

UWL REPOSITORY

repository.uwl.ac.uk

Teaching by (bad) example: what a confused attempt to “advance” EBM reveals about its underlying problems: commentary on Jenicek, M. (2015) Do we need another discipline in medicine? From epidemiology and evidence based medicine to cognitive medicine and medical thinking.

Loughlin, Michael ORCID: <https://orcid.org/0000-0002-2234-2146>, Wyer, Peter and Tanenbaum, Sandra (2016) Teaching by (bad) example: what a confused attempt to “advance” EBM reveals about its underlying problems: commentary on Jenicek, M. (2015) Do we need another discipline in medicine? From epidemiology and evidence based medicine to cognitive medicine and medical thinking. *Journal Of Evaluation In Clinical Practice*, 22 (4). pp. 628-633. ISSN 1356-1294

<http://dx.doi.org/10.1111/jep.12552>

This is the Accepted Version of the final output.

UWL repository link: <https://repository.uwl.ac.uk/id/eprint/5020/>

Alternative formats: If you require this document in an alternative format, please contact: open.research@uwl.ac.uk

Copyright:

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy: If you believe that this document breaches copyright, please contact us at open.research@uwl.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Teaching by (bad) example: what a confused attempt to “advance” EBM reveals about its underlying problems: commentary on Jenicek, M. (2015) Do we need another discipline in medicine? From epidemiology and evidence-based medicine to cognitive medicine and medical thinking. Journal of Evaluation in Clinical Practice, 21:1028-1034

Journal:	<i>Journal of Evaluation in Clinical Practice</i>
Manuscript ID	JECP-2016-0160
Wiley - Manuscript type:	Original Article
Date Submitted by the Author:	03-Apr-2016
Complete List of Authors:	Loughlin, Michael; MMU Cheshire, Interdisciplinary Studies Wyer, Peter; Columbia University, Medicine Tanenbaum, Sandra; Ohio State University, College of Public Health
Keywords:	philosophy of medicine, evidence-based medicine
Abstract:	Professor Jenicek's paper is confused, in that his proposal to “integrate” what he means by “evidence-based scientific theory and cognitive approaches to medical thinking” actually embodies a contradiction. But, although confused, he succeeds in teaching us more about the EBM debate than those who seem keen to forge ahead without addressing the underlying epistemological problems that Jenicek brings to our attention. Fundamental questions about the relationship between evidence, knowledge and reason still require resolution if we are to see a genuine advance in this debate.

Evidence, empiricism and reason

Introductory remarks: on being smart enough to feel confused

A philosophy student developing an inquiry into the field of “bad arguments” would face two immediate and underlying puzzles: Firstly, why is the field so large, and secondly, why are so many very well qualified academics amongst its contributors?¹ Our intuition on reading Professor Jenicek's article in the recent EBM thematic edition of the Journal of Evaluation in Clinical Practice (hereafter referred to as “EBM-Cog”) was that there was something not only deeply confusing but also fundamentally confused about it. Of course there is a need for extreme caution when reacting in this way, especially to the work of a well qualified and well published contributor to a most serious debate. One needs to consider the possibility that the work expresses some insight that one has just failed to grasp, despite one's best efforts. So it is worth stressing that what follows is simply our best attempt to make sense of Jenicek's piece in the context of the broader debate to which he contributes, and to use it to identify and explore what we regard as a fundamental problem for that debate. Should it turn out that we have just missed the author's key point, we invite him to explain the point we have missed in language we can understand.

Given that much of Jenicek's prior work has had to do with how to construct scientific arguments, many readers may, like us, react to EBM-Cog by wondering: “what is this about?” Quite often such a question expresses not anti-intellectualism or a failure to grasp a set of complex claims, but rather the exercise of critical faculties generating the sense “that a conclusion does not follow, that a line of argument someone has presented to us is either incomplete or just plain spurious”.² Sometimes understanding the nature of the problem will require examining fundamental assumptions that we bring with us to the debate – for instance, assumptions about the nature of knowledge, evidence and reasoning and the relationships between them. In that case, whether we use the term or not, in our critical questioning we are doing *philosophy*.^{1,2} On this point, we suspect that Jenicek would agree with us, though we find that a philosophical analysis of his own assumptions suggests that the confusing nature of his paper is not

Evidence, empiricism and reason

simply the result of the difficulty of the subject matter, nor is it merely the product of the terminological overload that characterises his work. Rather, at the core of his thesis is a contradiction. He is committed to incompatible claims about medical knowledge and clinical reasoning.

