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Preprint
not peer reviewed

Understanding evidence-based medicine using a funnel analogy

Received: 8 December 2020
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Please cite as: Meira, E. (2020, December 10). Understanding evidence-based medicine using a funnel analogy. https://doi.org/10.31236/osf.io/kr6aq

Abstract: The framework of evidence-based medicine (EBM) consisting of the best available external evidence, clinical expertise, and patient values/circumstances is often described by educators and clinicians as “three legs to a stool”. Unfortunately, this analogy seems to be easily misunderstood as separate pillars equally weighted and considered independently from each other. This may be causing confusion and imperfect adoption by physical therapists.

EBM may be better described as a sequential “funneling down” of information instead of as a three-legged stool. The totality of the evidence goes in at the top to be synthesized by clinical expertise into manageable concepts that can then be presented as options to the patient who is the ultimate decision maker. This may be a better way to process information into a more usable format for the support of patients.

Keywords: Evidence-based medicine; clinical practice

Introduction

In the early 1990s the Evidence-Based Medicine (EBM) Working Group brought a new paradigm to the practice of medicine.[4] This new process was intended to de-emphasize “intuition, unsystematic clinical experience, and pathophysiologic rationale as sufficient grounds for clinical decision making”.[4] This encouraged providers to go directly to the literature as needed and make independent assessments on those findings, applying them to their daily practice.

Almost 30 years later, the physical therapy profession is having difficulty with this process. A 2019 paper by Zadro et al found that only 54% of physical therapists chose treatments recommended by well-established guidelines.[10] This is not likely due to a lack of published evidence. To quote Zadro et al:

> “As there are now over 42,000 clinical practice guidelines, systematic reviews and clinical trials to guide physical therapy practice, the challenge in physical therapy is applying this

The author has read and approved this version of the manuscript.
This article was last modified on February 8, 2021.

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evidence to practice."[10]

The drive to "publish or die" has produced a volume of papers that can be overwhelming even to dedicated authors conducting systematic reviews let alone to a clinician with a full patient caseload. Also, a lack of reproducibility has been seen in clinical research which leads to a new reality of being able to find a paper somewhere in the literature to support almost any desired intervention.[6]

Bias can enter even randomized controlled trials through methodological misdirection in ways that are often unintentional.[9] Two examples would be HARKing and *p*-hacking. HARKing refers to "Hypothesis After Results are Known" which is the act of collecting data first and then building a hypothesis around those data. This is reasonable in order to generate ideas to test later but can be very problematic when the results are presented as confirmatory, since it leads to a high likelihood of false positives.[1]

In the case of *p*-hacking, the hypothesis was established before the data were collected, but the data analysis has been conducted in such a way so that the data will show a *p*-value below 0.05. This can be achieved by dropping subjects, looking at too many dependent variables, performing post hoc subgrouping, etc. Like HARKing, this also leads to a higher likelihood of false positives.[9] Newer tools like pre-trial registration and registered reports are now available to help identify and reduce both HARKing and *p*-hacking in trials while PRISMA and PROSPERO have been designed to address similar problems in systematic reviews and meta-analyses.[8]

It is easy to understand why this all can be difficult for the average clinician with a busy schedule. In 1996 David Sackett commented upon a simplified framework for considering EBM.[7] This framework consisted of the best available external evidence, clinical expertise, and patient values/circumstances to help guide the clinician. This is often described by educators and clinicians as "three legs to a stool" (Figure 1). Unfortunately, this analogy seems to be easily misunderstood.

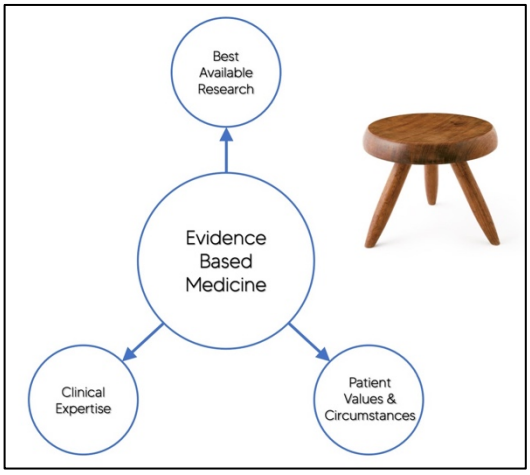

Figure 1. The commonly described three legs to a stool analogy may lead to a misunderstanding of evidence-based medicine.

Specifically, in the rehab world, many clinicians often ask themselves three simple questions:

1. Can I find a citation? (External evidence)
2. Does it fit with the way I see the world? (Clinical expertise)
3. Is the patient agreeable to it? (Patient values)

An answer of yes to all three questions is a delusion of EBM. These concepts are not equally weighted and siloed from each other like legs of a stool. In their 2017 paper, Djulbegovic and Guyatt instead describe this framework as a series of epistemological principles to achieve the ultimate goals of EBM.[3] In other words, it is a series of steps that help guide the clinician to the most accurate objective information regarding the patient in front of them.

