Concepts of EBM
"Evidence Based Medicine" II
or
Personal Protection in the World of Ideas
John Gay, DVM PhD DACVPM

Why "personal protection"?*

- Be very careful what you put in that head, because you will never, ever get it out.  
  Cardinal Wolsey (1475-1530)
- It ain’t so much the things we don’t know that get us into trouble. It’s the things we know that just ain’t so.  
  “Artemus Ward” (Charles Farrar Browne, 1834-1867)
- It is impossible for anyone to learn that which he thinks he already knows.  
  Plutarch

What is "Evidence-based Medicine"?

- EBM is an approach to practice in which the clinician is aware of the evidence in support of their clinical practice and of the strength of that evidence” (McMaster).
- Practicing EBM is simply practicing knowing the answers to two questions:
  - What is the evidence for that?
    - “that” being the use of a diagnostic test, prognosis, therapy, or preventive measure
  - How likely are the conclusions based on the evidence correct?

Information Types

- Dogma:
  - Those beliefs held as established or put forth as an authoritative or expert opinion without supportive empirical evidence.
- Anecdotal Evidence:
  - The occurrence of a single or a series of desired events, such as medical recoveries.
- Analogical Evidence:
  - Evidence based on reasoning by analogy, which is concluding from comparing known similarities between two systems that a relationship shown to exist in one system but unknown in the other also exists in the other.
- Empirical Evidence:
  - Knowledge obtained by looking rather than reasoning or feeling.

- Most of the veterinary curriculum is taught as dogma
  - The information necessary to judge its credibility is not provided.
  - Habits of deliberate, systematic, critical thinking are not developed
- Analogical evidence is the basis of reasoning taught in much of the curriculum
- Most individual case experience is anecdotal
Evidence as Information

That which tends to support something or show that something is the case.

- Varies greatly in strength depending on how it was obtained.
- Critical questions you must ask:
  - What is the evidence for that?
  - How strong is the evidence? (evaluation of evidence)
- Evidence can be correct but the underlying theory, paradigm or model can still be (is often) wrong.

Empirical Evidence (Facts)

- Knowledge obtained by looking rather than reasoning or feeling.
- Comprised of the objective findings from observational or experimental procedures that are repeatable (verifiable) and that meet currently accepted standards of design, execution, and analysis.
  - A poorly executed clinical trial in 10,000 animals can be weaker than a well done case series of 40 animals.
  - Strengthened by appropriately executed rigorous methods
  - Weakened by the degree of opportunity for other explanations that could account for the findings.
- How strong or weak? Your judgment!

Bias!

- Bias: The systematic deviation from the "truth"
  - Note: We never know the "truth"!
  - Controlled by study design
- Imprecision: The "noise" from random chance variation
  - Controlled by study "size"

Shooting Analogy

Bias vs. Imprecision

Which has more bias? Imprecision

Considering Empirical Evidence

- As independent verification and assessment of strength of evidence is key, the methods used to acquire the evidence must be described or referenced sufficiently that this verification and assessment can be done by independent investigators and you the reader.

  - John's Rule:
    - If the authors did not include all the elements, they likely did not do it properly because if they understood the importance, they also would have understood the importance of including the description.
  - Remember: The evidence can be correct (e.g., the sun "rises" predictably) but the underlying theory that it is believed to support is wrong (e.g., the sun moves around the earth).
Thinking about Observation

What goes wrong?
How bad wrong?
What do we need to do to prevent it?

Flexilinear Sampling as a Model

Legitimate Medical Activity


Just as it is difficult to describe adequately the exhilaration one feels when using a fly rod to land a trout caught from a mountain stream, there is also a tremendous amount of satisfaction in the successful completion of an obstetric operation.

Until recently, we were woefully ignorant of how fly fishing expertise could benefit pregnancy.

We report with great pride an instance in which fly fishing knot skill was essential to successful placement of a cervical cerclage for a woman with an incompetent cervix.