What makes EBM-Cog interesting is what it tells us about the broader debate and the fundamental problem the author is addressing. There is a method of argument in logic called *reductio ad absurdum*: if by asserting the truth of a particular thesis we find we are committed to a contradiction then, however plausible that thesis may seem, it must be false. Jenicek is one author amongst many making serious efforts to resolve problems for Evidence-based Medicine (EBM). In answer to the question in our opening paragraph, arguments can sometimes be bad ones despite being well informed and well thought through. This is because all arguments take place in the context of an intellectual history that is not complete.^{3,4} If our best efforts to defend a dominant intellectual starting point lead us to contradiction and confusion, or some other manner of practical and/or intellectual 'crisis'⁵ then it may be time not to expand or develop the existing 'paradigm'⁶ but to revise our thinking in a more fundamental way. Jenicek deserves credit for identifying a deficit in EBM and attempting to supplement its conception of "scientific" medicine with alternative "cognitive approaches".⁵ We will argue that the failure of these identified "approaches" to "interconnect" requires us to give more explicit attention to the underlying epistemological assumptions that frame the EBM debate. While we think he fails to solve the problem he identifies, that failure can, in itself, teach us something about its fundamental nature. There are times when proposing a confused solution to a problem is a better way to move a debate forward than simply insisting that there is nothing to feel confused about.

Jenicek and EBM

For over a decade, Milos Jenicek has offered himself as a 'voice of reason' in relationship to EBM. Specifically, he has published books and articles asserting the need to integrate principles of logic and

Evidence, empiricism and reason

clinical reasoning into the fabric of EBM for the latter's goals and aspirations to be realized.⁷⁻¹⁰ EBM-Cog goes a step further, calling for the development of a new healthcare related cognitive science to bridge the gap between medical science and clinical practice. EBM-Cog proposes that such a science should pertain to the care of individual patients, to community medicine and to public health. Jenicek aims to draw the building blocks of his proposed new science from EBM, epidemiology, biostatistics, medical specialties, and health management, as well as from philosophy and the humanities. He refers to developments and progress in these and other spheres but does not elaborate what he means by them. In many cases his references are limited to self-citations. The references to “developments in the arts and humanities”, although particularly vague, suggest an awareness of the need to add a phenomenological dimension to the integration and emergent cognitive “discipline” that he seeks.

To his credit, and in contrast to some recent literature,¹¹ Jenicek stops short of attempting to expand the meaning of EBM per se to encompass the other disciplines at play in his vision. Jenicek's call is nonetheless salient to contemporary issues surrounding EBM. EBM has for years espoused the integration of domains other than the results of clinical research into decision making, namely patient values and priorities, available resource issues, and clinical circumstances.^{12,13} However, it has never provided practical guidance as to how such integration is to be achieved.¹¹ Calls for the integration of the research literacy offered by EBM with humanism in healthcare and person-centered care have largely emanated from other sources.¹⁴⁻¹⁷ Jenicek's previous critical reviews suggest that EBM's epidemiological approach to evidence and decision making needs to be supplemented by attention to principles of logic and inference,⁷ and furthermore that EBM needs to acknowledge literature that is broadly critical of it and its precepts.¹⁸

Evidence, empiricism and reason

The Nature of the Argument

What, in fact, is Jenicek seeking? His call is richly infused with what seems at times like an avalanche of arcane philosophical terms, including “iatrosophy”, which strains the ability of even standard dictionaries to decipher, but which apparently is intended to mean the study of thinking related to medical examination and treatment. Our discussion therefore reflects interpretation, or translation, of the gist of the proposal embedded in EBM-Cog.

