Use of Evidence in Acute Stroke Decision-Making: Implications for Evidence-Based Medicine

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Abstract

Evidence-Based Medicine proposes a prescriptive model of physician decision-making in which "best evidence" is used to guide best practice. And yet, proponents of EBM acknowledge that EBM fails to offer a systematic theory of physician decision-making. In this paper, we explore how physicians from the neurology and emergency medicine communities have responded to an evolving body of evidence surrounding the acute treatment of patients with ischemic stroke. Through analysis of this case study, we argue that EBM's vision of evidence-based medical decision-making fails to appreciate a process that we have termed *epistemic evaluation*. Namely, physicians are required to interpret and apply any knowledge — even what EBM would term "best evidence" — in light of their own knowledge, background and experience. This is consequential for EBM as understanding what physicians do and why they do it would appear to be essential to achieving optimal practice in accordance with best evidence.

Keywords: evidence-based medicine, clinical decision-making

Introduction

Evidence-based medicine (EBM) emerged in the early 1990s as a new approach to clinical medicine inspired by the seemingly pure and anti-authoritarian goal of educating clinicians in the use of the published literature to optimize their practice [1]. First defined as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients"[2] EBM aims to position clinical practice on more solid scientific grounds and rescue clinical decision-making from physicians' fallible and value-laden intuitions. What rapidly became a core component of EBM's doctrine is the evidence hierarchy, which privileges knowledge gained from randomized clinical trials (RCTs) — especially when aggregated in systematic reviews or meta-analyses — over all other forms of knowledge, including mechanistic reasoning and physicians' experiences. Yet, in order to escape a number of pushbacks on the basis of reductionism, EBM was ultimately redefined as "the integration of best research evidence with clinical expertise and patient values" [3].

As advocates of EBM have recognized, EBM – as a theory of physician decision-making – is largely prescriptive: it is about how MDs *should* make decisions, not how they *do* make decisions. Haynes and al. [3], pioneers of the EBM movement, explicitly acknowledge this distinction: "[EBM] is prescriptive rather than descriptive. That is, it is a guide for thinking about how decisions should be made rather than a schema for how they are made"[1]. Therefore, as a means of understanding how physicians will act in the course of a clinical encounter, EBM can tell us little. Indeed, proponents of EBM also acknowledge that their model offers limited insights into physician decision-making, for example when Djulbegovic and Guyatt recently wrote that "The main challenge for EBM remains how to develop a coherent theory of decision making" [1].

In this paper, we suggest that EBM's vision of evidence-based medical decision-making fails to appreciate a process that we have termed *epistemic evaluation*. In Section 1, we introduce this process through the case study of acute stroke decision-making, in which drastic differences in interpretation of a large body of "high quality" evidence has driven decades of disagreement between the emergency medicine and neurological communities. In section 2, we return to EBM and identify important implications for its prescriptive mission. We contend that adopting a more open and solid descriptive foundation of decision-making, and particularly of the relationship between research evidence and research evidence-users, is likely to be more successful in changing practice than creating ever "more" and "better" evidence. Ultimately, we propose that devoting more attention to the processes of *epistemic evaluation* can lay the groundwork for a theory of clinical decision-making that reconciles the prescriptive ambition of EBM with what is understood about the realities of physician decision-making: that any clinical evidence is necessarily situated in an epistemic, social as well as clinical context. [4,5,6].

[1] Figure 2 of Haynes and al. [3] depicts a Venn diagram with three equally overlapping circles titled 'Research evidence', 'Clinical States and circumstances', 'Patients' preferences and actions' with an added circle titled 'Clinical expertise' overlaying the intersected parts of the Venn diagram.

Section 1 | Epistemic evaluation in acute-stroke decision-making

Over the last 30 years, the field of acute ischemic stroke therapy has seen two significant developments: in the mid-1990s, the identification of intravenous thrombolysis (tPA) as an effective therapy for selected patients; and then in the mid-2010s, the addition of endovascular thrombectomy (EVT) as an effective acute treatment for an overlapping set of patients. Despite the availability of evidence from multiple RCTs in both cases, adoption of these treatments was not straightforward and the way physicians engaged with this evidence tells us much about real-world decision-making. In this section, we contend that the prescriptive (normative) framework of EBM fails to capture relevant epistemic components of decision-making surrounding acute stroke treatment, in that there is both an extensive literature of (what EBM considers) "high quality" evidence as well as significant practice variation regarding these two treatments. The ways in which the RCT evidence for these two treatments was applied in practice can serve to demonstrate the limitations of the EBM model of decision-making in that: positive RCT trials did not necessarily lead directly to practice change; negative trials did not lead to abandoning treatments; and the factors that seem to have strongly influenced practice change (for better or for worse) are largely cultural and contextual.

