A Philosophical Approach to Addressing *Uncertainty* in Medical Education

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Abstract

Conveying the uncertainty inherent in clinical practice has rightly become a focus of medical training. To date, much of the emphasis aims to encourage trainees to acknowledge and accept uncertainty. Intolerance of uncertainty is associated with medical student distress and a tendency in clinicians toward overtreatment. The authors argue that a deeper, philosophical understanding of the nature of uncertainty would allow students and clinicians to move beyond simple acceptance to explicating and mitigating uncertainty in practice.

Uncertainty in clinical medicine can be categorized philosophically as moral, metaphysical, and epistemic uncertainty. Philosophers of medicine—in a way analogous to ethicists a half century ago—can be brought into medical education and medical practice to help students and physicians explore the epistemic and metaphysical roots of clinical uncertainty. Such an approach does not require medical students to master philosophy and should not involve adding new course work to an already-crowded medical curriculum.

Rather, the goal is to provide students with the language and reasoning skills to recognize, evaluate, and mitigate uncertainty as it arises. The authors suggest ways in which philosophical concepts can be introduced in a practical fashion into a variety of currently existing educational formats. Bringing the philosophy of medicine into medical education promises not only to improve the training of physicians but, ultimately, to lead to more mindful clinical practice, to the benefit of physicians and patients alike.

Making decisions under conditions of uncertainty remains a core function of physicians. Teaching students to acknowledge and accept uncertainty, essential for the practice of medicine, should be a goal of both pre- and postgraduate medical education.[1] We suspect that the majority of medical students in North America, having majored in the biologic or physical sciences,[2] where certainty is valued and expected, have not been forced to confront professional uncertainty. Uncertainty and the related concept of ambiguity both represent sources of risk for physicians. *Uncertainty* describes situations where knowledge or understanding is insufficient to allow for confident clinical decision making, whereas *ambiguity* implies that multiple clinical choices appear equally reasonable. In both uncertain and ambiguous cases, the diagnosis, appropriate treatment, and/or outcome are far from clear.

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Intolerance of ambiguity and uncertainty among clinicians is associated with increased resource use and poor communication skills.[3] Medical students' intolerance of uncertainty has also been associated with higher levels of psychological distress.[4] Concern that failing to teach students to better deal with uncertainty might ultimately increase the likelihood of disillusionment and burnout has led to calls for increased attention to ambiguity and uncertainty within the medical school curriculum.[5]

Uncertainty in clinical medicine comes in a variety of forms, affecting all parts of clinical practice, from diagnosis to treatment decisions.[6] Categorized philosophically, clinical uncertainty may be moral (e.g., What is the right thing to do for a dying patient?), metaphysical (e.g., What does it mean to be healthy?), or epistemic (e.g., Do I know enough to have confidence that this medication will do more harm than good for this patient?).

Moral uncertainty characterizes issues such as withdrawal of life-sustaining treatments, organ donation criteria, and allocation of scarce resources. To deal with the rising sense of moral distress that began in the mid-20th century around such issues, clinical medicine turned to philosophers, in the form of ethicists and theologians, to help clarify matters and to alleviate some of this moral uncertainty.[7] An entire academic field, bioethics, developed and remains integrated with medical education. While addressing moral uncertainty, bioethics has been of little help to students and clinicians in dealing with metaphysical and epistemic uncertainty.

Metaphysical uncertainty permeates clinical medicine but is rarely articulated in the course of practice. Is disease defined by statistical aberration, functional status, or patient experience? Can one have a disease and yet still be considered healthy? Does clinical medicine aim to cure, to restore function, or to restore agency? Metaphysical uncertainty is often reflected in debates between various schools of thought in the healing professions. For instance, the underpinnings of naturopathy (which tends to view manifestations of disease as occurrences within an individual) and those of allopathic medicine (where disease is viewed as existing independently of individuals) differ metaphysically.[8] Graduates of North American allopathic medical schools will inherit and accept, often without explicit consideration, a set of metaphysical assumptions regarding health, disease, and the goals of medicine. A better understanding of these assumptions (even simply the recognition that they represent assumptions, not demonstrable truths) would be expected to help

clinicians deal with the uncertainty of new diagnoses and reclassification of diseases; the relationship between research methodologies and theories of disease; and the importance of the patient's conception of illness, disability, and health. Sullivan[9] and Cassell,[10] both physician–philosophers, assert that a new understanding of the nature of health and disease is crucial for clinicians caring for patients in an era of chronic illness and multimorbidity. The benefits of this deeper metaphysical understanding, each argues, would confer upon patients and physicians alike.

