

# Pragmatic Evidence-Based Veterinary Medicine in Private Practice



# What is EBVM?

*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



# What is EBVM?

*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.



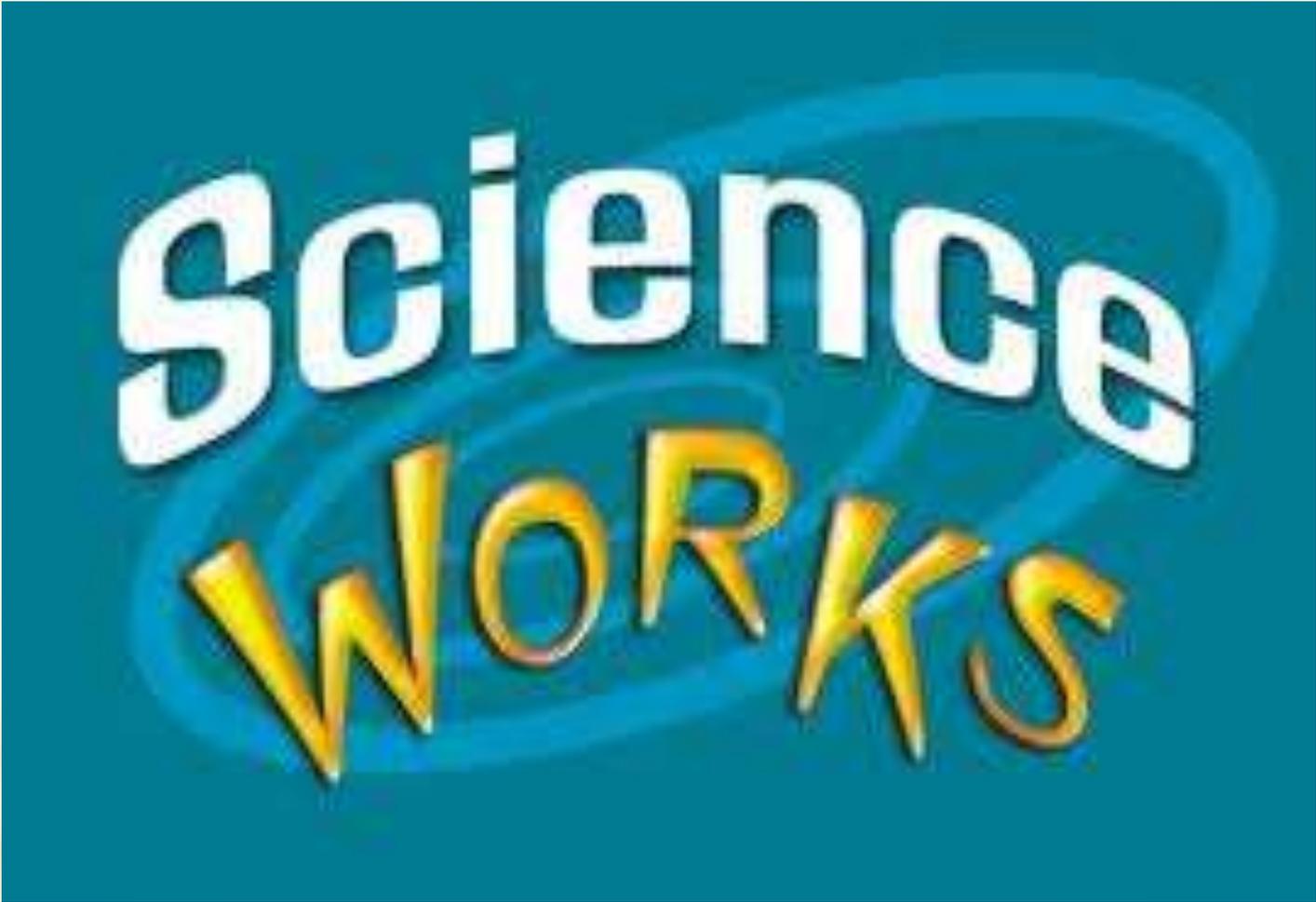
# What is EBVM?

*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.

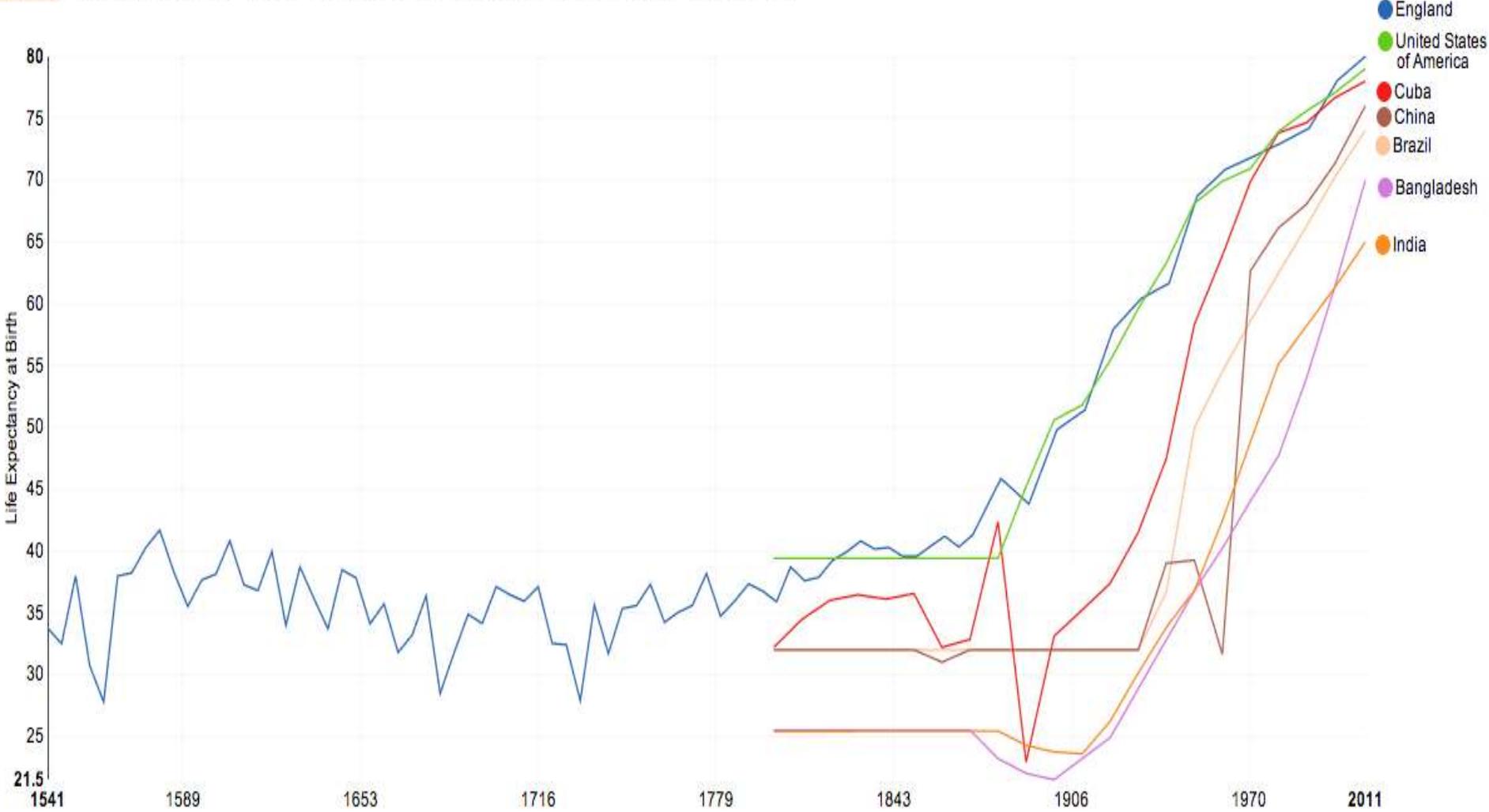
Handbook of Evidence-Based Veterinary Medicine