In what follows, we propose a descriptive model of physician decision-making, one based on studying the decision-making we see in the case of acute-stroke treatment. Our model – which we have termed *epistemic evaluation* – borrows tools from the philosophy of science to justify the epistemic gap in stroke decision-making between EM doctors and neurologists. Specifically, our descriptive approach highlights that different epistemic values regarding the evidence, influenced by differing background mechanistic knowledge related to the evidence, and different diagnostic skills necessary to apply the evidence, can better explain the gap in interpretation and application that arose in the neurological and emergency medical communities than can issues of evidence quantity or quality.

1.0 Treating acute stroke

The treatment of acute stroke can represent a (somewhat) pure case of how doctors – rather than patients, or patients in combination with doctors – make decisions. Acute stroke is a medical emergency and decisions about treatment must be made in a matter of minutes. Moreover, the decision-making process must often be undertaken without input from the patient, who is often incapacitated from a decision-making point of view. Therefore, acute-stroke decision-making allows us (for the sake of this paper) to ignore aspects of *shared* decision-making and focus on the relationship between the physician (or evidence-user) and the research evidence.

For most of medical history, stroke was understood as untreatable [7]. A series of scientific and technological advancements throughout the second half of the twentieth century helped reformulate this conception [8]. In 1995, the first randomized trial demonstrating efficacy for a thrombolytic agent in acute ischemic stroke was published. That trial — known as the NINDS trial for its sponsors — demonstrated a modest but statistically significant benefit to the use of intravenous alteplase for patients with acute ischemic stroke under 3 hours from symptom

onset [9]. Subsequent trials of different agents over different time windows did not reproduce this result until about a decade later when the ECASS III and IST3 trials once again showed benefit for tPA [10, 11]. A meta-analysis of these data demonstrated that benefit could be obtained out to 4.5 hours from symptom onset, though the greatest likelihood of benefit arose if treatment was administered as early as possible [12]. The neurological community was energized by these results and the use of intravenous alteplase became an accepted practice, as reflected by many national guidelines [13]. Moreover, legal cases in many jurisdictions have awarded damages to patients who were candidates for but who did not receive intravenous alteplase[14], again demonstrating that its use became a *de facto* clinical standard.

According to EBM's prescriptivist model of decision-making, there should have been little variation around this practice: alteplase is effective based on the highest quality of evidence, obtained from meta-analyses of multiple high quality RCTs. And yet, practice variation persisted for at least a decade. Many estimates suggest that fewer than 5% of stroke patients receive treatment with IV tPA. While this is largely owing to the fact that many patients do not arrive in hospital quickly enough to be assessed for treatment within 3 hours, at least 50% of eligible candidates did not routinely receive treatment with tPA [15].

Moreover, empirical studies demonstrated that many physicians expressed skepticism about the benefits of alteplase despite the available evidence, particularly physicians from an emergency medicine background. Emergency doctors are usually the first responders to evaluate patients with suspected stroke. They often collaborate with neurologists in acute-stroke decision-making. Yet, those two specialties would appear to interpret the evidence for alteplase very differently. A survey of neurologists in 1997 showed that only 3% considered the results of the NINDS “not convincing” [16], and another survey of Ontario neurologists in 2010 found that a mere 4% did not believe in the efficacy of tPA for stroke [17]. In contrast, in 2005, a survey of over 1100 American emergency physicians reported that 40% were unlikely to use tPA for stroke even “under ideal conditions” [18]. The same year, another survey of emergency doctors in New York showed that only 66% considered tPA to be an “appropriate agent for the treatment of acute ischemic stroke.” [19] In 2010, a similar survey found that only 49% of Michigan Emergency Physicians felt the scientific evidence regarding the use of tPA was convincing [20]. And official guidelines from the Canadian Association of Emergency Physicians (CAEP) paint a similar picture. Until 2015, the CAEP was not supportive of the use of thrombolytic agents for acute ischemic stroke [21].

