

## Clinical Forum

### Prologue

# Balancing Certainty and Uncertainty in Clinical Practice

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How certain are you that your clinical decisions and practices are the most optimal ones for your patients? How receptive are you to new ideas or new clinical procedures or techniques? Are you skeptical of anything that is inconsistent or different from the theories and knowledge that underlie your clinical methods? How do you deal with a fellow clinician who is certain that her clinical decisions are more appropriate than yours? The role that certainty and uncertainty play in clinical practice is often overlooked in considering how to provide optimal services for patients.

Dollaghan (2007) identified uncertainty as one of the important preconditions for successful evidence-based practice (EBP). Seeking evidence to prove what one already believes is contrary to the

basic tenets of EBP. If evidence is sought solely to support one's prior beliefs, contradictory evidence will likely be ignored or discounted. Strongly held beliefs often make one more susceptible to confirmation bias, impervious to counterevidence, and more fervent in trying to get other people to share one's belief. Unfortunately, it is not easy to achieve the appropriate balance between certainty and uncertainty because this requires having just the right degree of skepticism and openness. The difficulty achieving this balance has significant implications for clinical practice.

In this article, I consider how practitioners balance the certainty that they can help patients with the uncertainty that makes them continually question their beliefs and assumptions. I argue that the scientific method and evidence-based approaches can provide guidance to practitioners but will not lead to a consensus about best clinical practices. Given the controversial nature of these views, five speech-language pathologists (SLPs) with varying backgrounds have been asked to respond to this article. These commentaries are followed by an epilogue in which I discuss the responses and the changes I have made in my thinking about these issues in the 6 months since writing this article.

### Certainty and Uncertainty in Science

The history of science can be viewed as either a story of failed attempts to achieve the delicate balance between tradition (certainty) and change (uncertainty) or a story of successful challenges to existing scientific orthodoxy. Although the penalties for challenging the scientific orthodoxy are no longer life threatening, challenges are still not taken lightly by members of the scientific community who hold positions of power. Even the most renowned scientists have rejected evidence that did not support their theories. Einstein's rejection of quantum physics is an oft-cited example. One could

**ABSTRACT: Purpose:** In this article, I question how practitioners can balance the certainty and confidence that they can help their patients with the uncertainty that makes them continually question their beliefs and assumptions.

**Method:** I compare the mechanisms of science and models of clinical practice that may help practitioners achieve the right balance between total acceptance of the status quo and an open willingness to explore and accept new ideas.

**Conclusion:** Clinical practice, unlike science, has no independent self-correction mechanism that leads to consensus about best clinical practices. Evidence-based models provide principles and guidelines for clinical practice, but ultimately, clinical decisions may be influenced most by a practitioner's epistemology (belief systems) and propensity for rational thinking.

**KEY WORDS:** clinical practice, EBP, intervention

argue that scientists make mistakes because they are human, but the scientific method that scientists rely on can cause some of the mistakes. In other words, despite what we often read in our research textbooks, the scientific method is fallible. Using the scientific method does not ensure that data will be interpreted the same way by individual scientists.

What differentiates the scientific method from nonempirical methods is its built-in mechanism for self-correction (Shermer, 1997): “Whether mistakes are made honestly or dishonestly, whether a fraud is unknowingly or knowingly perpetrated, in time it will be flushed out of the system through the lack of external verification” (p. 13). Even with this built-in mechanism for self-correction, the scientific method is still subject to problems and fallacies that can be troublesome for even the most careful scientist. Few scientists have been able to strike the right balance between total acceptance of the status quo and an open willingness to explore and accept new ideas (Kuhn, 1977; Shermer, 1997). Some scientists are so certain in their beliefs that they discount and reject all alternative views. For example, some of the most renowned scientists (e.g., Einstein, Chomsky, and Freud) are as well known for their paradigm-shifting scientific insights as for their unyielding certainty in the correctness of their viewpoint. In contrast, other scientists are so uncertain in their beliefs that they are open to every new idea and have difficulty distinguishing the useful ones from the ridiculous ones. As Carl Sagan wrote, “If all ideas have equal validity then you are lost because then, it seems to me, no ideas have any validity at all” (cited in Shermer, 1997, p. 15). Fortunately, scientific progress does not depend on individual scientists achieving this balance. Progress occurs when a sufficient number of individuals in the scientific community (particularly those in positions of power) are willing to replace the old paradigm with a new one.

