only from parents, and relatives and friends of prospective parents, but from schools of social work, medical schools, teacher training schools, etc., who are using the book as a text, from obstetricians and pediatricians who give the book to each new patient, and even from a state health dept which is recommending it routinely.
Advice to Prevent SIDS

Babies Should Sleep on Their Stomachs

There are two disadvantages to a baby’s sleeping on his back. If he vomits, he’s more likely to choke on the vomitus. Also, he tends to keep his head turned toward the same side—usually the center of the room. This may flatten that side of his head.

I think it is preferable to accustom a baby to sleeping on his stomach from the start if he is willing.

Benjamin Spock, MD
Advice to put infants to sleep on the front for nearly a half century was contrary to evidence available from 1970 that this was likely to be harmful. Systematic review of preventable risk factors for SIDS from 1970 would have led to earlier recognition of the risks of sleeping on the front and might have prevented over 10,000 infant deaths in the UK and at least 50,000 in Europe, the USA, and Australasia.

Infant sleeping position and the sudden infant death syndrome: systematic review of observational studies and historical review of recommendations from 1940 to 2002
Ruth Gilbert, Georgia Salanti, Melissa Harden, and Sarah See
SIDS Incidence and Sleeping Position Before and After Public Education Campaign to Reduce Prone Sleeping
Preaching to the Choir?
Table 6: How would you describe your attitude towards evidence-based medicine? (118 responses)

<table>
<thead>
<tr>
<th>Respondents Own Attitude Towards EBM</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>91%</td>
</tr>
<tr>
<td>Neutral</td>
<td>19%</td>
</tr>
<tr>
<td>Negative</td>
<td>1%</td>
</tr>
<tr>
<td>No opinion</td>
<td>7%</td>
</tr>
</tbody>
</table>

Table 8: Do you feel research findings are useful in your day-to-day management of patients? (119 responses)

<table>
<thead>
<tr>
<th>Usefulness of Research Findings</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very useful</td>
<td>50.42%</td>
</tr>
<tr>
<td>Somewhat useful</td>
<td>47.06%</td>
</tr>
<tr>
<td>Not useful</td>
<td>2.52%</td>
</tr>
<tr>
<td>No Opinion</td>
<td>0.00%</td>
</tr>
</tbody>
</table>
Table 14: When did you last do a literature search which influenced your clinical practices? (113 respondents)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within last month</td>
<td>46</td>
<td>40.71%</td>
</tr>
<tr>
<td>Within last 6 months</td>
<td>32</td>
<td>28.32%</td>
</tr>
<tr>
<td>Within last 12 months</td>
<td>14</td>
<td>12.39%</td>
</tr>
<tr>
<td>&gt; 12 months</td>
<td>14</td>
<td>12.39%</td>
</tr>
<tr>
<td>Never</td>
<td>7</td>
<td>6.19%</td>
</tr>
</tbody>
</table>

Table 15: Have you ever received formal training in electronic literature search strategies or appraisal of scientific literature? (115 respondents)

<table>
<thead>
<tr>
<th>Response</th>
<th>Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>17</td>
<td>14.78%</td>
</tr>
<tr>
<td>No</td>
<td>98</td>
<td>85.22%</td>
</tr>
<tr>
<td>Research not relevant</td>
<td>No Barrier</td>
<td>Slight</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>9 (8.5%)</td>
<td>25 (23.6%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research not generalizable to practice</th>
<th>No Barrier</th>
<th>Slight</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 (1.9%)</td>
<td>33 (30.8%)</td>
<td>55 (51.4%)</td>
<td>17 (15.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amount of research overwhelming</th>
<th>No Barrier</th>
<th>Slight</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 (11.2%)</td>
<td>29 (27.1%)</td>
<td>39 (36.4%)</td>
<td>27 (25.2%)</td>
</tr>
<tr>
<td>Response</td>
<td>Unfamiliar</td>
<td>Some Understanding</td>
<td>Could Explain</td>
<td>Total</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>------------</td>
<td>--------------------</td>
<td>---------------</td>
<td>-------</td>
</tr>
<tr>
<td>Relative/Absolute Risk</td>
<td>28 (25.2%)</td>
<td>69 (62.2%)</td>
<td>14 (12.6%)</td>
<td>111</td>
</tr>
<tr>
<td>Systematic Review</td>
<td>30 (27.3%)</td>
<td>67 (60.9%)</td>
<td>13 (11.8%)</td>
<td>110</td>
</tr>
<tr>
<td>Meta-Analysis</td>
<td>85 (76.5%)</td>
<td>21 (18.9%)</td>
<td>5 (11.8%)</td>
<td>111</td>
</tr>
<tr>
<td>Confidence Interval</td>
<td>53 (47.8%)</td>
<td>44 (39.6%)</td>
<td>14 (12.6%)</td>
<td>111</td>
</tr>
<tr>
<td>Publication Bias</td>
<td>30 (27.0%)</td>
<td>56 (50.4%)</td>
<td>25 (22.5%)</td>
<td>111</td>
</tr>
<tr>
<td>Positive/Neg Predictive Value</td>
<td>32 (28.6%)</td>
<td>57 (50.9%)</td>
<td>23 (20.5%)</td>
<td>112</td>
</tr>
<tr>
<td>Confirmation Bias</td>
<td>65 (58.6%)</td>
<td>40 (36.0%)</td>
<td>6 (5.4%)</td>
<td>111</td>
</tr>
<tr>
<td>Number Needed to Treat</td>
<td>39 (35.4%)</td>
<td>64 (58.2%)</td>
<td>7 (6.4%)</td>
<td>110</td>
</tr>
</tbody>
</table>
Steps of EBVM