The logo features the word "Science" in white, bold, sans-serif font with a slight shadow, positioned above the word "WORKKS" in a yellow, 3D, blocky font. Both words are set against a blue, rounded rectangular background that has a subtle gradient and a slight shadow, giving it a floating appearance. The entire logo is centered on a light beige background.

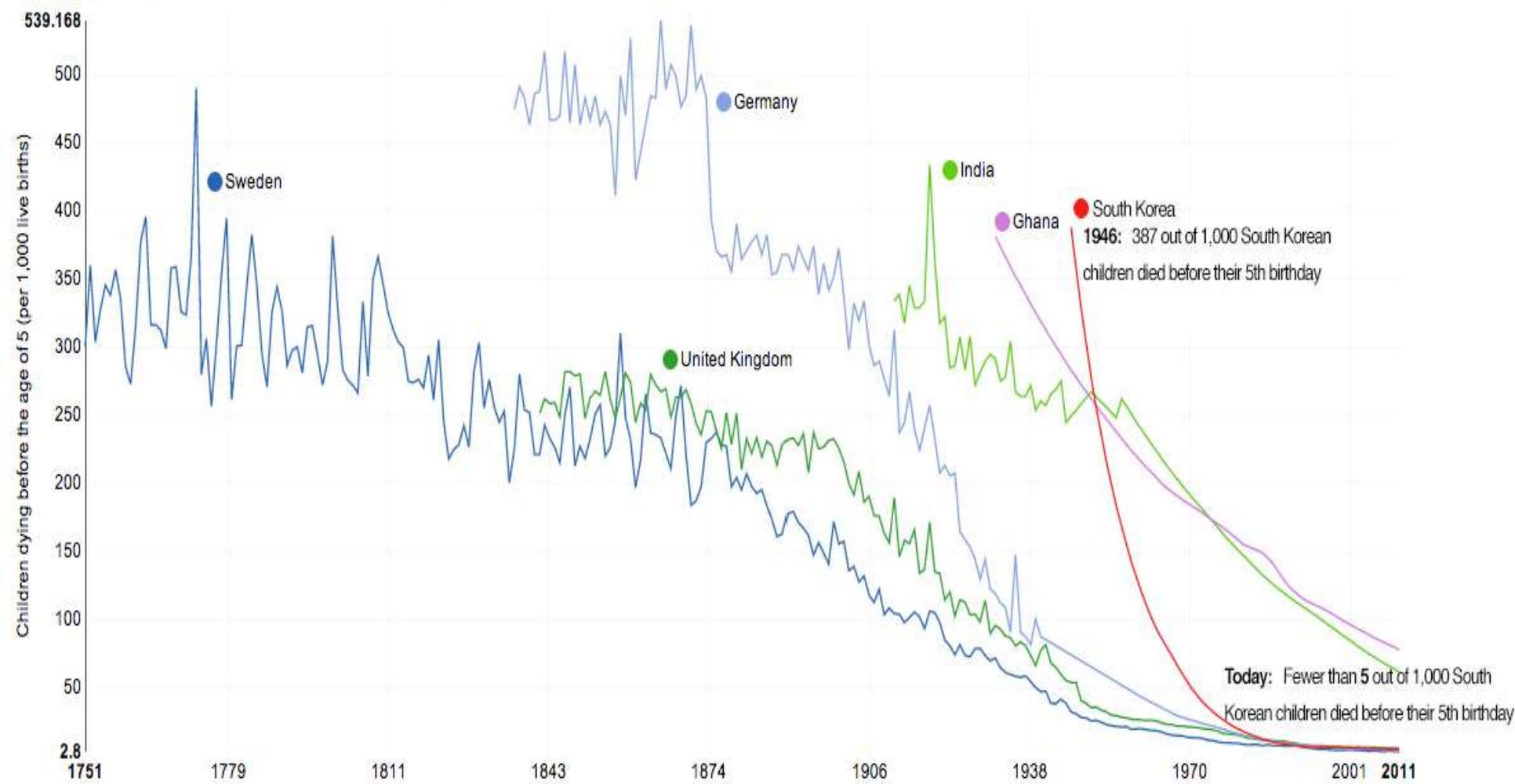
Science  
WORKKS

# Life expectancy at birth in countries around the world 1540-2011 – Max Roser



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# Child Mortality from 1751 to 2011 – Max Roser



The author Max Roser licensed this visualisation under a [CC BY-SA license](https://creativecommons.org/licenses/by-sa/4.0/). 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](http://www.OurWorldinData.org/data/population-growth-vital-statistics/child-mortality)

Data source: UNICEF's [www.childmortality.org](http://www.childmortality.org)

# Evidence for EBM

- Better information means better care:

**Outcomes of evidence-based clinical practice guidelines: a systematic review.**  
Bahtsevani C, Udén G, Willman A. Int J Technol Assess Health Care. 2004 Fall;20(4):427-33.