In his text and using two figures, Jenicek unfolds a description of a process that may be simplified, abbreviated and summarized for purposes of comparison to the standard EBM formula (**Table**). Jenicek's description can be seen as interpolating two additional steps (numbers 1 and 5 of the **Table**) into the standard EBM formula for clinical problem solving, a formula that can be summarized as “ask, acquire, appraise, apply”.¹⁹ The EBM prescription for problem solving conforms closely to the standard formula for “information literacy” that dates from 1980s visions of the information age.²⁰ EBM, in the process of moving from clinician empowerment via passive skepticism to a more dynamic literacy movement,¹¹ adapted the information literacy model to the practice of medicine.²¹ Insofar as this formula is strictly adhered to, EBM regards the information needs encountered by clinicians in the course of evaluating and treating patients to be self-evident and inherently related to research designs.²² A related shortcoming of EBM has been observed to carry over into medical education, starting at the undergraduate level. Maggio et al²³ reviewed published reports of EBM related educational interventions for medical undergraduates and found that only one in five included attention to the process of identifying information needs, i.e. step 1 in the **Table**. The others took the process as self-evident for the purposes of their structured curricular approaches. In the later stages of the problem solving cycle, the EBM literature considers the integration with other knowledge domains of information gleaned from review of published research to be entrustable to a process with which EBM need not be concerned. The EBM literature does not go beyond superficial acknowledgement of the relevance to that process of clinical

Evidence, empiricism and reason

and social context as well as patient values and preferences.^{12,24-29} In other words, step 5 of Jenicek's schema, as simplified in our **Table**, is omitted. It is here that his quest seems most importantly to come to bear.

Jenicek's solution to EBM's problem

Familiarity with intellectual history helps to explain why EBM literature typically omits Jenicek's step 5. It has been argued that EBM's intellectual heritage is 'positivist' in nature,²⁴⁻²⁹ and, while this claim has been at least partially contested by EBM advocates,³⁰ EBM's consistent association with a conception of clinical reasoning which places research evidence at the top of a generic epistemic hierarchy (where famously mechanistic reasoning/'pathophysiologic rationale' and clinical judgment sit somewhere below) strongly suggests a link between the core ideas espoused by EBM authors and conceptions of causal reasoning developed by empiricist philosophy. The positivists' model of reasoning is typically characterised as 'deductivist' because it effectively equates rational argument – the presentation of good reasons to believe a conclusion - with logical validity. A deductively valid argument is one in which the conclusion follows logically from the premises presented, meaning that to deny the conclusion while asserting the truth of the premises is to be guilty of a formal contradiction. Deduction as a logical process cannot generate knowledge, because a deductively valid argument simply makes explicit a conclusion already 'contained' within the premises. And the great positivist thinkers³¹⁻³³ are clear that it is the process of observation, the acquisition of empirical data, that generates the knowledge reported by true premises. Thus all knowledge (including any knowledge expressed in highly abstract, theoretical statements) is ultimately based on, or 'comes from', empirical evidence. As the great empiricist philosophers (most notably Locke³⁴ and Hume³⁵) argued, 'reason' is not the source of knowledge. The positivists (or 'logical empiricists') add to this a focus on meaning, asserting that theories are simply ways of organising data, and that their meaningfulness, even in the most complex scientific theories, is entirely a matter of their function in arranging large amounts of empirical information. Ultimately, by

Evidence, empiricism and reason

this view, the adequacy of any theory depends entirely on its ability to describe and predict the empirical data that will serve either to verify, confirm or falsify the theory.

Hume famously argued that necessity is not a feature of experience and that experience simply reveals 'constant conjunctions' of observed facts.³⁵ This idea provides the basis of the claim that there can be no way of establishing causal connections other than identifying large-scale correlations of data. As Locke observed, systematic empirical science is the best way to gather and describe large amounts of data, such that all disciplines devoted to the study of reasoning (most notably philosophy) must regard themselves as 'under-labourers' to the empirical sciences.³⁴ Thus positivism bolstered the view that only empirical data acquired in certain quite specific ways could provide 'objective evidence', giving rise to an intellectual culture in which judgment, personal experience and context-specific information were regarded with suspicion as 'subjective' factors, and even mechanistic reasoning was accorded a lower epistemic status than the gathering of information.^{2,3,36,37}

Positivist assumptions are so deeply embedded within our contemporary 'common-sense' that they may strike some 'practically minded' authors as too obvious to require defense or even explicit articulation.^{2,37} In fact, far from being sheer common sense or 'just plain obvious', this philosophical position has been subjected to extensive criticism, and the problems it creates for scientific practice have been well documented.^{4,38,39} Rationalist thinkers have argued that an adequate account of many forms of scientific reasoning requires positing innate human capacities "not based on experience" to "generate hypotheses about what in general the world might possibly be like" and then to "reject those we see could not include ourselves and our experiences".⁴ The debate has by no means been "settled" one way or the other, but few would now defend the strict empiricism of the logical positivists, precisely because it seems too restrictive to explain how many ordinary cases of reasoning are legitimate.^{3,37}

Evidence, empiricism and reason

That said, the influence of positivist ideas on the development of EBM seems clear – its privileging of research evidence over expert opinion, limited, personal, context-specific experience, intuition and mechanistic reasoning would seem to follow (strictly, deductively) from the conceptions of knowledge and reasoning developed in the empiricist tradition. The one clearly epistemological thesis associated with the various statements of EBM over the decades has been the idea of a “hierarchy of evidence”.

