

Uncertainty about uncertainty tolerance: the elephants in the room

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In this issue of *Medical Education*, Patel et al. present a scoping review of interventions intended to improve uncertainty tolerance (UT) among medical students.¹ The authors found that most interventions demonstrated a positive response to uncertainty in at least one of three domains (cognitive, behavioral, and emotional). This study provides fuel for reflection on the complex and pervasive phenomenon of uncertainty in clinical medicine and the optimal approach to its teaching. Herein, we argue that the medical education community must confront

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several “elephants in the room,” uncomfortable but unavoidable questions or controversies, before achieving an ideal path forward for teaching UT.

First, we must confront whether simulated educational interventions can truly “teach” UT at all. Some evidence suggests that UT represents a trait, rather than a modifiable state.² Rather than attempting to change a student’s UT, efforts might be better devoted to encouraging reflection and self-awareness about one’s UT in order to facilitate appropriate specialty selection. In one study, senior students choosing a clinical specialty had higher tolerance for risk than those who chose surgical specialties.³ Additionally, the notion that medical educators can teach UT implies that a gold standard or benchmark for an ideal UT exists. Although intolerance of uncertainty can lead to negative outcomes such as physician burnout, overtesting, increased cost and potentially harm to patients, it can also drive curiosity, research, and innovation.^{4–8} Accordingly, Reis-Dennis et al. argue that neither tolerance or intolerance of uncertainty is necessarily a good or bad trait, but that both can provide advantages and disadvantages in different scenarios.⁹ Longitudinal curricula should incorporate career counseling, encourage mindfulness of trainee reactions to uncertainty, and help trainees cultivate virtues of courage, diligence, and curiosity that will allow them to avoid the extremes of UT.⁹

Second, improving medical student UT will require a broader reckoning with past and current approaches to medical education that provide students with an oversimplified view of the world. In medical school, high stakes multiple-choice tests may unintentionally emphasize the notion that a single correct answer exists, and any uncertainty emanates from an individual’s

knowledge gap. This offers a stark contrast to the complexities of actual clinical practice. Approaches to assessment that normalize the common gray areas encountered by physicians may in part address this cultural hurdle.¹⁰ Additionally, medical education efforts commonly emphasize evidence-based medicine as a mechanism for approaching uncertainty. This involves utilizing a Bayesian approach to seek additional information and continually adjusting probabilities until a threshold for testing or treatment is met.^{11,12} This approach, while helpful in many scenarios, fails to acknowledge the dramatic influence of contextual factors such as the social determinants of health on real-world decision making.^{13,14} Additionally, reference probabilities do not exist for every condition and every potential new data point, and may not account for the complex interplay of multiple factors.

Additionally, will efforts to modulate physician UT at the student level result in meaningful change if society's UT is not simultaneously modulated to align? Physicians experience an enormous pressure to achieve perfection, both internal and societal. At least one study has identified an inverse and significant correlation between patients' global satisfaction and perception of physician uncertainty.¹⁵ Despite the adage that "to err is human," society does not willingly accept the notion that physicians are imperfect beings operating in an imperfect system in which diagnostic and treatment decisions are not always black and white. Furthermore, the standards are high, and the acceptable miss rates are low to zero, particularly for high stakes diseases. The COVID-19 pandemic serves as a prime case example of how poorly both physicians and society tolerate uncertainty. The pandemic leveled the playing field for all levels of experience given the novel nature of the disease. The dramatic practice variation that resulted from uncertainty over how to optimally prevent, test for, and treat COVID-19 bred

significant mistrust. Changing recommendations about optimal mask use and quarantine duration were not interpreted within the context of evolving data, but as an indicator of incompetence or fuel for conspiracy theories. The impact of such uncertainty on an intolerant public has contributed to vaccine hesitancy and damaged public health efforts. The COVID-19 pandemic has demonstrated that transparency about uncertainty, including that scientific “knowledge” is imperfect and continually changing, is critical in public health communication for engendering long-standing trust, even if it leads to challenges and backlash in the short term.¹⁶

In summary, while the results of the work by Patel et al. demonstrate a promising impact on medical student response to uncertainty as a result of educational interventions, several *elephants in the room* must be addressed moving forward to enact meaningful change in the domain of physician UT. Namely, early and longitudinal efforts by medical schools to promote student self-awareness about UT, incorporate career counseling, and emphasize virtues that avoid extremes of UT are likely to be more effective than interventions intending to simply improve UT. Additionally, efforts to teach UT are likely to fall short without a broader overhaul of both medical education and public health to normalize uncertainty. This includes developing assessment approaches that better reflect the complexity and spectrum of “correct” answers. It also includes radical transparency from public health organizations about the imperfect and continuously evolving nature of scientific knowledge.

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