For EBM's prescriptive model, this variability can only be justified by a lack of research evidence, or dissemination thereof, or guidelines that do not follow GRADE processes. And yet, this is clearly not the case. A large body of evidence was available, with which both communities of physicians were intimately aware. Indeed, evidence suggests that the emergency medicine community's skepticism was based on a set of arguments grounded *within* the available evidence. They were keenly aware of it, and contested it despite it being of the "highest quality" as per EBM standards. We will dissect those specific arguments in order to draw broader conclusions about the need to expand EBM's model of the way physicians use evidence in decision-making. We argue that EM doctors and neurologists arrived at their

differing interpretations of the evidence because they *evaluated* it differently: they prioritized different sets of epistemic values in regard to the evidence, which were themselves influenced by different background mechanistic knowledge related to the evidence and distinct diagnostic skills necessary to apply the evidence.

1.1 Background mechanistic knowledge

A recurring argument against the efficacy of tPA as a treatment for acute stroke questions the validity of the results of by the NINDS trial in comparison to other larger clinical trials. According to this criticism, benefit seen in the 624 patients enrolled in the NINDS trial is overwhelmed by lack of benefit in the 1847 patients enrolled in other trials – ECASS I, ECASS II, ATLANTIS A and ATLANTIS B. Indeed, these trials showed high rates of post-tPA intracerebral hemorrhage, leading to excess mortality [22, 23, 24].

At first glance, this criticism is based on the routine statistical importance of sample size: the larger the population of a trial, the more likely the results shown are valid. However, a key difference between the NINDS trial and those other clinical trials reveals the subtext of the criticism: the NINDS trial enrolled all its patients within 3h from the onset of symptoms while the other trials used a 6h window. The selection of such a narrow therapeutic window in the NINDS trial relied on animal experimentation suggesting the existence of a *penumbra* – a region of the brain that could survive despite being deprived of blood flow — if only for a few hours after symptom onset [25]. Interestingly, the *penumbra* is a concept commonly referenced in articles defending the treatability of stroke [26,27,28] but is not mentioned in articles challenging it [18, 22, 23].

Emergency doctors' knowledge is necessarily broader and shallower in scope. They have less chance to be familiar with such physiological concepts compared to neurologists. And without the concept of the penumbra, and its operational correlate of the 3-hour therapeutic window, there would indeed be no grounds to distinguish between the NINDS trial and its related trials. In such a case, the NINDS results would be submerged by the results of the other trials due to their combined sample size.

We contend that this example demonstrates how the epistemic evaluation of "best" evidence requires the integration of mechanistic concepts in the background knowledge of physicians. Different relationships with mechanistic concepts – such as vascular anatomy, localization, and the penumbra [8]– between neurologists and emergency doctors provides an alternate source of explanation to make sense of their different epistemic evaluation and application of the evidence.

1.2 Diagnostic skills and Risk Tolerance

Another argument against the treatability of acute stroke by alteplase relies on the risk of intracerebral hemorrhage, the most dangerous potential side effect of tPA treatment. According to the NINDS trial, 6% of patients who were treated with tPA suffered some form of intracerebral hemorrhage, in contrast to only 0.6% of the patients who received placebo [9].

Emergency doctors have maintained that such risk is simply “unacceptable” [18]. Here, the critics are not contesting the validity of the NINDS trial’s results, but are arguing about their meaning. A 6% absolute risk of hemorrhage is intolerable is felt to outweigh the 35% relative increased chance of benefit derived from tPA treatment. This criticism is found principally among the emergency medicine community [29], and not the neurological community.

A great deal of the concern relating to the risk of hemorrhage surrounds the administration of alteplase to patients who shouldn't have received it: what is seen as the risk of causing unjustified harm. The risk of hemorrhage from thrombolysis for stroke is much higher than in acute myocardial infarction (MI), where the risk of hemorrhage is less than 1%. Accurately identifying patients who do indeed warrant thrombolysis is a key element of the decision-making process, and is much more complex in stroke than in MI, where clear measures such as ECG and troponins are more consistently interpreted. In the case of stroke, a CT scan is primarily used to exclude other causes while the diagnosis often depends upon a clinician's recognition of the pattern of symptoms. To help the physician identify patients less likely to be harmed, the NINDS trial came up with a number of criteria including the 3 hour window, the absence of hemorrhage on the CT scan, the absence of obvious signs of irreversible infarction on the CT scan, and any feature that would predispose the patient to bleeding, such as abnormalities of clotting [9].