Darwin is sometimes presented as an example of a scientist who achieved the exquisite balance between certainty and uncertainty (Shermer, 1997; Sulloway, 1991). Sulloway (1991, p. 28), in his review of Darwin’s biography, identified four characteristics of Darwin’s intellect and personality that led to this balance: (a) the ability to challenge authority and develop new ideas while having an “unusual reverence for the opinions of others”; (b) openness and tolerance for negative evidence, such that “his objectors were rarely able to present him with a challenge he had not already confronted or addressed”; (c) the ability “to tap the collective resources of the scientific community and enlist other scientists as fellow collaborators in his own research projects”; and (d) the ability to maintain some modesty and cautiousness that helped prevent an overestimation of the importance of his theories. What Sulloway saw as particularly special about Darwin was his ability to resolve the essential tension between tradition and change within himself. In most cases, it is the scientific community as a whole that resolves this essential tension.

To sum up, in scientific endeavors, uncertainty is part of the scientific process in which new hypotheses are formulated and tested, theories are tweaked or radically changed, and one uncertainty is replaced by another uncertainty. All knowledge is tentative in science; science progresses by creating testable hypotheses that can be falsified. Falsification, negative evidence, and lack of external verification are the mechanisms of scientific progress. Scientists can thus be fallible because the scientific method and the scientific community ensure that empirical evidence will always be more important than one’s beliefs.

## Certainty and Uncertainty in Clinical Practice

Uncertainty, as Dollaghan (2007) reminds us, is one of the preconditions of EBP because seeking evidence to prove what one already knows is contrary to the basic tenets of EBP. The uncertainty that leads practitioners to question their beliefs and assumptions must be balanced by the confidence and certainty that they can help their patients. Achieving the right balance between certainty and uncertainty is not easy. Most practitioners appear to err on the side of certainty, adopting a confident mind-set in clinical practice. Katz (cited in Groopman, 2007), for example, described what he calls the “culture of conformity and orthodoxy” that begins in medical schools. He relates his experience in a class where he was taught that thinning blood with anticoagulants was the treatment of choice for a pulmonary embolism and any other treatment was unprofessional. The professor disparaged the faculty at another equally distinguished medical school who taught its students that the only correct treatment was surgically tying off the inflamed veins. When Katz later met some of the students at this other school, he realized that none of the students at either school were ever told there was considerable disagreement about the best course of action. Katz felt that he was educated for dogmatic certainty rather than the uncertainty that physicians would often experience in their medical practices. Although this is an extreme example of certainty, every profession, including speech-language pathology, has similar examples of educating students to believe that what they are taught is the best course of action.

Education is not the only factor that makes practitioners adopt a confident mind-set. Confidence and certainty are often viewed as positive clinical traits because of the potential benefits they have on clinical outcomes. Confident practitioners often have years of experience treating particular disabilities or illnesses and know that their clinical actions result in positive outcomes. The confidence a patient has in a practitioner may also influence clinical outcomes. Indeed, it is sometimes difficult to disentangle the influence of practitioner effects from the effects of clinical actions. In clinical psychology, for example, there is considerable evidence that the therapist has more of an influence on outcomes than the actual therapy provided (Wampold, Lichtenberg, & Waeher, 2005). The prevalence of placebo effects in medicine is also well known and well documented in the literature (e.g., Groopman, 2007).

Although there are clearly some benefits of certainty and confidence, confident practitioners may be less likely than uncertain practitioners to question their beliefs and assumptions or be open to new ideas. Groopman (2007) and Katz (cited in Groopman, 2007) believe that the denial of uncertainty is a serious problem in medical practice and that physicians have an obligation to let patients know about their uncertainties. The proclivity to substitute certainty for uncertainty is also a very common psychological behavior. It is also one of the more remarkable ones because it is both adaptive and maladaptive (Groopman, 2007). The adaptive aspect is that substituting certainty makes action possible by making matters clearer and more certain than they are. Too much uncertainty can paralyze action. The maladaptive aspect is that all alternative diagnoses and treatments are discounted or are viewed as poor clinical practice.

Given the influence that confidence and certainty have on clinical outcomes, it is understandable why practitioners might hesitate to share their uncertainty with patients. They are concerned that

the admission of uncertainty might undermine their patients' confidence in them, resulting in a poor clinical outcome. Groopman (2007) does not think this would happen. Instead, he argues that admitting uncertainty can actually enhance treatment effectiveness because it shows honesty, a willingness to be more engaged with patients, and a commitment to the reality of the situation rather than having to resort to evasion, half-truths, or lies. Admitting uncertainty also makes it easier to try another course of treatment if the first one fails.