We assert that the majority of the uncertainty faced by clinicians on a day-to-day basis is epistemic; that is, the uncertainty is related to a great number of challenges in obtaining, understanding, weighing, and applying knowledge derived from a variety of sources in reaching medical decisions. For example, a physician trying to decide whether a new treatment for diabetes is appropriate for a patient who would have been excluded from the clinical trials of the treatment because of multiple comorbidities faces an epistemic challenge.

Epistemic uncertainty is pervasive and affects all dimensions of clinical decision making: diagnosis, prognosis, and therapeutic choice.[11] The challenge of applying clinical research results to individual patients; dealing with multiple sources of (at times conflicting) information, guidelines, and principles; and determining what level of confidence to have and convey in a medical conclusion are all contemporary sources of epistemic uncertainty in medicine. Decision support tools, particularly those that can take patient preferences into account, may aid clinicians and patients by alleviating some uncertainty in common situations.[12] Tools based on decision analysis, however, require accurate and reliable probability estimates to be effective; such estimates are only available for a limited number of common and well-studied ailments. These kinds of tools are applicable to only a minority of patients. Nor will a better understanding of individual variability solve the problem, as the advent of precision medicine adds to, rather than mitigates, uncertainty.[13,14]

Although the call to train medical professionals how to acknowledge and accept uncertainty is a necessary start,[1] it is unambitious and incomplete. Rather than simple acceptance, the goal should center on aiding future clinicians in understanding the various kinds and sources of uncertainty and in developing strategies to make the best possible decisions regardless. As with moral uncertainty, understanding and dealing effectively with metaphysical and epistemic uncertainty will benefit from the aid and expertise of philosophers of medicine and science.[6]

Introducing the Philosophy of Medicine Into Medical Education

Published calls for and descriptions of formal educational initiatives to address uncertainty have ranged from including questions with multiple correct answers throughout the medical curriculum[1] to using fine art as an educational tool.[15] Clarifying the types of uncertainty that directly impact practice would be useful for students.[16] Such initiatives could be evaluated by more explicit and inclusive teaching and assessment of clinical reasoning.[17] In advocating a more philosophical approach, formal courses or workshops that include the philosophy of medicine have been undertaken, generally as electives for medical students.[18] Spike[19] suggested two mandatory courses in the philosophy of medicine (one metaphysics, the other epistemology) for all medical students, neither of which appears to have ever been implemented.

We do not advocate a required course in the philosophy of medicine for undergraduate medical students. Not only would finding sufficient time in a crowded medical curriculum be a challenge, but preclinical students would not be in a position to most benefit, as they do not yet have any direct experience with uncertainty in practice. As with bioethics, teaching philosophical understanding and approaches to uncertainty should occupy multiple levels of medical education and practice. Being pragmatic, we suggest the formal inclusion of the philosophy of medicine related to uncertainty as part of current curricular initiatives (specific examples below) in most North American medical schools and teaching hospitals.

Bioethics developed as medicine recognized the increasing moral uncertainty inherent in practice and partnered with philosophers and theologians to better deal with that uncertainty.[7] The introduction of bioethics into medical education and practice may serve as a model for incorporating medical epistemology and metaphysics. Borrowing from bioethics, philosophical input in medicine should be targeted to areas where trainees, medical educators, and clinicians already have a sense that a problem exists, but may not be able to name or fully appreciate it. The input should also represent philosophical consensus rather than simply perpetuating debates in the philosophy of science in a medical context. Early on, bioethics was particularly successful in this regard, forging consensus on issues including whole brain death, withholding and withdrawing support, and the importance of patient autonomy even while reasoned debates on these issues continued in academia.

Although consensus may be hard to reach among professional philosophers, currently there are some areas of agreement. General consensus acknowledges, for instance, that findings from population-level studies alone are an inadequate basis for providing individualized care[20] and that definitions of disease are malleable and often value laden.[21] By focusing and building on areas of consensus, students can be provided with a philosophical education that is practical and useful, reinforcing the value of such training. Teaching medical students and clinicians the vocabulary and methodologies necessary for the analysis of epistemic and metaphysical uncertainty will be as important as teaching the moral vocabulary and framework of ethical deliberation. Philosophers will need to partner with interested physician champions, both to understand the challenges in clinical medicine and to help translate the philosophical analyses of these issues to clinicians in a meaningful way. For instance, a prominent philosopher worked with one of us (M.R.T.) to help develop an understanding of and an approach to the compromised individual autonomy of seriously ill patients.[22]

The challenges of incorporating the philosophy of medicine into medical

education are likely to be greater than those faced with ethics, as epistemic and metaphysical challenges are more difficult to recognize and articulate. In addition, ethicists and theologians drew from established ethical frameworks in their foray into medicine, whereas the epistemology and metaphysics of medicine remain a work in progress.