Tonelli⁴⁰ argues that, in EBM, the results of empirical research function as 'the major premises' from which conclusions about particular cases are deduced. The problem, of course, (as numerous authors have noted over a number of years¹) is that the process is invalid as no conclusion about any specific case follows deductively from general premises. Hence, despite all of the references in EBM literature to the need to 'integrate' other warrants for practical conclusions to bridge the logical gap, the process goes largely unexplained.⁴⁰

This seems to be Jenicek's point of entrance to the debate. He hopes to supplement EBM with 'gnostic processes' which, it seems, we should construe as forms of reasoning that go beyond the strict empiricist model of deductive validity. He characterises these 'gnostic or epistemological processes' as 'those processes that generate knowledge' and his whole point seems to be that you need much more than the Humean/positivist model of "observation plus deduction" to arrive at any substantive conclusions. If the 'gnostic process' is anything other than strict logical deduction (from premises derived from observation) and it does really 'generate knowledge', then that seems to imply some form of *rationalism* in epistemology. In short, he supplies a rationalist solution to the problem created by EBM's empiricism. Step 5 of his proposed “new medical cognitive science” simply inserts a conception of reasoning that is logically incompatible with empiricism into a process whose basis and legitimacy derives from empiricism. This perhaps explains why standard EBM literature has tended to omit this step.

Evidence, empiricism and reason

Quite apart from the difficulties in understanding the specific nature of this supposed solution, (for example, how precisely the forms of reasoning Jenicek proposes work, especially against the background of his own, deeply confused, approach to philosophical logic^{41,42}), we have a problem with the idea of 'supplementing' one approach with another when the two seem logically incompatible. EBM-Cog is confusing not just because it adopts a general stylistic approach of 'why choose one familiar word when five unfamiliar ones will do just as well?' It is confusing because at its own 'base' there seems to be a fundamental confusion. If EBM's whole basis for privileging certain sorts of evidence over others is philosophically unfounded (i.e., if empiricism is the wrong philosophy, which it must be if Jenicek's implicit rationalism is tenable) then the correct thing to do is not to supplement this philosophy with something else but to reject it altogether.

Jenicek's characterisation of clinical reasoning might be defended by claiming either that medicine is not a science, or that science is not the strict, empirical-deductive process described by the positivists. At points he seems to be saying both of these things. But either way, he no longer has a position that seems compatible with EBM. What we need is not a 'paradigm extension' but rather a new (or different) paradigm. Or even better, (dropping the unnecessary and inappropriate use of Kuhn's jargon, an intellectual pretension for which Jenicek cannot be held responsible as it has been part of the debate since 1992⁶), what we need is a different way of thinking about rationality and decision-making in clinical practice.

Conclusion: implications for “the EBM debate”

For this commentary we have chosen to avoid dwelling on the many points of unclarity that make EBM-Cog a confusing read and to focus on an issue that may not immediately strike some readers as crucial, but whose significance cannot be over-stated in any serious analysis of the current EBM debate. That is, the question of *epistemic commitment*: a phrase we use here to indicate the underlying presuppositions

Evidence, empiricism and reason

about the nature of knowledge to which contributors to a discussion commit themselves by the claims they make. At a time when influential authors are calling for the 'science' of EBM to be 'expanded' and for its underlying knowledge base to be 'supplemented'¹¹ it is crucial that we are clear on which assumptions about knowledge we are committed to if we accept certain claims. We therefore begin our conclusion by recapitulating our interpretation of EBM-Cog

EBM has consistently been proposed not as a trivial or platitudinous claim, but as a substantive thesis concerning medical knowledge.¹ While the term can of course be used in many different ways, key defenders of EBM have, from the outset, asserted the idea of a generic epistemic hierarchy of evidence, with evidence from clinical research at the top and with the randomized trial constituting the only "real evidence" one can admit to support causal conclusions regarding effectiveness.⁴³ Other clinical research designs may be admitted, but only on the understanding that they are imperfect surrogates for randomized trial data. We have argued that if such a thesis is indeed entailed by what its defenders have called the EBM 'paradigm'⁶ then it is thoroughly grounded in, and, logically committed to, empiricist epistemology.