*There is a tendency toward support for the idea that outcomes improve for patients, personnel, or organizations if clinical practice in health care is evidence-based, that is, if evidence-based clinical practice guidelines are used*

**Does evidence-based practice improve patient outcomes? An analysis of a natural experiment in a Spanish hospital.** Jose I. Emparanza JI. Cabello JB. Burls AJE. Journal of Evaluation in Clinical Practice. 2015. epub before print.

*EBP patients had a clinically and statistically significantly lower risk of death than contemporaneous standard practice patients...and a shorter length of stay...*

# Evidence for EBM

- Better information management reduces errors and leads to better outcomes:

**Clinical information technologies and inpatient outcomes: a multiple hospital study.**

Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Arch Intern Med. 2009 Jan 26;169(2):108-14

*Hospitals with automated notes and records, order entry, and clinical decision support had fewer complications, lower mortality rates, and lower costs.*

# Why do We Need EBVM?

- To prevent and correct our errors
- To improve patient care outcomes
- To meet our ethical obligation to our clients

In

My

Experience



50c  
GC • 40



DR. BENJAMIN SPOCK

# BABY AND CHILD CARE



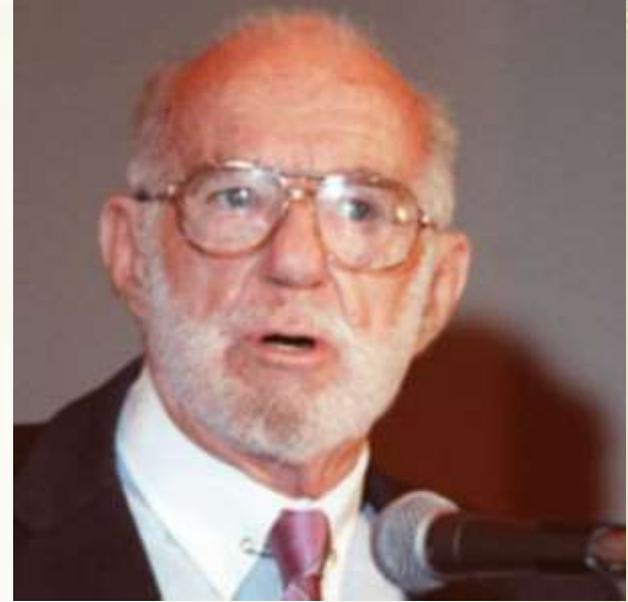
The most widely recommended handbook for parents ever published—  
Authoritative, illustrated, indexed

Over 19,000,000 copies sold

The Complete Book  
POCKET BOOKS

*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*

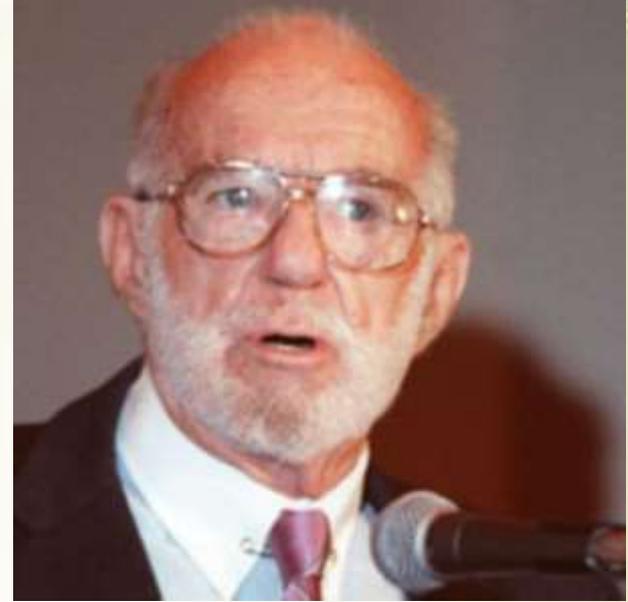


By 1973 *Baby and Child Care* had gone through 201 printings and sold over 23 million copies; been translated into 29 languages; For two decades it sold about a million copies a year.

*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



*If he vomits, he's more likely to choke on the vomitus....I think it is preferable to accustom a baby to sleeping on his stomach from the start if he is willing.*