Places to Begin

We recommend the following four specific areas of contemporary medical education as ideal starting places to explore the philosophical underpinnings of medical practice and to introduce well-reasoned approaches for mitigating epistemic uncertainty. Although we are focused on undergraduate medical education here, we caution against the notion that a single, concentrated exposure to the philosophy of medicine will be of persisting value. As with bioethics, the philosophy of medicine should be incorporated into medical education at multiple levels, from undergraduate, through graduate, and into continuing medical education. Still, the importance of the early introduction of the vocabulary, concepts, and methods of analysis of the philosophy of medicine cannot be overstated, as these foundational skills will allow future physicians to continue to use the philosophy of medicine to help them deal with uncertainty in practice.

Epidemiology/evidence-based medicine modules

Evidence-based medicine (EBM) has had a profound impact on medical education, with most medical schools and residency programs augmenting their curricula with the addition of dedicated units on epidemiology and/ or how to use the medical literature. Basic epidemiological understanding is certainly necessary for medical practice, but so too is the understanding of the limitations of population-level research for the generation of medical knowledge and application to individual patients. Epidemiological uncertainty represents a major source of epistemic uncertainty in medicine.[6] Too narrow a focus on population-based research tends to devalue the mechanistic and experiential knowledge that is often required to arrive at the best decision for particular individuals. As clinicians progress

through training, they may face more and more cases where clinical research fails them for any of a variety of reasons. The current focus of medical education on epidemiologic methods and knowledge derived from population-level research tends to devalue knowledge that develops as the result of direct clinical experience and from understanding biologic principles and pathophysiology.

Whereas EBM has provided detailed guidance on the development, acquisition, and appraisal of population-level research, it has not yet adequately described how such research should be integrated with clinical experience and pathophysiologic reasoning. Encouraging epistemic pluralism—that is, the use of multiple kinds of medical knowledge in caring for individual patients—earlier in training will strengthen students' ability to deal with uncertainty as they encounter it in clinical practice. Noting the strengths and weaknesses of a variety of kinds of medical knowledge,[23] and demonstrating that clinical judgment more closely represents an argument than it does the application of an algorithm or deductive reasoning,[24] will position trainees to be able to make explicit their clinical judgments and to understand the reasoning of others.

Undergraduate research training

One of us (R.U.) created a seminar and tutorial for the undergraduate health science research module called Understanding Uncertainty. The seminar builds on Sir William Osler's oft-quoted dictum that "Medicine is a science of uncertainty and the art of probability."[25] The seminar uses a video lecture that explains the relationship between evidence and uncertainty. Using examples from the history of medicine (particularly the discovery of *Helicobacter pylori* as the cause of peptic ulcers), it emphasizes the inherent provisional nature of medical evidence and leads students to the normative requirement to maintain continuous learning. The seminar shows the mutually reinforcing relationship between epistemology (particularly the idea of fallibilism*) and medical ethics. It concludes with Valerie Miké's[26] two imperatives for an ethics of evidence:

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*Fallibilism is an epistemological approach that holds that all of our scientific beliefs are uncertain and subject to revision in light of new developments. See https://www.iep.utm.edu/fallibil.

1. to create, disseminate, and use the best possible scientific evidence as a basis for every phase of medical decision making, and

2. to increase awareness of, and come to terms with, the extent and ultimately irreducible nature of uncertainty.

In the companion tutorial, medical students are each assigned to an epoch in the history of medicine and its treatment of peptic ulcer disease. Students are provided articles from their epoch that explain that epoch's physicians' understanding of the diagnosis, therapy, and prognosis of that disease. Students then explain to the other tutorial groups the concepts of causation, diagnosis, and therapy of peptic ulcer disease from their epoch. Students are encouraged to pay close attention to how uncertainty on key clinical elements was acknowledged or discussed, and to reflect on how these uncertainties were addressed and how new ones emerged as our understanding of the disease evolved.