In EBM-Cog, Jenicek proposes a "new medical cognitive science". The specific quest appears to be for a construct or model to enhance our understanding of what the EBM literature terms the movement from evidence to action (**Table**).⁴⁴ Whereas EBM has at times verged on a denial of the difference between evidence, defined as information from clinical research, and knowledge (as a consequence of its own epistemic commitment), Jenicek recognizes the need for a cognitive process going beyond the evidence *per se* for the latter to have meaningful impact on practice. While he refrains from explicit alignment with a philosophical school or tendency, we have argued that such a view commits him to some version of rationalism in epistemology. Indeed, EBM-Cog's concluding statement is: "Rational uses of medical evidence are as important as evidence itself". While there is nothing evidently absurd in such a

Evidence, empiricism and reason

commitment, it is clearly logically incompatible with a commitment to empiricism. It is hard to overstate the seriousness of the error in attempting to defend a position by 'supplementing' it with claims that are logically incompatible with its own underlying assumptions.

EBM-Cog, perhaps because of the confused nature of its argument, has provided us with a useful vehicle with which to explore the philosophical underpinnings of the longstanding EBM debate. Perhaps the most useful principle illustrated by our exploration is that, in the quest to remedy the ills and limitations of the EBM paradigm, a viable philosophical and epistemological framework is the essential starting point. Adding one non-viable framework, in this case Jenicek's version of rationalism, to another such framework (empiricism) can never adequately fix the latter.

However, precedents pointing beyond the rationalist-empiricist dilemma exist within healthcare and we will identify a few potentially guiding examples. We resist prematurely plunging into a full scale attempt to define a path or formula for achievement of the mission proposed by Jenicek, or to identify a comprehensive list of ingredients. Indeed, a list of generic disciplines such as suggested in EBM-Cog, many of which are themselves populated by conflicting epistemologies and traditions, is premature. Only after defining a philosophically viable overall framework will it be possible to harvest the fruits of empiricist methodologies in a fashion that maximizes their value.

Jenicek himself has at least flirted with bodies of work that suggest pathways beyond the rationalist/empiricist conundrum. One is the accumulating literature on 'dual process' theory, a construct that acknowledges that both intuitive and analytic modalities of cognition operate in the context of clinical practice, particularly diagnostic reasoning. EBM-Cog cites one source article on dual process theory without mention of its content.⁹ The construct does not itself define an epistemology and is subject to reductionist interpretations.⁴⁵ However, by acknowledging tacit processes at play in medical

Evidence, empiricism and reason

cognition, it is also consistent with more explicitly non-reductionist concepts. An example is the notion of reflective practice introduced by Donald Schon.⁴⁶ Schon rejected the notion of professional expertise as the perfection of the ability to apply fixed rules and principles to practical problem solving and emphasized the improvisational dimension (reflection in action) in tandem with analytical reflection (reflection on action). Schon's model of expertise informed the development of the relationship centered care construct.^{16,17} The latter is an excellent example of an approach framed with explicit reference to philosophical frameworks leading beyond the rationalist-empiricist dichotomy, particularly the phenomenology of Merleau-Ponty⁴⁷ and the writings of Polanyi.⁴⁸ Another source cited but not explored by EBM-Cog is Montgomery's "How Doctors Think."⁴⁹ Montgomery's casuistic approach to clinical problem solving is based on a reduction of empiricist science as the foundational basis of clinical practice, but not as a crucial dimension of healthcare. These examples, while not providing the finished blueprint of medical cognition and reflection apparently sought by EBM-Cog, may nonetheless, at least preliminarily, point the way to such a thing by demonstrating that it one can be empirical without being an 'empiricist' and that it is possible to know without succumbing to rigid hierarchies of knowledge or of research designs such as those promulgated by EBM.