Benjamin Spock, MD

# SIDS Research

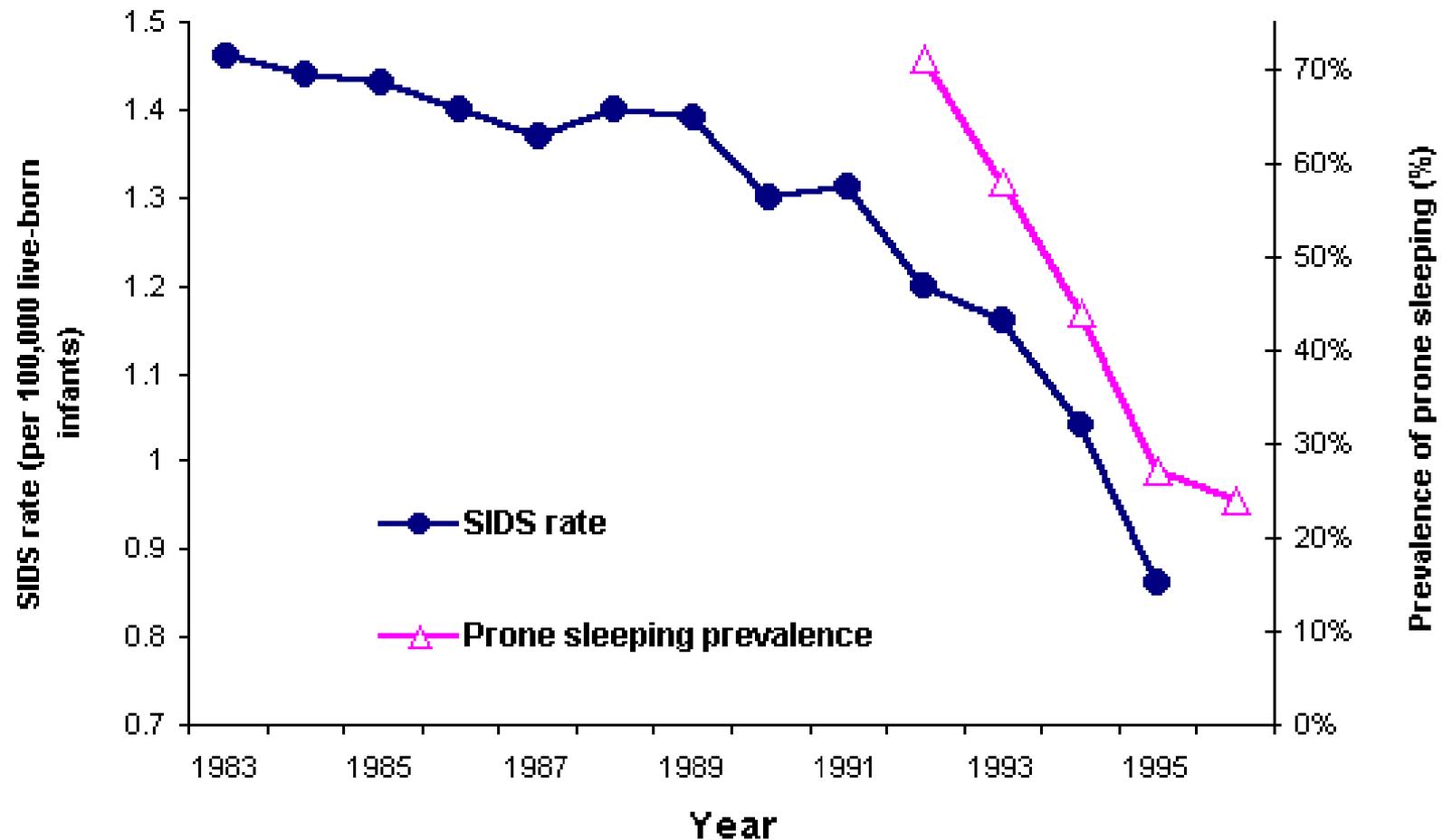
## Babies Should Sleep on Their Backs



*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

*The greatest deception men suffer is from their own opinions.*

Leonardo da Vinci, 1452-1519

# Human Error

## Patient/Doctor Surveys-

- Mistakes made in 35-42% of cases

## Mistakes Often Serious-

- 20-40% of cases misdiagnosed 33% of deaths due to diagnostic error

## Most Mistakes are Human Error-

- 50-96% of medical mistakes due to decision errors

# Why do We Need EBVM?

- To prevent and correct our errors
- To improve patient care outcomes
- To meet our ethical obligation to our clients

# Science & EBM Can Help

## Checklists-

### WHO Surgical Checklist-

- Decreased mortality from 1.5% to 0.8%
- Decreased inpatient complications from 11% to 7%

### SURPASS Surgical Safety Checklist Study-

- Would have prevented 40% of deaths
- 29% of liability incidents

# Science & EBM Can Help

## Evidence-based Clinical Practice Guidelines-

Sodhi K, Singla, MK, Shrivastava A. *Impact of advanced cardiac life support training program on the outcome of cardiopulmonary resuscitation in a tertiary care hospital.* Indian J Crit Care Med. 2011;15(4):209-12.

*Formal certified BLS and ACLS training of healthcare professionals leads to definitive improvement in the outcome of CPR.*

# Science & EBM Can Help

## Evidence-based Clinical Practice Guidelines-

Fakhry SM, Trask AL, Waller MA, Watts DD, IRTC Neurotrauma Task Force  
*Management of brain-injured patients by an evidence-based medicine protocol improves outcomes and decreases hospital charges.* J Trauma. 2004 Mar;56(3):492-9; discussion 499-500.

*Adherence to a protocol based on the BTF guidelines can result in a significant decrease in hospital days and charges.... In addition, mortality and outcome may be significantly affected.*

**Outcomes of evidence-based clinical practice guidelines: a systematic review.**  
Bahtsevani C, Udén G, Willman A. Int J Technol Assess Health Care. 2004 Fall;20(4):427-33.

*There is a tendency toward support for the idea that outcomes improve for patients, personnel, or organizations if clinical practice in health care is evidence-based, that is, if evidence-based clinical practice guidelines are used*

# Science Can Help

## EBM Methods

**Does evidence-based practice improve patient outcomes? An analysis of a natural experiment in a Spanish hospital.** Jose I. Emparanza JI. Cabello JB. Burls AJE. Journal of Evaluation in Clinical Practice. 2015. epub before print.

*EBP patients had a clinically and statistically significantly lower risk of death than contemporaneous standard practice patients...and a shorter length of stay...*

# Science Can Help

## Algorithms-

Grove WM, Zald DH, Lebow BS, et al. *Clinical versus mechanical prediction: a meta-analysis*. Psychol Assess. 2000;12(1):19-30.

- 136 clinical studies evaluated
- 128 studies found mechanical prediction as good as or better than clinical judgment (about 50:50)
- 8 studies found clinical judgment to be superior

# Why do We Need EBVM?

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- 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.



# Informed Consent

*“Veterinarians significantly underestimated the desire of clients to be told about uncertainties in treatment [and] significantly overestimated the loss of client confidence resulting from saying ‘I am not sure about this’*

*This study suggests that most clients want to be told about their veterinarian’s clinical uncertainties.”*

Mellanby, R. J., J. Crisp, et al. (2007). "Perceptions of veterinarians and clients to expressions of clinical uncertainty."

# Informed Consent

*For the clients, the central qualification was that the information given had to be the truth.*

Stoewen DL, et al. (2014) Qualitative study of the information expectations of clients accessing oncology care at a tertiary referral center for dogs with life-limiting cancer.