I cannot imagine a practitioner whose level of certainty will preclude an openness to new ideas and treatment innovations. All practitioners question some of their beliefs and assumptions, but how do they choose which beliefs and assumptions to question? As noted earlier, one cannot be open to every new idea. One has to be certain about some ideas and clinical practices. Does clinical practice have a built-in self-correction mechanism to flush out mistakes and help practitioners balance certainty and uncertainty? I do not think it does.

## Why Clinical Practice Is Not Scientific

In our profession, the terms *clinical scientist* and *scientific clinician* have been used to describe clinicians who use some aspects of the scientific method (Apel, 1999; Kamhi, 1984, 1999). Yet, in many ways, the scientific method, with its emphasis on theoretical coherence, replicability, unbiased measurements, and logic, is diametrically opposed to flexible, dynamic, spontaneous, reactive, and creative clinical practice. The dynamic and fluid nature of clinical practice makes it very difficult to maintain the experimental controls necessary to do science. Science can never be spontaneous. Scientists are not only constrained by the data they obtain; they are also constrained by the theories they test. Practitioners, in contrast, have the option of being theoretically agnostic because clinical outcomes are almost always more important than theoretical coherence.

Even if all of the conditions of the scientific method could be met in clinical practice, the aspect of the scientific process that leads to self-correction would still be missing. It is not sufficient for scientists to conduct theoretically and methodologically sound empirical research. The scientific process also involves a rigorous peer review process and independent verification of findings through subsequent studies by other members of the scientific community. The scientific community plays a crucial role in determining which challenges to the scientific orthodoxy survive to become the new orthodoxy. This external self-correction mechanism in science does not operate at the level of the individual scientist. The checks and balances that ensure scientific progress are imposed by the scientific community. Clinicians may use the scientific method to evaluate clinical actions, but the aspect of science that ensures self-correction will be missing. Because dissemination and external verification are not requirements for clinical practice, few practitioners will be exposed to the evaluation process and critical discourse that scientists experience when they disseminate their work to the scientific community.

The self-correction process in science depends on this evaluation process and critical discourse. As Pinker (2007) notes, "At a scientific conference, when a student points out a flaw in a presenter's experiment, it won't do to shut her up because the presenter is older and deserving of respect, or because he worked very hard on the

experiment and the criticism would hurt his feelings" (pp. 437–438). The rules of social interaction based on authority or communality do not apply at scientific conferences or in the peer review process where critical discourse is not only acceptable but required.

Clinical practice has no similar context for critical discourse. There are, of course, settings like individualized education program meetings or grand rounds where clinicians must defend their clinical decisions, but there is no formal mechanism in clinical practice for independent evaluation and verification of clinical decisions. In many clinical settings, annual evaluations are not even performed by individuals with knowledge of speech-language pathology or audiology. Without a mechanism for independent evaluation, there will be considerable variability in the quantity and quality of critical feedback that clinicians receive and the impact this feedback has on clinical practices.

The benefits of applying scientific principles and methods to clinical practice are not in dispute. My argument is that although clinical practice may include some of the principles and methods of science, it will always fall short of being truly scientific because it has no intrinsic mechanism for independent evaluation and verification. Without such a mechanism, it is often difficult to reach consensus about best clinical practices.

## Functioning Without a Self-Correction Mechanism: Can EBP Help?

The absence of a self-correction mechanism in clinical practice should come as no surprise to most practitioners because they recognize that it is their clinical decisions and choices that determine patient outcomes. They may attribute clinical outcomes to a particular clinical action, but they know that they are ultimately responsible for these actions. Although most clinical actions will benefit patients, practitioners can potentially make mistakes that may cause undue harm to patients. This is why every practitioner needs malpractice insurance. Practitioners are held accountable by law for the clinical choices they make; patients cannot sue a clinical procedure for not working or for causing harm. Clinical mistakes are thus very different from scientific mistakes. Mistakes in science are often viewed as beneficial and necessary for scientific progress, whereas mistakes in clinical practice are to be avoided whenever possible. When mistakes inevitably occur in clinical practice, they often have a significant influence on subsequent clinical actions. Studies of medical decision making have found that "the last bad experience" had the most influence on clinical choices (Potchen, 2006). Bad clinical experiences are thus not only associated with less than optimum clinical outcomes, but they also may cause lingering negative emotions of remorse, anxiety, and self-doubt.