References

1. Loughlin M. (2010) *Argument, Platitude, Caricature & Ridicule in the EBM Debate* [Talk delivered 13April 2010 at Manchester Metropolitan University, UK] Available at <https://www.youtube.com/watch?v=Khl7P0gCneY> . Accessed 1April 2016.
2. Loughlin M, Upshur REG, Goldenberg MJ, Bluhm R, Borgerson K. (2010) Philosophy, ethics, medicine and healthcare: the urgent need for critical practice. *Journal of Evaluation in Clinical Practice*, 16, 249-259.
3. Loughlin M, Lewith G, Falkenberg T. (2013) Science, Practice and Mythology: A Definition and Examination of the Implications of Scientism in Medicine. *Healthcare Analysis*, 21, 130-145.
4. Nagel T. (1986) *The view from nowhere*. Oxford: Oxford University Press.
5. Greenhalgh T, Howick J, Maskrey N. (2014) Evidence Based Medicine Renaissance G. Evidence based medicine: a movement in crisis? *British Medical Journal*, 348 (g3725), 1-7.
6. Evidence-Based Medicine Working Group. (1992) Evidence-based medicine: A new approach to teaching the practice of medicine. *Journal of the American Medical Association*, 268, 2420-2425.

Evidence, empiricism and reason

7. Jenicek M. (2003) *Foundations of Evidence-Based Medicine*. New York: Parthenon Publishing Group.
8. Jenicek M. (2006) The hard art of soft science: Evidence-Based Medicine, Reasoned Medicine or both? *Journal of Evaluation in Clinical Practice*, 12, 410-419.
9. Jenicek M, Croskerry P, Hitchcock DL. (2011) Evidence and its uses in healthcare and research: The role of critical thinking. *Medical Science Monitor*, 17, RA12-RA17.
10. Jenicek M, Hitchcock DL. (2005) *Evidence-Based Practice: Logic and Critical Thinking in Medicine*. USA: AMA Press.
11. Wyer P, Silva SA. (2015) 'All the King's horses . . .': the problematical fate of born-again evidence-based medicine: commentary on Greenhalgh, T., Snow, R., Ryan, S., Rees, S., and Salisbury, H. (2015) six 'biases' against patients and carers in evidence-based medicine. *BioMed Central Medicine*, 13,200. *Journal of Evaluation in Clinical Practice*, 21(6), E1-E10.
12. Haynes RB, Devereaux PJ, Guyatt GH. (2002) Physicians' and patients' choices in evidence based practice: Evidence does not make decisions, people do. *British Medical Journal*, 324(7350),1350.
13. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. (1996) Evidence based medicine: what it is and what it isn't. *British Medical Journal*, 312(7023),71-72.
14. Frankel RM, Inui TS. (2006) Re-Forming Relationships in Healthcare Papers from the Ninth Biennial Regenstrief Conference. *Journal of General Internal Medicine*, 21 (Suppl 1), S1-S2.
15. Miles A, Mezzich JE. (2011) The care of the patient and the soul of the clinic: person-centered medicine as an emergent model of modern clinical practice. *International Journal of Person Centered Medicine*, 1, 207-222.
16. Tresolini C, Pew-Fetzer Task Force. (1994) *Health Professions Education and Relationship-Centered Care*. Pew Health Professions Commission. Available at rccswmi.org/uploads/PewFetzerRCCreport.pdf Accessed 1April2016
17. Wyer PC, Silva SA, Post SG, Quinlan P. (2014) Relationship-centred care: antidote, guidepost or blind alley? The epistemology of 21st century healthcare. *Journal of Evaluation in Clinical Practice*, 20, 881-889.
18. Jenicek M. Evidence-based medicine: Fifteen years later. Golem the good, the bad, and the ugly in need of a review? (2006) *Medical Science Monitor*, 12, RA241-RA251.
19. Dawes M, Summerskill W, Glasziou P, et al. (2005) Sicily statement on evidence-based practice, *BioMedCentral Medical Education*, 5,1.
20. Presidential Committee on Information Literacy. (1989) Final Report. <http://www.ala.org/ala/mgrps/divs/acrl/publications/whitepapers/presidential.cfm>. Accessed 1 April 2016.
21. Wyer PC, Silva SA. (2009) Where Is The Wisdom: I. A Conceptual History of Evidence Based Medicine *Journal of Evaluation in Clinical Practice*, 15, 891-898.
22. Sestini P. (2010) Epistemology and ethics of evidence-based medicine:putting goal-setting in the right place. *Journal of Evaluation in Clinical Practice* , 16, 301-305.
23. Maggio LA, Tannery NH, Chen HC, ten Cate O, O'Brien B. (2013) Evidence-Based Medicine Training in Undergraduate Medical Education: A Review and Critique of the Literature Published 2006–2011. *Academic Medicine*, 88, 1022-1028.
24. Goldenberg MJ. (2006)On evidence and evidence-based medicine: Lessons from the philosophy of science. *Social Science and Medicine*, 62, 2621-2632.
25. Gupta M. (2014) *Is Evidence-Based Psychiatry Ethical?* UK: Oxford University Press.
26. Loughlin M. (2008) Reason, reality and objectivity – shared dogmas and distortions in the way both 'scientific' and 'postmodern' commentators frame the EBM debate. *Journal of Evaluation in Clinical Practice*, 14, 665-671.