# Preaching to the Choir?



# Preaching to the Choir?

Table 6: How would you describe **your** attitude towards evidence-based medicine? (118 responses)

Respondents Own Attitude Towards EBM	Percentage
Positive	91%
Neutral	19%
Negative	1%
No opinion	7%

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

Usefulness of Research Findings	Percentage
Very useful	50.42%
Somewhat useful	47.06%
Not useful	2.52%
No Opinion	0.00%

# Preaching to the Choir?

Table 14: When did you last do a literature search which influenced your clinical practices? (113 respondents)

Time Period	Respondents	Percentage
Within last month	46	40.71%
Within last 6 months	32	28.32%
Within last 12 months	14	12.39%
> 12 months	14	12.39%
Never	7	6.19%

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

Response	Respondents	Percentage
Yes	17	14.78%
No	98	85.22%

# Preaching to the Choir?

Response	Unfamiliar	Some Understanding	Could Explain	Total
Relative/Absolute Risk	28 (25.2%)	69 (62.2%)	14 (12.6%)	111
Systematic Review	30 (27.3%)	67 (60.9%)	13 (11.8%)	110
Meta-Analysis	85 (76.5%)	21 (18.9%)	5 (11.8%)	111
Confidence Interval	53 (47.8%)	44 (39.6%)	14 (12.6%)	111
Publication Bias	30 (27.0%)	56 (50.4%)	25 (22.5%)	111
Positive/Neg Predictive Value	32 (28.6%)	57 (50.9%)	23 (20.5%)	112
Confirmation Bias	65 (58.6%)	40 (36.0%)	6 (5.4%)	111
Number Needed to Treat	39 (35.4%)	64 (58.2%)	7 (6.4%)	110



# Preaching to the Choir?

Vandeweerd JMEF, Vadeweerd S, Gustin C, et al. *Understanding veterinary practitioners' decision-making process: Implications for veterinary medical education*. J Vet Med Edu 2012;39(2):142-51.

*To inform their decision, veterinary surgeons rarely take the evidence-based medicine (EBM) approach. They consult first-opinion colleagues, specialists, laboratories, and the Internet rather than scientific databases and peer-reviewed literature, mainly because of limited time.*

# The EBVM Story So Far

- We Need to Do It
  - Reduce Error
  - Improve Patient Care
  - Fully Inform Clients
  
- We Want to Do It
  
- Most of Us Don't Do It
  - Lack of Time
  - Lack of Knowledge
  - Lack of Resources
  - Lack of Motivation

WHAT'S NEXT?



# Steps of EBVM

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



# Steps of EBVM

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# Ask Useful Questions

P- patient, problem

I- intervention

C- comparator

O- Outcome

# Tallulah



- 13 year old, FS Labrador
- Mild progressive HL weakness x years

What about glucosamine?

# Ask Useful Questions

## P- Patient, Problem

- 13 year old FS Labrador retriever
- systemically healthy
- moderately overweight
- mild gradually progressive HL weakness
- moderate bilateral hip osteoarthritis

# Ask Useful Questions

## I- Intervention

- Oral glucosamine, injectable
- +/- chondroitin, MSM, green-lipped muscle, fish oil, turmeric, Vitamin C, etc.....
- Pills, capsules, chewable treats, liquids
- Cosequin, Dasuquin, NaturVet, human products, etc.....

# Ask Useful Questions

## C- Comparator

- Doing nothing (education!!!)
- Weight loss
- Physical therapy, chiropractic, massage
- Acupuncture
- NSAIDs, analgesics
- Other supplements/nutraceuticals (fish oil, herbals, turmeric, MSM, etc.....)
- Total hip replacement

# Ask Useful Questions

## O- Outcome

- Hunting
- Agility competition
- Activities of daily living
- Free of pain
- Free of lameness

# Ask Useful Question

P- Tallulah

I- oral glucosamine+chondroitin

C- nothing or NSAID

O- pain, lameness

# Steps of EBVM

1. Ask useful questions
2. **Find relevant evidence**
3. Assess the value and reliability of the evidence
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# Hierarchy of Evidence