1. Ask useful questions
2. Find relevant evidence
3. Assess the value and reliability of the evidence
4. Draw a conclusion
5. Assign a level of confidence to your conclusion
Hierarchy of Evidence

Synthetic Literature
- Systematic reviews, EBM guidelines, CATs

Primary Literature
- RCTs, other designs, case reports, pre-clinical, human studies

Expert Opinion
- CE, clinical guidelines, consensus statements, textbooks

My Opinion
- personal experience, colleagues, school, CE, ??????????
Published Research Evidence
Simulations show that for most study designs and settings, it is more likely for a research claim to be false than true. Moreover, for many current scientific fields, claimed research findings may often be simply accurate measures of the prevailing bias.
1. The smaller the studies conducted in a scientific field, the less likely the research findings are to be true.

2. The smaller the effect sizes...

3. The greater the number and the lesser the selection of tested relationships...

4. The greater the flexibility in designs, definitions, outcomes, and analytical modes...

5. The greater the financial and other interests and prejudices...

6. The hotter a scientific field (with more scientific teams involved)...)
Critical Appraisal
Critical Appraisal

• Key factors
  • Control Group
    • Placebo, positive control
  • Allocation (random)
  • Blinding
    • Investigator, caregiver
  • Stats
    • Power, multiple comparisons, confidence intervals
Critical Appraisal

• Key factors
  • Effect Size
  • Replication
  • Applicability

• Other sources of bias
  • Funding
  • Publication

RCT reports in the small animal veterinary literature are incomplete...Absence of reporting was found [for]...informed consent, eligibility criteria, sample size, and statistical power...group allocation, blinding...

Brown, D. C. (2006)- randomization

Randomization was reported...in most publications...However, in most reports, little corroborating information was included to support the claim.
Giuffrida, M. A., et al. (2012)- blinding

Most reports of blinding methodology were incomplete and there was no consistency in how blinding terminology was used.

Giuffrida, M. A. (2014)- power

Small animal RCTs with negative results were often underpowered to detect moderate-to-large effect sizes between study groups. Information needed for critical appraisal was missing from most reports.
Sargeant, J. Met al. (2009)- quality & reporting affect outcomes

There were substantive deficiencies in the reporting of many of trial features...these deficiencies may be associated with biased treatment effects.

Sargeant, J. M., et al. (2010)- quality & reporting affect outcomes

Many clinical trials involving dogs and cats in the literature do not report details related to methodological quality...There is some evidence that these deficiencies are associated with treatment effects.
300 controlled clinical trials from 25 journals

- Randomization- 19.5%
- Allocation Concealment- 15.4%
- Blinding
  - Investigator- 40%
  - Caregiver- 18.6%
- Power- 12%
- Mean proportion of 23 criteria adequately reported- 49.6%
Arlt, S., et al. (2010)- canine reproduction

- meta-analyses, clinical trials, and case reports published in German or English between 1996 and 2006.

- 287 articles from 64 journals met the inclusions criteria. Of these, 58 were controlled clinical trial, and the remainder were case reports, observational studies, or other uncontrolled designs.

- about 40% reported randomization

- 13.8% reported blinding.

- The authors concluded that overall, 67.9% of the reports evaluated were inadequate to allow clinicians to draw valid conclusions for integration in clinical practice.
Simoneit, C., et al. (2011) - bovine, equine, & canine reproduction

- 268 published research reports: 121 were controlled clinical trials.

- Randomization was reported in
  - 34% of bovine studies
  - 22% of equine studies
  - 12% of canine studies

- Blinding was reported in
  - 4% of bovine studies
  - 6% of equine studies
  - 7% of canine studies

- Overall, only 17% of the reports were graded adequate to draw valid conclusions,
  - 33% bovine studies
  - 11% equine studies
  - 7% in canine studies
EBVM improves decision-making and outcomes

- Formal, explicit integration of research evidence with expertise, circumstances

- Evidence must be critically appraised
Resources

- EBVMA (ebvma.org)
- CEVM (nottingham.ac.uk/cevm)
  - Best Bets for Vets (bestbetsforvets.org)
  - VetSRev (nottingham.ac.uk/cevm/refbase)
- RCVS Knowledge
  - EBVM Network
    (knowledge.rcvs.org.uk/evidence-based-veterinary-medicine)
  - EBVM Forum (ebvmnetwork.org)
Resources

- VetAllTrials (vetalltrials.org)
  - Clinical trial registries
  - Transparency, Better Reporting
  - Facilitate Critical Appraisal
  - Better Evidence
Resources