Evidence, empiricism and reason

27. Miles A, Loughlin M, Polychronis A. (2007) Medicine and evidence: knowledge and action in clinical practice. *Journal of Evaluation in Clinical Practice*, 13, 481-503.
28. Walsh B, Gillett G. (2011) Is Evidence-based Medicine Positivist? *International Journal of Person Centred Medicine*, 1, 232-239.
29. White K, Willis E. (2002) Positivism resurgent: the epistemological foundations of evidence-based medicine. *Health Sociology Review*, 11, 5-15.
30. Djulbegovic B, Guyatt GH, Ashcroft RE. (2009) Epistemologic Inquiries in Evidence-Based Medicine. *Cancer Control*, 16, 158-168.
31. Ayer AJ. (1987) *Language, Truth and Logic*. New York: Penguin Books.
32. Carnap R. (2011) *The Unity of Science*. Oxon: Routledge.
33. Schlick M. (1979) *Moritz Schlick: Philosophical Papers, Volume II (1925–1936)*. Amsterdam, Netherlands: Springer.
34. Locke J. (1976) *An Essay Concerning Human Understanding*. London: J Dent & Sons.
35. Hume D. (1978) *A Treatise of Human Nature*. Oxford: Clarendon Press.
36. Kirkengen AL, Thronquist E. (2012) The lived body as a medical topic: an argument for an ethically informed epistemology. *Journal of Evaluation in Clinical Practice*, 18, 1095-1101.
37. Loughlin M. (2002) *Ethics, management and mythology*. Oxford: Radcliffe Medical Press.
38. Kincaid H, Dupre J, Wylie A. (2007) *Value Free Science? Ideals and Illusions*. Oxford: Oxford University Press.
39. Maxwell N. (2004) *Is science neurotic?*. London: Imperial College Press.
40. Tonelli M. (2014) Values-based medicine, foundationalism and casuistry. In: Loughlin M, ed. *Debates in Values-Based Practice: Arguments For and Against*. Cambridge: Cambridge University Press, 236-243.
41. Jenicek M. (2006) *A Physician's Self-Paced Guide to Critical Thinking*. Chicago, ILL: AMA Press.
42. Loughlin M. (2007) Analysis: A Physician's Self-Paced Guide to Critical Thinking. Jenicek, M. *Journal of Evaluation in Clinical Practice*, 13, 540-544.
43. Colquhoun D. (2011) *Why philosophy is largely ignored by science*. DC Science Available at <http://www.dcsience.net/2011/10/28/why-philosophy-is-largely-ignored-by-science> Accessed 1 April 2016.
44. Guyatt G, Rennie D, Meade MO, Cook DJ. (2015) *Users' Guides to the Medical Literature: A Manual for Evidence Based Clinical Practice*. 3rd ed. New York: McGraw-Hill.
45. Norman G. (2009) Dual processing and diagnostic errors. *Advances in Health Sciences Education*, 14, 37-49.
46. Schon DA. (1983) *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.
47. Merleau-Ponty M. (1962) *Phenomenology of Perception*. London: Routledge & Kegan Paul.
48. Polanyi M. (1967) *The Tacit Dimension*. New York: Anchor Books.
49. Montgomery K. (2006) *How Doctors Think: Clinical Judgment and the Practice of Medicine*. UK: Oxford University Press.

Evidence, empiricism and reason

EBM-Cog (Jenicek 2015)	EBM (Dawes et al¹⁹)
1. Delineating a healthcare problem	1. -----
2. Identifying key questions and information needs	2. Ask a question
3. Collecting and summarizing relevant evidence, observations and measurements	3. Acquire the evidence
4. Evaluating relevant evidence, observations, and measurements using the tools of epidemiology, biostatistics and qualitative research	4. Appraise the evidence
5. Reasoning about the results of the above steps	5.-----
6. Formulating recommendations, such as those found in clinical practice guidelines; decision-making	6. Apply the evidence to decision making ("evidence to action")