# Hierarchy of Evidence

Systematic reviews, EBM guidelines, CATs

Synthetic  
Literature

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

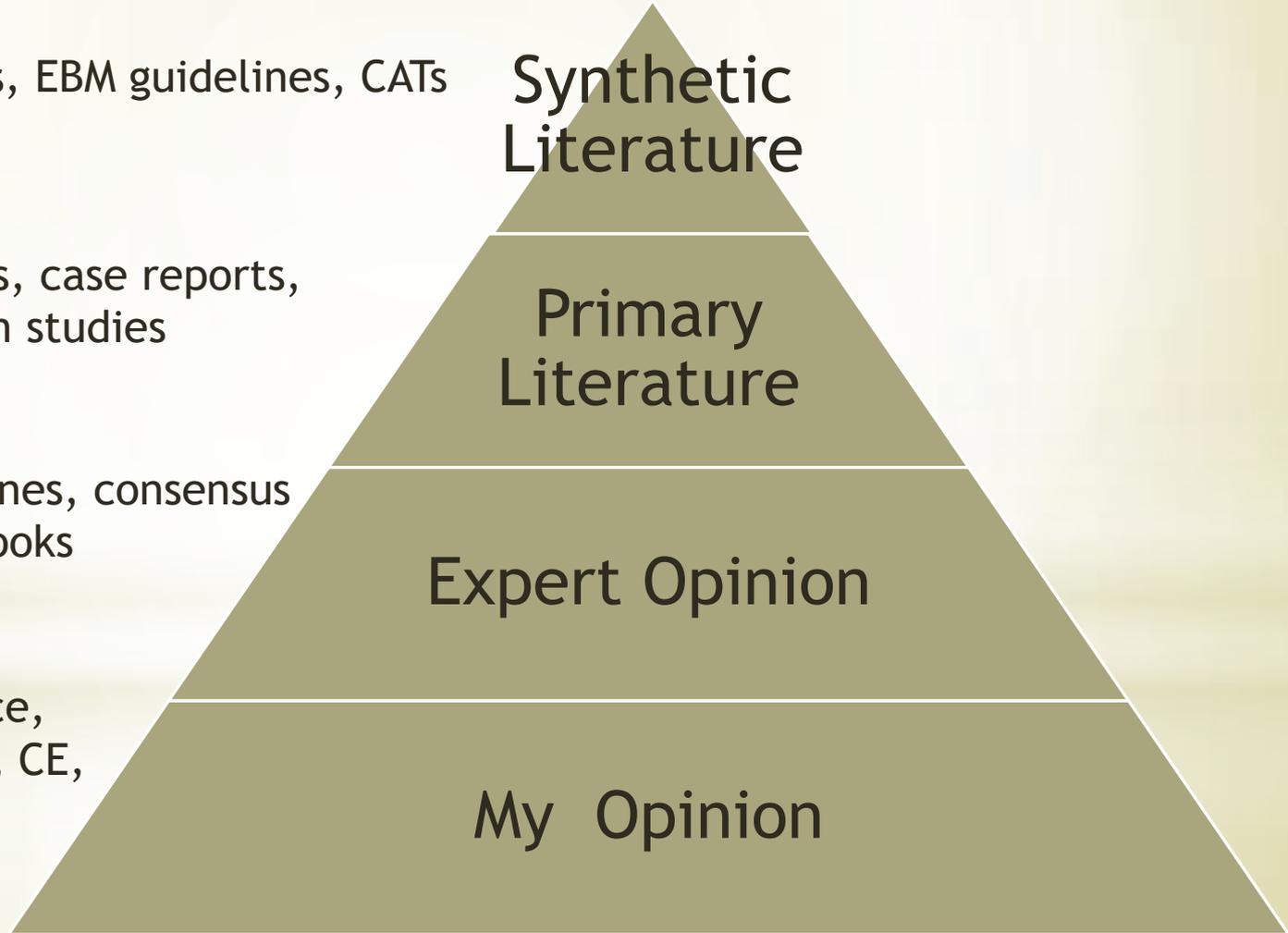
Primary  
Literature

CE, clinical guidelines, consensus  
statements, textbooks

Expert Opinion

personal experience,  
colleagues, school, CE,  
???????????

My Opinion



# Synthetic Literature

## Clinical Practice Guidelines-

- Must be evidence-based
  - Transparent
  - Explicit review of evidence quality and quantity
- Not GOBSAT
- Must be interpreted in context of individual patient

# Synthetic Literature

## RECOVER (Reassessment Campaign on Veterinary Resuscitation)

Dr. Daniel Fletcher, Cornell University (EBVMA)

Dr. Manuel Boller, University of Pennsylvania (trained in Switzerland)

Generate evidence-based consensus guidelines for veterinary CPR



# Synthetic Literature



<b>I</b>	Benefit >>> Risk	<b>Should</b> be performed, is <b>recommended</b>
<b>IIa</b>	Benefit >> Risk	Is <b>reasonable</b> to perform
<b>IIb</b>	Benefit $\geq$ Risk	<b>May be considered</b>
<b>III</b>	Risk > Benefit	<b>Should not</b> be performed

<b>A</b>	<ul style="list-style-type: none"><li>• Multiple high quality or high LOE studies</li></ul>
<b>B</b>	<ul style="list-style-type: none"><li>• Multiple low quality or low LOE studies</li><li>• Few to no high quality or high LOE studies</li></ul>
<b>C</b>	<ul style="list-style-type: none"><li>• No strong evidence in the literature</li><li>• Consensus opinion, expert opinion, or standard of care</li></ul>

# Synthetic Literature

## Systematic Reviews-

- Literature search and critical appraisal done for you
- May include meta-analyses
- Only as good as evidence on which they are based
- Not 100% bias free

# Synthetic Literature

## Critically Appraised Topics (CATs)-

- Smaller, more narrowly focused than systematic reviews
- Less comprehensive
- Some critical appraisal done for you