An additional large-group lecture, nested in the nephrology unit, centers on a case of whether to offer dialysis to an 82-year-old woman with renal failure. Students, placed in buzz groups to discuss certainty and uncertainty, are polled throughout the session regarding how certain they were regarding the decisions made. This case illustrates diagnostic, therapeutic, prognostic, and moral uncertainty and provides guidance on how research and consulting the existing literature and experienced colleagues serve as the best strategies for mitigating, but not eliminating, uncertainty. Thompson and Upshur[27] provide further examples of how uncertainty plays a role in even the most simple of diagnostic tasks, such as management of a viral upper respiratory infection in an otherwise healthy child.

Introduction to clinical medicine

Approaches to uncertainty can usefully be taught in the introduction to clinical medicine course, and the concepts reinforced through bedside teaching. Metaphysical uncertainty, in particular, rises to the fore once students begin to lay hands on patients. Initial encounters with persons who are ill naturally engender questions about the nature of illness and the meaning of disease. Experiencing

patients for the first time encourages an empathetic examination of the experience of patients.

Explicit discussions of the bases of clinical decision making are not always emphasized in medical education, but the prominent role of intuition and heuristics in clinical practice should be made clear to students early on to facilitate their eventual development into experts.[28] Acknowledging the importance and ubiquity of heuristics and intuition also allows for explicit discussion of potential biases that may inappropriately enter into such clinical assessments.[29] The presence of such biases does not undermine the value of heuristics and intuition, but understanding and checking for bias allows clinicians to use these approaches more wisely and confidently. A taxonomy of the various types of uncertainty encountered in routine clinical care and a useful vocabulary for analyzing and addressing uncertainty would also help build familiarity and competence.[6] Students will be better poised to manage uncertainty once they identify the domain in which the uncertainty arises.[16]

Professionalism

Many medical schools and postgraduate training programs have taken a more active approach to developing professionalism in trainees, although the best model for doing so remains in question.[30] Embracing and understanding the full extent of uncertainty is critical to the understanding of the practice of medicine; thus, clinicians' professionalism includes acknowledging the limits of medical knowledge and the probabilistic nature of all medical decisions. Initiatives to instill professional behavior in medical trainees would do well to point out the perils of false certainty that often accompany overly authoritative or paternalistic practice. Some may argue that too much emphasis on uncertainty will undermine the confidence of the patient and society in the credibility of physicians or may also invite more oversight from regulatory authorities and malpractice claims. Our view is that there are greater hazards to ignoring uncertainty and acting on false confidence and self-certainty. Acknowledging uncertainty underscores the fallibility of physicians and of the knowledge that they must, of necessity, rely on. Marcum[31] has

argued for the importance of an "epistemically virtuous" clinician. The important intellectual virtues of such a physician include curiosity, courage, and honesty as well as intellectual humility. Uncertainty necessitates the cultivation of these virtues in medical education; understanding uncertainty may facilitate professionalism.

The Importance of Bringing the Philosophy of Medicine Into Medical Education

A half century ago, medical education invited, facilitated, and benefited from the influx and input of philosophers and theologians to help address and ameliorate moral uncertainty in clinical practice. The ongoing challenges of epistemic and metaphysical uncertainty in clinical medicine will not be solved by more clinical research. Medical education would best serve future physicians by not only imploring them to accept uncertainty as part of clinical medicine but also providing them insight into the nature of uncertainty and concrete approaches to dealing with the epistemic challenges and metaphysical assumptions that permeate practice. Although it has not yet been demonstrated that teaching students strategies to name and mitigate uncertainty will ultimately improve their tolerance of uncertainty and decrease their risk of distress, we believe that efforts to do so are nonetheless warranted.

Although there has been a tremendous surge of interest and activity in the philosophy of medicine over the last decade or two, the vast majority of this work remains in the philosophical domain. In our experience, philosophers of medicine working independently of physicians tend to focus on questions of less interest to clinicians, slowing development and uptake of the ideas and concepts valuable for practice. Medical educators should consider reaching out to philosophers of science in affiliated departments to foster understanding and collaboration aimed at questions and challenges inherent in clinical practice. Philosophers of medicine would do well to keep medical students and clinicians in mind as they choose what problems to work on and how they communicate their insights. Medical students and clinicians who tolerate uncertainty appear to be less distressed, use fewer resources, and

be better at communicating uncertainty with patients. Bringing the philosophy of medicine into medical education promises not only to improve the training of physicians but, ultimately, to lead to more mindful clinical practice, to the benefit of physicians and patients alike.

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