Objective: Learn how to catch (and release) more of these things by flyfishing

Pike

Problem

How do I go about obtaining and applying this knowledge?
Background – Prior Context

Where I had fished: The Powder River

Where I want to fish

Where to Start: Contact an Expert

Where to start: Books

Literature Terminology

- **Literature**: The written repository of medical knowledge.
- **Primary Source**: Report of evidence derived directly from observation, procedures or experiments.
- **Secondary Source**: A synthesis of primary sources, experience, or authoritative belief (dogma);
  - Review articles, most practitioner-oriented conference proceedings, trade publications and authorities presenting information without supporting evidence (lectures, CE meetings, e-mail forums).
- **Tertiary Source**: A compilation of information for application across a broad spectrum
  - Class notes and core course textbooks.
  - Often presented in a dogmatic, authoritative fashion as a sequence of facts and interpretations
  - Strength of evidence is not indicated and any current controversy between researchers is usually not addressed.
  - Bibliography is usually predominately secondary literature to provide entry points.
With secondary sources, you have “outsourced” the responsibility for critical evaluation.

With tertiary sources, you have outsourced the responsibility another level!

Is this a problem?

You betcha!

Secondary Source Author


- In this study, blood cultures were performed in 30 dogs undergoing dental procedures (including scaling and extractions). **Blood cultures were positive in 9 of 30 dogs (30%).** Of the bacterial isolates, *Pasteurella* spp were most common and sensitive to amoxicillin and amoxicillin with clavulanic acid. *Clostridium* spp, *Staphylococcus* spp, *Moraxella* spp, and *Actinomyces* spp were also isolated. Previous studies have reported a higher incidence of positive blood cultures in dogs undergoing similar procedures.

Secondary Source Author


- **Editor’s comments:** A significant proportion of older dogs undergoing dentistry procedures have concurrent degenerative valve disease, and a long-standing concern is the risk of bacteremia inducing endocarditis. This concern applies also to animals with congenital heart disease. Bacteremia has previously been reported to occur in up to 93% of humans undergoing dental procedures, and in 87% of dogs undergoing dental scaling and extraction. Current guidelines of the American Heart Association call for prophylactic antibiotic use in several situations. Patients with acquired valve dysfunction, prosthetic cardiac valves, a history of bacterial endocarditis, congenital heart disease, or hypertrophic cardiomyopathy should receive oral amoxicillin 1 hour before the procedure, and a second dose 6 hoursafter the first dose. Chemoprophylaxis is recommended when dental procedures which induce gingival or mucosal bleeding (including scaling) is performed. Other procedures carrying a risk of significant bacteremia include intestinal surgery, urologic catheterization if urinary tract infection is present, and incision and drainage of infected tissue.

The primary source paper


- Bacteria in blood cultures in 30 dogs undergoing high-speed dental scaling and tooth extraction were examined. One or more positive blood cultures were identified in 9 of 30 (30%) dogs. *Pasteurella* spp were most frequently (5 dogs) isolated and were sensitive to amoxicillin, penicillin, cephalothin, chloramphenicol, tetracycline, amoxicillin with clavulanic acid, and sulfamethoxazole with trimethoprim.

- Two groups of 15 dogs each, anesthetized or sedated but not undergoing dental procedures, served as non-dentistry controls.
The primary source paper
- There were no significant (p < .05) differences between the number of positive cultures in dentistry and non-dentistry groups.
- In healthy dogs undergoing high-speed dental scaling and tooth extraction, the occurrence of bacteria in blood cultures was much lower than previously reported. The clinical significance of positive blood cultures was uncertain.

Is this consistent with the "outsourced" evaluation?

Point
When you "outsource" evaluation of the evidence for strength, you pays your money and takes your chances!