Without the access to a CT scanner – and therefore the ability to exclude a hemorrhagic cause – a physician is unable to safely initiate therapy with a thrombolytic agent like tPA. Similarly, the inability to interpret correctly the history and physical examination findings of a patient with acute stroke could impact a physician’s treatment decisions. While the working skill to localize “focal neurological deficits” is a central focus of a neurologist’s training, emergency physicians are not trained with the same rigor on such skill. The suggestion that emergency physicians are less comfortable administering tPA to stroke patients is often evoked in debates about stroke treatments. For instance, emergency physician Dr. Anand Swaminathan of New York University raised concern about the fact that “we don’t know who to give the drug to” [30]. Physicians who lack such knowledge or ability might administer tPA to patients who have more chance to develop post-tPA hemorrhage, feeding into their belief that tPA is unacceptably dangerous.

Here, we see that the application of the “evidence” requires well-developed diagnostic abilities (on top of access to the right diagnostic technologies). Differences in the diagnostic skills – and confidence therein – between neurologists and emergency doctors can hence also help explain the difference in their epistemic evaluation of the evidence.

1.3 The case of endovascular thrombectomy

In order to counter potential arguments that the phenomenon we described of *epistemic evaluation* is idiosyncratic to emergency doctors (that they somehow take a different position regarding the hierarchy of evidence) or is limited to the response to early trials of alteplase, we briefly discuss the case of another recent treatment for acute stroke, namely endovascular thrombectomy. Large, multicentre randomized trials published in late 2014 and early 2015 concluded that there was benefit to endovascular thrombectomy for stroke patients with so-

called large vessel occlusions, where a thrombus is visible on angiographic imaging of the brain [31] doption of this novel treatment was met with no resistance by the emergency medicine community. In fact, they adopted it quickly and in many cases argued that it further added to the proof that alteplase was ineffective or unnecessary [32].

Yet, the 2014-2015 trials that established the efficacy of EVT were preceded by a series of similarly well-conducted trials - all published in the *New England Journal of Medicine* in 2012-2013 – that arrived at the conclusion that thrombectomy offered no benefit [33, 34, 35]. According to EBM's hierarchy, 3 large scale well-conducted RCTs should have been considered definitive evidence establishing that EVT was not effective and should have halted the practice. And yet, despite this evidence, the stroke and emergency communities pushed forward with more trials, convinced of EVT's benefit despite their own clinical trials.

This example reinforces three important conclusions. First, that the importance of a non-hierarchical interpretation of evidence is not restricted to the case of tPA or to emergency physicians. If the physicians in question had followed the principles of EBM then EVT should have been rejected out of hand at this point; 3 large RCTs had demonstrated that it was no more effective than standard treatment. And yet, these trials only spurred a further generation of trials. Second, that the reason for which the neurological community continued to believe in EVT despite RCT evidence to the contrary is based in fundamental physiological (read mechanistic) reasoning and individual experience. Many physicians in the community had direct clinical experience of technically successful thrombectomy leading to rapid and unquestionable individual patient benefit. The basis for that success was felt to be the rapidity with which the treatment would successfully recanalize the affected intracerebral artery. Appropriately, much of the criticism directed towards the first three negative EVT trials pertained again to the issue of time — namely, that the EVT was not administered quickly enough on average to have been effective. This is another example of the penumbra principle in action. Third, the emergency medicine community rapidly adopted EVT as an effective treatment, a clear contrast to how they had interpreted the tPA trials. Why the difference? We suspect – as some EM doctors have explained to us – that this has to do with the fact that EVT-related procedures lead to the direct visualization of the presence of thrombus pre-treatment (which removes doubt about the diagnosis, and hence about the appropriateness of therapy) and of the absence of thrombus post-treatment, thereby confirming the efficacy of the intervention. This example illustrates how direct (and often personal) experience of a treatment's efficacy, alongside mechanistic reasoning, inform the interpretation of RCT results, exemplifying what we have termed the process of epistemic evaluation. We believe this conclusion bears important implications for the future of EBM.

Section 2 | Implications for EBM

From our descriptive argument, we extract three implications for EBM that build on each other.

Implication 1: Maintaining an objective unbiased view of evidence is not possible (nor perhaps desirable)

Our argument supports and adds to a growing body of literature contesting the possibility (or even desirability) of EBM's goal to maintain an objective view of evidence. This literature – powered by voices such as Upshur [5, 36, 37], Goldenberg [8, 38], and Kelly [39] – is itself building on a now well-established feminist and post-positivist literature in the philosophy of science.