Concern for patient well-being and the desire to avoid the negative emotions that result from poor clinical choices may cause practitioners to be cautious and skeptical about trying out innovative approaches. This caution and skepticism is offset and ultimately balanced, however, by the desire to provide the most effective and efficient treatment possible. Providing the most efficient treatment possible requires an openness to new ideas and the latest treatment efficacy research. These two complementary attitudes may help practitioners achieve the balance between certainty and uncertainty that eludes many scientists. These attitudes may also make practitioners more receptive to using the principles of EBP and other approaches to improve clinical decision making.

Many scientists and practitioners believe that the process of EBP has the potential to optimize clinical practices. The process of EBP is one in which practitioners gather and integrate information from a variety of sources (e.g., research, patient preferences, prior experience) to make decisions (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). This process allows practitioners to evaluate different approaches, avoid fads and biases, generate knowledge, and provide empirical justification for clinical decisions and services to patients. It also requires practitioners to review patients' progress and their own performance in an unbiased fashion, update their knowledge on a regular basis, and question their subjective beliefs and assumptions (Dollaghan, 2007, p. 8).

Unfortunately, as Justice (2008) has pointed out, there is a second definition of EBP that is more commonly used in clinical practice. In this definition, EBP is viewed as the static implementation of a scientifically proven intervention rather than an individualized clinical process. The definition of EBP provided by Wikipedia is consistent with this static view. According to Wikipedia, EBP is the "preferential use of mental and behavioral health interventions for which systematic empirical evidence has provided evidence of statistically significant effectiveness as treatments for specific problems ("Evidence-based practice," n.d.).

The process of EBP can surely help practitioners improve their clinical decisions, but exactly how the process should be implemented is not straightforward. It is unclear, for example, how clinical experience and patient values should be integrated with research-based evidence. The hierarchy of evidence in traditional EBP models clearly identifies research-based evidence as the best evidence to guide clinical decisions (Sackett et al., 1996). Giving lower forms of evidence equal status to research-based evidence would thus violate this primary axiom of EBP (Tonelli, 2006). If clinical experience is allowed to trump research-based evidence, what would prevent practitioners from ignoring the empirical evidence because it does not support their clinical experiences?

Another problem with EBP is the prominence given to large-scale, high-quality randomized controlled trials (RCTs). In addition to the dearth of RCTs in many clinical areas, the knowledge gained from large-scale population studies may not apply to the treatment of individual patients (Feinstein & Horwitz, 1997; Horwitz, 1996). EBP also diminishes the importance of theory in making clinical decisions (Cohen, Stravri, & Hersh, 2004, cited in Bernstein-Ratner, 2006). The difficulty integrating different empirical and nonempirical sources of evidence has led to alternative models of clinical decision making that give equal value to different forms of evidence and knowledge.

### **Alternatives to EBP: Practice-Based Evidence and a Case-Based Approach**

It has been common in recent years to refer to evidence from clinical experience as practice-based evidence (PBE; e.g., Horn & Gassaway, 2007). Many clinical disciplines have the challenge of integrating what the science says is effective and what practitioners are already doing. For example, in the last few years, states like Oregon have tried to reduce the costs of substance-abuse treatment programs by requiring that the programs be evidence based (Carey, 2008). These state mandates have caused a culture clash, however, between the academic researchers and state officials who embrace evidence-based treatments and veteran counselors working in the clinics. The challenge has been to build a bridge between

what the science says is effective and what counselors are already doing.

A promising way to build this bridge has been to combine EBP with PBE. PBE can range from unsystematic observational evidence obtained by practitioners about the effectiveness of their treatments to systematic research that evaluates in-depth, comprehensive information about patient characteristics, processes of care, and outcomes (Horn & Gassaway, 2007). Horn and Gassaway (2007) found that PBE studies were able to identify medications and interventions that led to better outcomes for specific types of patients in real-world practice. Importantly, PBE studies are not meant to replace RCTs; they provide another source of information to improve clinical practice (Horn & Gassaway, 2007).