Comparison of two review articles references
- A review is given of the fleas of pets (dogs and cats) and domestic premises in North America, including information on the species involved (Ctenocephalides spp., Echidnophaga gallinacea and Pulex spp.), the diseases they cause (mainly dermatitis), and methods of controlling the fleas themselves. Several lists of pesticides are given, which include details of the brand name, manufacturer, active ingredient and usage. There is also a table explaining the symptoms of poisoning for the major pesticide groups, as well as how to treat them.
- The classification of the references is:
  - 22 primary literature
  - 2 proceedings
  - 7 Industry technical publications
  - 26 secondary literature
  - 1 self citation
  - 21 tertiary literature
  - 8 personal communications, letters to the editor

- "The veterinary literature contains numerous inconsistencies concerning the biology of fleas of dogs and cats. It is now apparent that these discrepancies have contributed to errors in designing regimens for control, administration of inappropriate treatment, and delays in practitioner acceptance of new flea products."
- The classification of the references is:
  - 40 primary literature
  - 1 proceedings
  - 4 graduate thesis
  - 6 self citations
  - 4 secondary literature
  - 1 self citation
  - 2 tertiary literature

Which should you add to your knowledge base?
- Kwochka:
  - 22 primary literature
  - 2 proceedings
  - 7 Industry technical publications
  - 26 secondary literature
  - 1 self citation
  - 21 tertiary literature
  - 8 personal communications, letters to the editor.

- Dryden:
  - 40 primary literature
  - 1 proceedings
  - 4 graduate thesis
  - 5 self citations
  - 4 secondary literature
  - 1 self citation
  - 2 tertiary literature

Further Comparison
  - The author is a DVM and is board certified but doesn’t list any research-oriented degrees (MS or PhD).
  - A Medline search on Kwochka-K-W lists 6 publications between 1985 and 1997. This is the only one listed on fleas.
  - The author is a DVM, does not list any board certification but does list an MS and PhD.
  - A Medline search on Dryden-M-W lists 12 publications between 1989 and 1997. Most of these appear to be primary literature and most of them are on fleas.
Objective: Catch (and release) more of these things

Knowledge of the Biology?

Source of Biological Plausibility

Adult Caddis: Fish Food!

Problem: Selecting the best fly

So: Read this text?

Maybe this one?

“31 Indispensable pattern styles and their most useful variations”
In this book, Alley shares the 40 most productive flies used for trout. Covering nymphs, streamers/bucktails, wets and dries, Alley gives general information, the pattern, plus the best fishing techniques for each fly discussed. He also gives rod weight recommendations and an easy-to-reference chart of the 40 best trout patterns. Take the guesswork out of your next trout-fishing trip, this book has all the answers.

How did he figure those out?

Do those look like these?

Elk Hair Caddis Dry Flies

The questions
- What stimulates a fish to try to eat my fly?
- Do fish see things the same way I do?
- When do fish eat something?
  - Temperature?
  - Light?
- Where are the fish?
- If there are 3,000 fish per mile, why aren't I catching any?

Aha: A primary paper!


- **OBJECTIVE:** To investigate the importance of the type of dry fly (artificial floating fly) in catching trout (brown and rainbow) in an English chalkstream.
- **SETTING:** River Kennet, Berkshire.
- **DESIGN:** Five anglers on five separate occasions spent five hours using a randomly allocated fly from a selection of five types.
- **PARTICIPANTS:** Five anglers of considerable but varying experience, determination, and opinion.
- **MAIN OUTCOME MEASURES:** Number, weight, and species of trout caught.
- **RESULTS:** One fly (Black Gnat) performed significantly worse than the others. The fly most successful in catching brown trout was the Cinnamon Sedge.

- **CONCLUSION:** The possible prolongation of doctors’ leisure time consequent on the use of unproductive trout flies has resource implications for the NHS. Urgent funding of a definitive, large multiriver trial is needed.

(Structured abstract)

First Question: *Is this paper useful?* (External Validity)

Should I spend my time reading it?
Okay, I have to do my own study
But How?

How about if I just kept a fishing log?
Day, water temperature, weather, bugs I saw, fly type?

Would this comparison work?