EBM praises objectivity as an epistemic virtue. Objectivity is a scientific virtue that stands for an aperspectival "view from nowhere" [38]. It underscores an emphasis towards certainty, and freedom from bias and prejudice. Even if pure objectivity cannot be reasonably reached, it is perceived to be an ideal worth striving for by EBM theorists and clinicians alike (e.g., see [40]). Yet, the concept of underdetermination, in the tradition of Quine and Duhem, and the role of epistemic values and inductive risk, as best described by Douglas [41, 42], paired with the argument we advance in this paper, can help us understand the problems with holding such an ideal[2].

In the philosophy of science, underdetermination is a key concept stating that the "evidence available to us at a given time may be insufficient to determine what beliefs [or theory] we should hold in response to it" [43]. In other words, the decisions we make are never determined (and never can they be) solely by the evidence. As Douglas [42] puts it: "Although all of the evidence may one day be in and make clear what we should think, as actual epistemic actors, we are not in that position. The evidence does not clearly determine which claims are the right ones, nor does it indicate that we have all the plausible options on the table for consideration, nor even whether our background assumptions are adequate." This gap between theory and evidence, she proceeds to argue, is filled with values. Exemplary science has been shown repeatedly to be value-laden in important ways [44, 45, 46, 47, 48]. Specifically to EBM, critics have hammered this point continuously, but Kelly et al. [39] is probably the most comprehensive critic showing how every aspect in the production of EBM evidence is influenced by social and ethical values.

Descriptively, RCT evidence underdetermines decision-making in clinical practice [36]. In this paper, we argued that such underdetermination points to the importance of other forms of knowledge in applying evidence to practice – mechanistic knowledge and specialty-specific cultural knowledge such as diagnostic skills. For instance, when considering the effectiveness of tPA, emergency doctors caution against the hemorrhagic risk of tPA to deny its use, while neurologists seem to embrace the beneficial effect tPA can bring in restoring patients' cognitive abilities. This difference in prioritization can best be explained in terms of inductive risk [41,37].

[2] For a more in-depth philosophical analysis of these concepts (and more), see [37].

Inductive risk refers to the risk for error that occurs when we infer broader conclusions from limited data, which is omnipresent in medicine and most evident in the case of developing clinical guidelines from EBM evidence. The decision-maker must balance the opposing wrongs of false positives and false negatives. While one could argue that a certain optimal balance could be reached, we suggested in light of our case study that idiosyncratic features of a physician – such as their background knowledge or their diagnostic skills – can pull them in one direction, which may be disease- or patient-specific. No matter how hard EBM attempts to curate and purify the evidence, extraevidential factors and evidence-users' assumptions will necessarily guide the interpretation and use of evidence.

Implication 2: An optimal theory of evidence-based decision-making must recognize and include evidence-users' assumptions.

As pointed out earlier, EBM proponents themselves recognize a deficiency of their framework: "The main challenge for EBM remains how to develop a coherent theory of decision making" [1]. We suggest that one critical step in such a process is the recognition that evidence-users (such as physicians) carry assumptions in their interpretation and application of the evidence. Their assumptions emerge from multiple sources, whether it be mechanistic knowledge, experiential skills, or social values, and nothing guarantees *a priori* that these assumptions can or should be homogenized.

While EBM was developed to rescue clinical medicine from physicians' fallibility and value-ladenness, it fails to recognize – or at least convincingly acknowledge – that the relationship of physicians with the evidence is itself fallible and value-laden [37]. EBM effectively maintains a dichotomy between the "objective value-free" evidence and the "subjective values" of patients and society [4]. While they acknowledge the ubiquity and need for values, they merely encompass them in patients' values and preferences. Therefore, they manage to keep their ideal goal of objectivity, clumped into "the evidence." By building a hierarchy restricted to methodological mitigation of biases in study design, with meta-analyses, reviews, and RCTs at the top, they fail to highlight and convey that values will necessarily distort every other step in the production and interpretation of research.

As a result, our personal experience with colleagues shows us that when considering a clinical question, physicians frequently ask: "What is the evidence?" [49, 50, 51]. They expect a conclusive answer that can epistemically guide them. They fail to recognize the epistemic evaluation they will undeniably have to perform, together with the ineradicable interpretive dimension of such reasoning. EBM popularized the idea that variation in decisions must arise from differences in the quality of knowledge available in the literature or possessed by different individuals. In other words, either more clinical trials are needed because the sufficient evidence does not exist, or it does exist but is not disseminated properly and physicians are unaware of it [52].