Combining the principles of EBP with PBE should be appealing to many practitioners. The framework emphasizes the importance of high-quality treatment evidence while also recognizing the value of evidence derived from personal experience with patients, their families, and real-world practice. Dollaghan's (2007) E<sup>3</sup>BP model, which views EBP as requiring three kinds of evidence, is consistent with this framework. There is still some question, however, about how much weight clinicians should assign to high-quality empirical evidence versus practice-based, experiential evidence. Tonelli (2006) suggested that the relative weight assigned to these different sources of evidence should be based on the particular patient being treated. He proposed a case-based approach as an alternative to the traditional model of EBP.

Tonelli's (2006) case-based approach places equal value on five distinct topics: (a) empirical evidence, (b) experiential evidence, (c) pathophysiologic rationale (i.e., theories of physiology, disease, and healing), (d) patient goals, and (e) system features. No topic or form of evidence/knowledge has priority over any other; the relative importance of a topic depends on the circumstances of the particular case. An attractive aspect of a case-based approach is that it attempts to combine the strengths of EBP and PBE while addressing the limitations of these approaches. As mentioned previously, a major limitation of EBP is the prominence given to large-scale RCTs, whereas a major limitation of PBE is that it is prone to confirmation bias that may lead to erroneous conclusions about causality and treatment effectiveness (Elstein & Schwarz, 2002).

The first step in a case-based approach is to determine whether one's patient resembles the "average" patient in the high-quality clinical research. If the answer is yes, then the findings from the study can be used to plan the patient's intervention. If the patient differs from the average study participant, however, then the clinician must decide whether the findings from the study are relevant to the patient. Once this decision is made, the practitioner compares the patient's condition with real cases from his or her personal experience. Understanding biologic, cognitive, and environmental aspects of disease and disorders allows practitioners to relate presenting behaviors to a diagnosis and prognosis. The remaining topics to be considered are patient goals, values, and preferences as well as system features, which include the policies and practices of employment facilities as well as the economic, logistic, legal, and cultural barriers and facilitators of service delivery (see also, Gottfred, 2008).

A case-based approach recognizes that clinical decision making is a personal and thoughtful process that may lead practitioners to reach different conclusions for similar cases (Tonelli, 2006). Dollaghan's (2007) E<sup>3</sup>BP model embraces many of the same

principles as Tonelli's (2006) case-based approach. In contrast, the traditional models of EBP may limit practice variability by presuming that there is one right course of action—the one supported by the best evidence. Uncertainty in EBP occurs only when the body of empirical evidence is insufficient or equivocal. But uncertainty may also occur because there will always be exceptions to any clinical practice (Gawande, 2007; Tonelli, 2006). By presuming that there is one best course of action, EBP has the potential to create the kind of dogmatic certainty that it was designed to eliminate.

Examples of this dogmatic certainty, and the polarization it can cause, can be found throughout clinical disciplines. Bernstein-Ratner (2005) and Kamhi (2006) recently provided examples of polarization in various areas of speech-language pathology. Polarization is often caused by different theoretical orientations that lead to different goal choices (e.g., fluency vs. cognitive/affective goals, auditory discrimination/sequencing vs. language/communication). Because evidence-based approaches are theoretically agnostic, they cannot resolve controversies over goal selection (Kamhi, 2006). Suppose, for example, a high-quality study was just published showing that a particular fluency modification intervention significantly reduced disfluencies in adolescent and adult persons who stutter. A clinician who views stuttering as a cognitive/affective disorder may find the study interesting but will continue to target affective/cognitive behaviors rather than work directly on fluency.

Importantly, a case-based approach is consistent with the core values of EBP that require clinical reasoning to be rigorous and explicit. Practitioners may arrive at different conclusions based on the weight they give to different topics, but they must be able to justify the weight they give to different topics. By doing so, the reasons for practice variability will be clear, ultimately facilitating progress of a clinical discipline. As noted earlier, newer models of EBP, like Dollaghan's (2007) E<sup>3</sup>BP, acknowledge that varying perspectives of researchers, clinicians, and patients will lead to different weightings of different sources of evidence. As models of EBP continue to evolve, the distinction between EBP and a case-based approach may disappear entirely.

## Some Final Thoughts

I began this article by questioning the role of certainty and uncertainty in clinical practice. How do clinicians achieve the right balance between skepticism and openness to new ideas and treatment approaches? Scientists are fortunate because science has an external, independent self-correction mechanism that eventually flushes mistakes out of the system through the lack of external verification. Importantly, self-correction occurs regardless of whether an individual scientist acknowledges that a mistake has been made. Practitioners, in contrast, function without an external, independent self-correction mechanism. Making clinical practice even more challenging is that clinical mistakes have the potential to harm patients. Clinical practice is also costly, which means that practitioners may have additional pressure to provide the most cost-effective treatment. These basic truisms about clinical practice have led to the search for models to improve clinical decision making and reduce the likelihood of costly and potentially harmful clinical mistakes.