# Primary Literature

## Veterinary Clinical Trials-

- More effort
  - Locating
  - Appraising

## Human Clinical Trials-

- Often numerous
- Questionable applicability

# Primary Literature

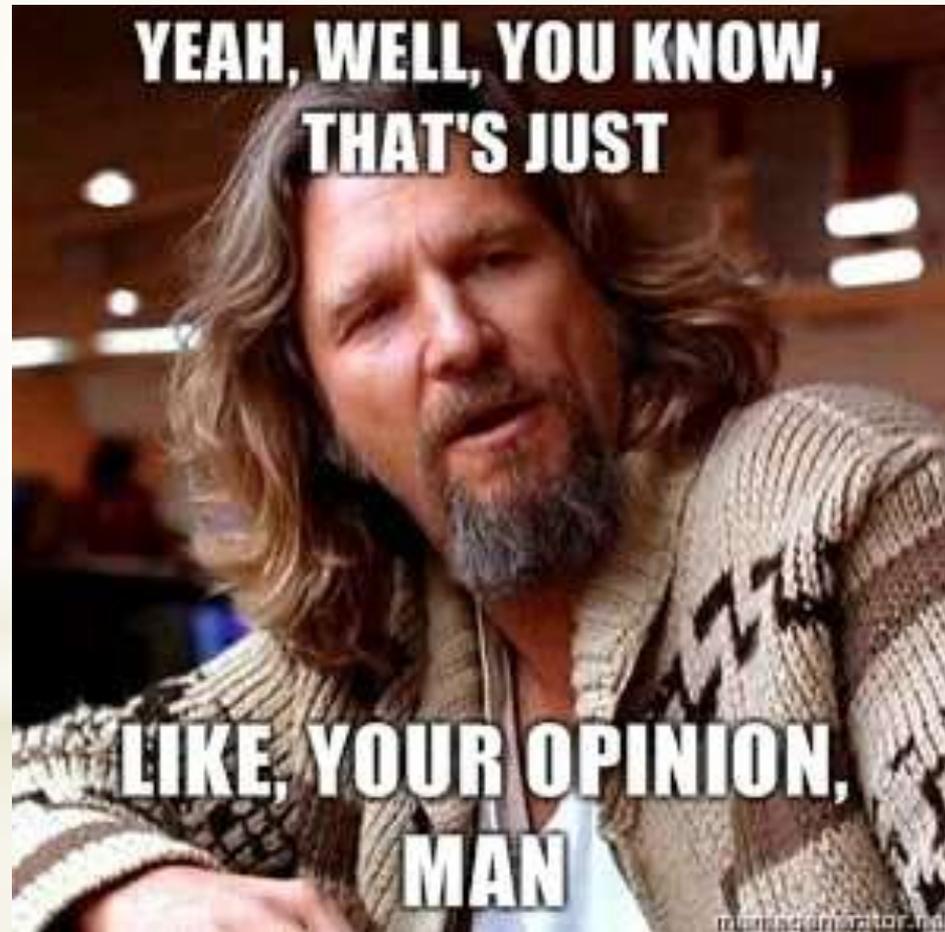
## Other Study Designs-

- Observational
- Case-control
- Case studies/series

## Pre-clinical Research-

- In vitro
- Animal models

# Opinion



# Finding Research Evidence

- VetSRev- CEVM Univ. of Nottingham
- BestBETSforVets- CEVM
- PubMed, CAB Abstracts (Vetmed Resource), Agricola
- USPSTF, National Guidelines Clearinghouse, NICE,
- Google
- Individual Sites (e.g. RCVS Knowledge, Banfield BARK, EVE Clinical Evidence Collection, SkeptVet, Worms & Germs, etc.)

# Getting Research Evidence

- Google
- Association memberships, personal subscriptions
- Veterinary colleges (local practitioners, alumni, fee-based)
- Local Libraries
- Fee-based Sources (e.g. RCVS Library, VIN, VetAccess)
- Direct from journals: fee-based, DOAJ
- Colleagues: pool subscriptions, be nice to academics



P- Tallulah

I- oral glucosamine  
+chondroitin

C- nothing or NSAID

O- pain, lameness

# Synthetic Literature

Clinical Practice Guidelines-

None

# Synthetic Literature

## Systematic Reviews-

Vandeweerd JM, et al. **Systematic review of efficacy of nutraceuticals to alleviate clinical signs of osteoarthritis. 2012**

*the global strength of evidence of efficacy was low...In addition, results were contradictory in the 2 studies conducted in dogs*

Sanderson RO, et al. **Systematic review of the management of canine osteoarthritis. 2009**

*Low quality & quantity of evidence, no overall recommendation*

Aragon CL, et al. **Systematic review of clinical trials of treatments for osteoarthritis in dogs. 2007**

*1 study included, good quality, no benefit*

# Synthetic Literature

## Critically Appraised Topics-

- Best Bets for Vets

Nutraceuticals versus carprofen in dogs with osteoarthritis

*Carprofen is superior to glucosamine/chondroitin supplements in reducing the clinical signs of osteoarthritis (McCarthy et al. 2007). Glucosamine and chondroitin supplement efficacy cannot be commented on, as there was no placebo group or there was no comparison made with the placebo group in the studies.*

# Synthetic Literature

## Critically Appraised Topics-

### Banfield

Evaluation of glucosamine hydrochloride/ chondroitin sulfate nutraceuticals as a treatment to improve symptoms associated with canine and feline joint disease

*Despite some evidence that a combination of glucosamine hydrochloride and chondroitin sulfate nutraceuticals improves symptoms associated with joint disease in dogs and cats, strong clinical evidence of efficacy is lacking, and these compounds are understudied.*

# Synthetic Literature

## Critically Appraised Topics-

Journal of the American Veterinary Medical Association

McKenzie, BA. What is the Evidence? JAVMA 2010;237(12):1382-1383.

*Two studies, mixed results, better quality study found no benefit, carprofen better*

# Synthetic Literature

## Human Clinical Guidelines-

- 15 that mention glucosamine
- AAOS
  - We cannot recommend using glucosamine and chondroitin for patients with symptomatic osteoarthritis of the knee.
  - Strong evidence
    - quality of the supporting evidence is high
    - practitioners should follow a **Strong** recommendation unless a clear and compelling rationale for an alternative approach is present.
  - At this time, both glucosamine and chondroitin sulfate have been extensively studied. Despite the availability of the literature, there is essentially no evidence that minimum clinically important outcomes have been achieved compared to placebo, whether evaluated alone or in combination.

# Synthetic Literature

## Human Clinical Guidelines-

- ACR
  - We conditionally recommend that patients with OA should not use the following:  
Chondroitin sulfate  
Glucosamine
- OSARI
  - Glucosamine and chondroitin were both found to be “not appropriate” for all patients when used for disease modification and “uncertain” for all patients when used for symptom relief.

# Synthetic Literature

## Human Systematic Reviews-

- 90 on PubMed search
- Variable conclusions
  - Different methods
  - Studies included/excluded
  - Statistical methods

# Other Evidence

## Primary Literature-

- Clinical trials- already evaluated in synthetic literature
- Pre-clinical research-
  - Plausibility
  - Safety