Yet, this paper reveals that another line of reasoning seems probable to explain variations in physician decision-making. Values, knowledge, and skills are key determinants of a physician's

decision-making, and any discrepancies in those determinants between physicians might impact their decision-making. As Goldenberg [6] puts it: “The appeal to the authority of evidence that characterizes evidence-based practices does not increase objectivity but rather obscures the subjective elements that inescapably enter all forms of human inquiry”. One should think of background assumptions as playing a constitutive (and not a biasing) role in epistemic evaluation [48]. Maybe that under such a premise, the CAPE guidelines that denied tPA as a useful treatment for acute stroke until 2015 would have not taken so long to recommend altepase treatment. Ultimately, our goal is not to incriminate the variation that exist in physician’s decision-making. But, if physicians’ decision-making does not align, we need a framework to help uncover and map the assumptions and values that might explain such misalignment. An important first step in that direction (and towards a robust account of clinical reasoning) would be to avoid hastily incriminating physicians when they do not follow guidelines or practice EBM and rather examine the reasons why they may not.

Implication 3: “More, better” evidence is not always the optimal path to bridging epistemic conflicts

From our descriptive analysis and the first two implications, we can deduce that EBM’s model and ambition to create “more, better” evidence – best captured in their “hierarchy of evidence” – might not always be the optimal path to bridging epistemic conflicts in clinical medicine.

The design of a study does not confer all its epistemic ground or quality, and patients’ values and preferences do not represent the only source of unavoidable (and perhaps necessary) subjectivity in decision-making. As prime evidence-users, physicians are key epistemic actors. While some discrepancies between physicians may be curable (gaps in diagnostic uncertainty), others have no clear solutions (preferring “effectiveness” over “safety”) and would require considerable discursive space to explore the optimal way forward. Adopting a more open and solid descriptive foundation of decision-making (that exceeds methodological purposes), and particularly of the relationship between evidence and evidence-users, is likely to yield better insights into the practice-changing ambitions of EBM. For instance, acknowledging and identifying differences in the education and socialization of distinct specialities may lead to the possibility of acting on those areas of dis-interpretation.

In parallel, this paper brings a novel argument in support of the relevance of mechanistic evidence in clinical decision-making. The fact that EBM undermines the epistemic validity of mechanistic evidence has been criticized repeatedly in the literature [53, 54, 55]. The EBM+ approach, for instance, is a new model aimed at defending and increasing the use of mechanistic evidence in clinical research [56]. While arguments put forth so far often directly defend the epistemic role of mechanistic evidence in the acquisition of clinical knowledge, our paper brings an “indirect” argument for the epistemic role of mechanistic evidence in the interpretation of existing clinical evidence by evidence-users such as physicians. That being said, it is worth pointing out that mechanistic evidence runs in the same issues with underdetermination and interpretive variability. It is not a complete solution, yet incorporating

other forms of knowledge does provide us with a much more complex and nuanced appreciation of clinical reasoning and clinical judgment.

Conclusion

We do not seek to reject EBM but rather acknowledge a central limitation, in that it does not adequately capture what physicians do when they apply “best evidence” in the course of clinical decision-making. Physicians do not simply follow best evidence, even in the most holistic sense that would integrate patient values and preferences. Why? Because the process by which physicians interact with evidence and decisions is more complex, dependent upon epistemic and ethical evaluations of diagnosis, prognosis, treatments, and evidence for treatments. Results of clinical trials are insufficient to explain treatment decisions. Variation in medical decisions surrounding the same clinical scenario cannot always be traced back to a lack of significant results from clinical trials, or the availability thereof.

Should physicians merely apply “best” evidence? Is the variation often seen desirable in any way? Those are important and not straightforward questions that we raised but did not attempt to answer in this paper. Yet, if proponents of EBM are serious when they assert that “The main challenge for EBM remains how to develop a coherent theory of decision making” [1], then such a theory should recognize that research evidence interacts intimately with a physician’s belief system, characterized by values, background knowledge and experiential skills. EBM perhaps over-emphasizes methodological ways to mitigate biases in research studies. Our descriptive account of acute-stroke decision-making suggests we should shift our focus from producing more evidence to defining the intricate assumptions that characterize physician’s use (or lack thereof) of evidence in order to develop a robust account of clinical judgement.

The benefit of unmasking the assumptions, norms, and values at play in scientific inquiry is that we can now address the important socio-political question of which values ought to enter the scientific arena [6]. By embracing and acknowledging values and exploring them seriously, we anticipate (as others before us) that EBM will achieve a more mature, and socially useful status [39].

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