The process of EBP has been championed as the best way to improve clinical practice, but despite its promise, it has proven difficult to implement in clinical practice (Tonelli, 2006). Unlike

traditional models of EBP, a case-based approach and newer models of EBP, like Dollaghan's (2007) E<sup>3</sup>BP, allow for variability and uncertainty. Yet even the most comprehensive evidence-based approaches omit attitudes and skills that are crucial to provide high-quality clinical services. For example, none of the models considers clinician qualities such as interpersonal skills and attitudes (e.g., rapport, compassion, adaptability, enthusiasm) or technical and problem-solving skills.

Interpersonal skills and attitudes were an integral part of clinical expertise models (e.g., Cornett & Chabon, 1988; Kamhi, 1994, 1995) that fell out of favor in recent years because they were not evidence based. It may be time to reconsider these models because they capture the full range of knowledge, attitudes, and skills required to provide high-quality services. Cornett and Chabon (1988), for example, identified three attitudes that are central to providing high-quality services: (a) a *scientific attitude* that represents the theoretical knowledge and scientific database; (b) a *therapeutic attitude* that reflects interpersonal skills, caring, and compassionate behaviors; and (c) a *professional attitude* that encompasses the substantive aspects, occupational values, and economic principles of clinical work. The four-component model of clinical expertise I proposed (Kamhi, 1995) was based on clinician interviews and questionnaires. Cornett and Chabon's scientific attitude corresponded to my knowledge base. Therapeutic attitude was expanded to include interpersonal skills and attitudes such as adaptability, enthusiasm, confidence, interest, and innovativeness. The other two components were self-monitoring and procedural/problem-solving skills involved in assessment, diagnosis, and treatment.

Combining a comprehensive model of clinical expertise with evidence-based models or a case-based approach could provide the best overall framework for clinical practice. When high-quality evidence is available and the patient resembles the average patient in the clinical research, EBP is the model of choice. When high-quality evidence is not available or the case is atypical, a case-based approach may be preferable. For patients with long-term developmental disabilities (e.g., autism, intellectual disability, language impairment, learning disability), adult language disorders, or the dementias, models of clinical expertise may provide the most guidance because they emphasize the importance of interpersonal skills and attitudes. Establishing and maintaining patient and family relationships is crucial for providing optimal clinical services over extended periods of time.

It should be apparent that no model or approach can ensure that practitioners will make the best clinical decisions. Models can provide a framework and principles to help the decision-making process, but ultimately, clinical decisions may be influenced most by a practitioner's epistemology and propensity for critical or rational thinking. The tendencies associated with rational thought are, not coincidentally, the same ones that are required to conduct empirical research and use the process of EBP or a case-based approach. These tendencies, according to Stanovich (2009, pp. 31–32), include (a) collecting information before making up one's mind, (b) seeking various points of view before coming to a conclusion, (c) thinking extensively about a problem before responding, (d) calibrating the degree of strength of one's opinion to the degree of evidence available, (e) thinking about future consequences before acting, (f) explicitly weighing the plusses and minuses of a situation before making a decision, and (g) seeking nuance and avoiding absolutism.

Unfortunately, these tendencies do not develop naturally; irrational thinking pervades all aspects of our lives (Stanovich, 2009).

The most proven way to develop rational thinking dispositions is to engage in science: conducting, disseminating, and critically evaluating empirical research within a scientific community. EBP and a case-based model also have the potential to develop these rational thinking dispositions, but without an independent mechanism for critical discourse and evaluation, they may be less successful than science.

Importantly, rational thinking should not be viewed as a beneficial by-product of learning to conduct empirical research or using the process of EBP or a case-based approach. Rational thinking is the goal. Weighing different sources of evidence and questioning one's beliefs and assumptions is only possible if one thinks rationally. Static implementations of EBP are more likely to promote dogmatic certainty than rational thinking tendencies. So, at long last, we have the answer to the question posed at the beginning of this article: How do practitioners balance the certainty and confidence that they can help their patients with the uncertainty that makes them continually question their beliefs and assumptions? By thinking rationally.

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