DOI: 10.31236/osf.io/kr6aq

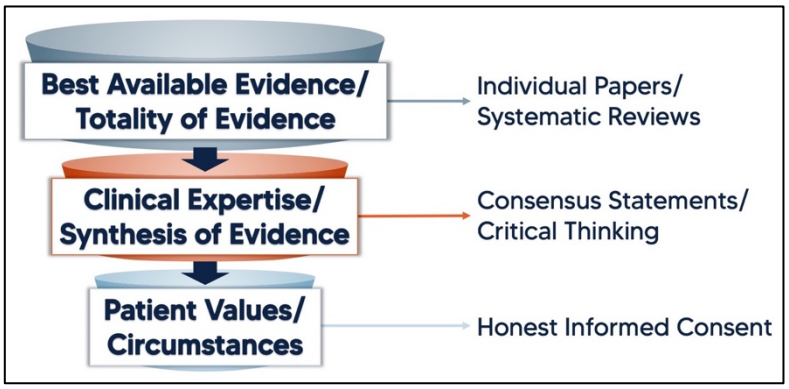

Figure 2. Evidence-based medicine may be better described as a sequential three-step funneling process instead of three legs to a stool.

This may be better described as a sequential process of narrowing or "funneling down" of information instead of as a three-legged stool (Figure 2). The totality of the evidence goes in at the top to be synthesized by clinical expertise into manageable concepts that can then be presented as options to the patient who is the ultimate decision maker.

Best available evidence/Totality of the evidence

Science is not just considering one single paper in isolation. It is the systematic consideration of ALL evidence.[3] In order to do this, all evidence must be reviewed. As pointed out by PRISMA, systematic reviews are very susceptible to bias of the reviewers.[8] Doing an honest review of the current body of literature requires specific methodological protocols which can be aided by registering the review prior to execution through services like PROSPERO. As challenging and labor intensive as this is, it is unreasonable to expect clinicians to do such reviews of all the literature related to every topic that they may be exposed to in the clinic. As Djulbegovic and Guyatt highlight, the improvement of systematic reviews is the key to the future of EBM.[3]

What clinicians see in the clinic should also be included in the totality of the evidence. Although this is uncontrolled and biased in its presentation, it is still under the category of evidence. But we should never lose sight of how low the quality of this evidence is. As with any other evidence, it must be weighed and interpreted in the context of all other evidence, never in isolation.[2] The key to science is the synthesis or interpretation of the entirety of the evidence, combining "what we see in the clinic" with "what we see in the published literature" to find the most consistent and honest thread of our current understanding.

Clinical expertise/Synthesis of the evidence

At one end of the funnel we have the raw evidence from the body of published literature and our clinical experience. Now, how does that apply to the clinic? "Clinical expertise" here refers to an exercise in critical thinking. This is more nuanced than simple statements of "in my professional experience". Critical thinking requires trying to reconcile apparent contradictions in the presence of uncertainty instead of declaring simple "right and wrong".

The literature cannot refute what is seen in the clinic, but it can refute our explanations of those experiences. For example, an intervention may result in the immediate improvement of a patient's symptoms. But well-controlled studies may reveal that those benefits were placebo driven or are short term in duration. This may actually result in long term costs to the patient or the healthcare system that the provider has not considered. In this situation, the clinician may have evidence from personal experience that "this works", but when considered in light of the totality of evidence, the proposed benefit of the intervention may be inaccurate. This does not change the original experience but provides a deeper understanding of the interaction which ultimately enhances practice.

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Consensus statements and practice guidelines can play a role here.[2,3] Professional associations can gather accepted clinical experts to review and comment on systematic reviews of the literature and their own professional expertise to provide practical guidance to clinicians. As representatives of practicing clinicians, they can also comment back to the research community to explore where the current body of literature is lacking and help set research agendas.

Patient values and circumstances/Honest informed consent
Here lies the most important part of the process. The patient is the ultimate decision maker. The objective here, as stated in an interview with David Ring, is to "provide complete, balanced, dispassionate, and hopeful information" to the patient.[5] No salesmanship on behalf of the provider's preferences.

If it is possible that the effects of an intervention are all placebo-based, explain that. What are the true risks? The true likelihood of benefit? What will it cost not just in terms of money but also in terms of time and discomfort? This is simply providing information for the patient to consider against their own values and circumstances to make the final decision. Maybe they will choose what the provider has to offer. Maybe not. But at the end of the interaction, that is their decision to make.

Conclusion
EBM is a tool to process information into a usable format for the support of patients. As the evidence evolves into deeper and deeper understanding, we need a model that fits with the process and can evolve with it. Thinking less of it as three distinct components and more as a multistep process of refinement may make it easier for clinicians to apply the evidence to practice. From now on, think funnel not stool.

Key points
1. The "three-legged stool" model may lead to a poor understanding of evidence-based medicine (EBM) for the average clinician.
2. EBM may be better understood by clinicians as a sequential series of steps, or a funnel, to help guide the provider towards a more optimal experience and outcome for the patient.
3. In a funnel model of EBM, the totality of the evidence goes in at the top to be synthesized by clinical expertise into manageable concepts that can then be presented as options to the patient who is the ultimate decision maker.

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