# Other Evidence

## Expert Opinion-

- Mixed, no consensus
- Low reliability

## My Opinion-

- Low reliability

# Steps of EBVM

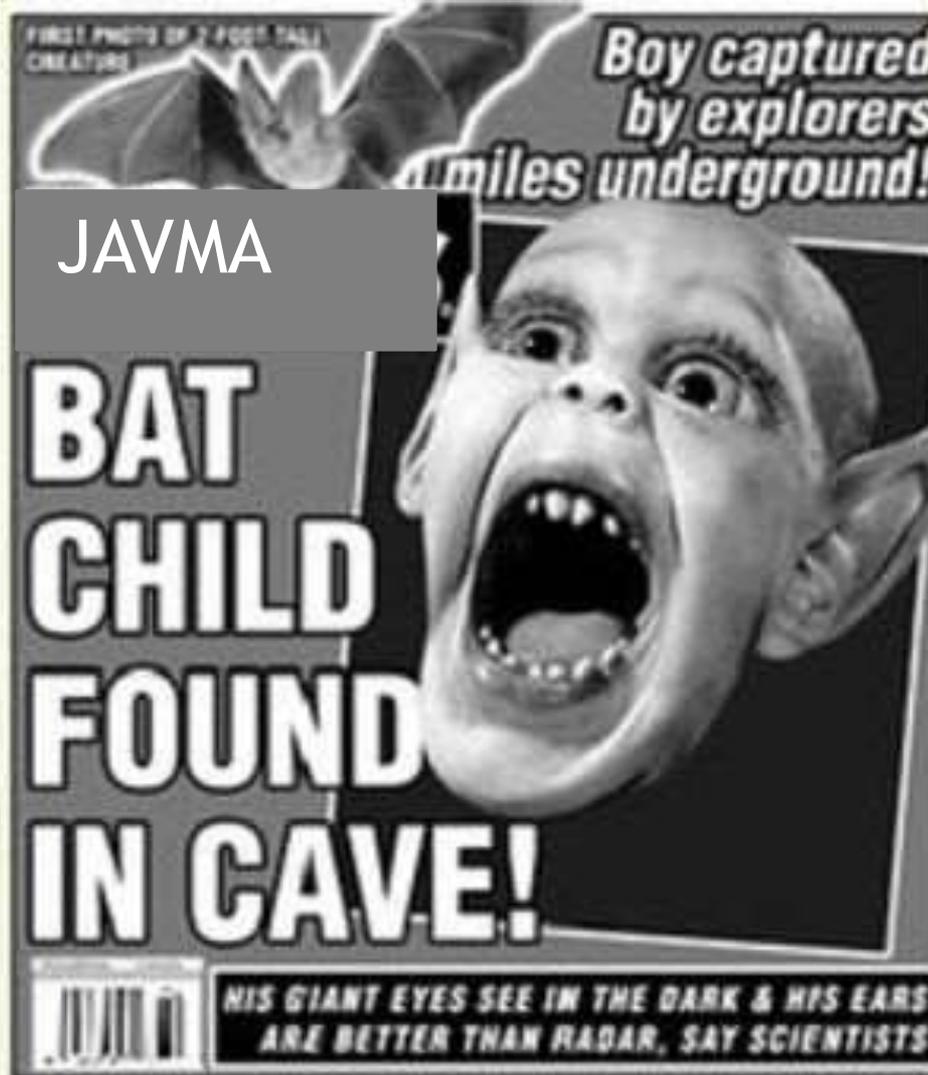
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# Published Research Evidence



# Published Research Evidence



# Published Research Evidence

## Why Most Published Research Findings Are False

John P. A. Ioannidis



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.

# Published Research Evidence

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...

# Published Research Evidence



Critical Appraisal

# Critical Appraisal

- Key factors in Clinical Trials
  - 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

# Published Veterinary Research

Lund, E. M., et al. (1998)- overall reporting

*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.*

# Published Veterinary Research

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.*

# Published Veterinary Research

Arlt , S., et al. (2010)- canine reproduction

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

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

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# Appraise the Evidence

- Not much veterinary clinical trial evidence
  - Variable, generally low quality
  - Mixed results
- Large amount of human clinical trial evidence
  - Mixed results, highest quality suggests little to no benefit
  - No evidence of significant risk
- Other evidence
  - Pre-clinical- potential benefits, little risk
  - Opinion- Everyone has one....

# Steps of EBVM

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# Draw a Conclusion

- Recommend the intervention
- Recommend against the intervention
- Recommend something else instead/in addition
- Take no position
- Sell the intervention to the client?
- What do you tell the client?

# Draw a Conclusion

Having thoroughly reviewed the evidence...

- Evidence is weak
- Very little risk
- Not much reason to expect benefit
- Minimal to moderate cost

My recommendation-

- Begin with interventions that have better evidence
  - NSAIDs
- Consider glucosamine if these not needed/tolerated or if you want to

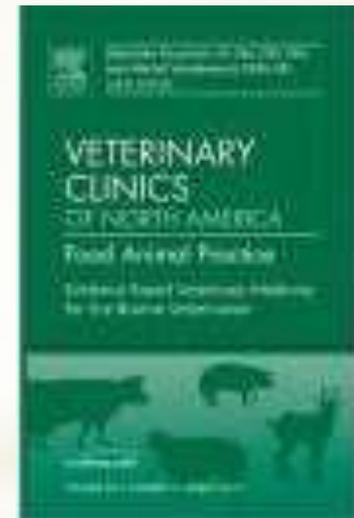
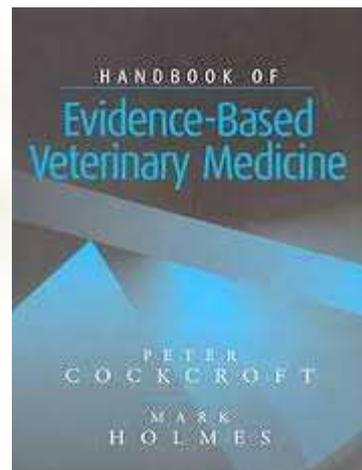
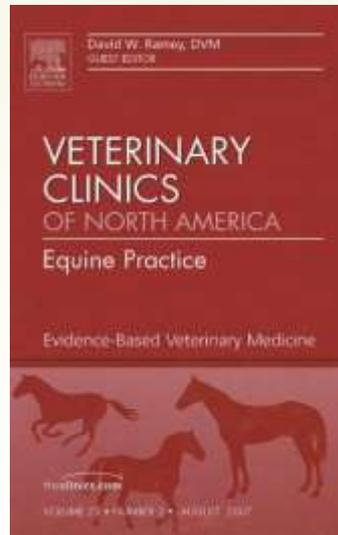
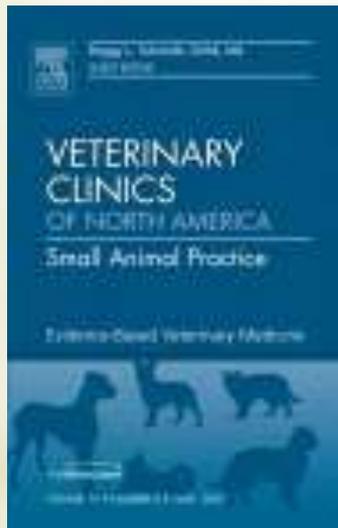
# Bottom Line

- EBVM improves decision-making and patient outcomes
- EBVM requires formal, explicit integration of research evidence with clinical expertise, circumstances, client values
- Evidence must be critically appraised
- More & better evidence is needed!!!!!!

# Resources

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

# Resources



# Resources

- VetAllTrials ([vetalltrials.org](http://vetalltrials.org))
  - Clinical trial registries
  - Transparency, Better Reporting
  - Facilitate Critical Appraisal
  - Better Evidence