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The culture of doubt: Do medical students really experience clinical uncertainty when they should?

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ABSTRACT

Uncertainty is a fundamental aspect of medical practice, necessitating incorporation into undergraduate medical training. The integrative model of uncertainty tolerance (UT) developed by Hillen and Han serves as a comprehensive framework for exploring clinical uncertainty. While studies have extensively examined UT dimensions, including sources, responses, and moderators, the factors influencing the perception of uncertainty stimuli remain underexplored. However, students' ability to perceive uncertainty and their approach to uncertain stimuli play a crucial role in enabling them to develop adaptive responses to uncertainty, necessary for their comfort in these situations. Defining uncertainty as a metacognitive state suggests significant variability in its perception among individuals and within an individual over time. Moreover, several studies have demonstrated the substantial influence of various individual and contextual factors on how individuals perceive and respond to uncertainty. In this paper, the authors present multiple hypotheses to address the question of whether students genuinely perceive uncertainty stimuli when they should. The authors argue that students' personal relationship with their knowledge is essential in their ability to identify clinical uncertainty, particularly concerning the limits of medical knowledge. Therefore, they propose that an academic culture fostering doubt, through exposing students to a variety of perspectives, would enhance their ability to identify uncertainty zones in a clinical situation at an early stage. Drawing on Dewey's situational theory, the authors emphasize the importance of better understanding, in a work setting, the influence of contextual and situational characteristics on individual perceptions of uncertainty. In line with this idea, ethnographic studies would offer valuable insights into identifying the relationship between the students, their work environment, and their perception of clinical uncertainty.

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Uncertainty, being inherent in medical practice, is an essential training objective for undergraduate students. Hillen and Han have developed an integrative model of uncertainty tolerance (UT) (Hillen et al. 2017). Considering its comprehensive conceptualization of UT, this model now serves as a reference for studies exploring clinical uncertainty. Drawing on this framework, previous research highlighted how uncertainty perception shapes subsequent responses by individuals (Anderson et al. 2019), thus playing a pivotal role in the construct of UT. While numerous studies have delved into the various dimensions of UT, including sources (Stephens et al. 2022), responses, and moderators, the factors that contribute to perceiving a stimulus as a source of uncertainty remain to be further explored.

According to Han, uncertainty is defined as 'the conscious metacognitive awareness of ignorance—a self-awareness of incomplete knowledge' (Hillen et al. 2017). The strong correlation between metacognition, one's understanding of their own knowledge, and uncertainty

suggests considerable variation in the ability to perceive uncertainty, both among students and within an individual over time. This hypothesis is in line with a growing body of evidence supporting the idea that uncertainty tolerance is a subjective state that evolves through the medical curriculum and the accumulation of professional experience, rather than being a static personality trait.

Besides, prior research has underscored the impact of diverse factors, termed moderators, on uncertainty tolerance. These factors encompass various individual, contextual, or situational characteristics that have the potential to directly shape how individuals appraise and respond to uncertainty. Nevertheless, the documentation regarding the extent to which these factors may interact to influence the initial perception of clinical uncertainty stimuli, especially in the clinical situations encountered by trainees during their placements, remains limited. Making the development of uncertainty tolerance a training objective requires educators to ensure that the learning conditions and work situations provided effectively enable students to perceive a

dimension of uncertainty. Therefore, investigating the determinants of uncertainty perception in students becomes a major research challenge. Framing uncertainty perception as a situated, dynamic, and evolving state prompts the question: do medical students really experience clinical uncertainty when they should? To that extent, we can put forth various working hypotheses to enhance our understanding of the factors that prompt students to identify a stimulus of uncertainty in a work situation.

Students' definition of clinical uncertainty

Our initial hypothesis revolves around the notion that students may lack a precise understanding of what uncertainty entails, or their definition of uncertainty may differ from that of experienced practitioners. However, a significant body of qualitative research contradicts this hypothesis, as medical students have provided rich and nuanced descriptions of uncertainty experience in the past (Stephens et al. 2022). Such results suggest that their understanding of uncertainty aligns closely with that of experienced physicians.

Reducible uncertainty: Identifying the 'knowns unknowns'

A second hypothesis would involve how students identify the dimension of uncertainty within a clinical scenario. On one hand, in line with Han's definition of uncertainty, we could hypothesize that students' difficulties in perceiving uncertainty may result from insufficient content knowledge, leading them to fail to generate the relevant hypotheses and/or to prioritize them inadequately. Such difficulty in identifying the 'known unknowns' within a clinical situation could lead students to inadvertently neglect the ambiguous dimension of the problem they are confronting. By limiting their ability to perceive uncertainty, these challenges for students in identifying the boundaries of their knowledge would thus hinder them from implementing adaptive responses to the uncertain situation, impacting their overall tolerance for uncertainty. Accordingly, if the development of knowledge throughout the curriculum helps reduce the significance of 'reducible' uncertainties associated with a lack of knowledge, it could also play a role in students' ability to consider multiple hypotheses when facing a clinical problem. This, in turn, may enhance their perception of the uncertain dimension of the situation at hand.

Clinical uncertainty: Exposing students to the limitations of medical knowledge

Past research has shown that clinical uncertainty mostly arises from the 'unknown unknowns' embedded in the situation (Stephens et al. 2022). Here, students described the lack of evidence, the indeterminacy of future outcomes, and the inherent complexity in patient care as major sources of uncertainty. Hence, the majority of clinical uncertainty is associated with the limitations in the body of medical knowledge, characterized by Renée Fox as type 2 uncertainty. While some qualitative studies have provided rich descriptions of this ontological uncertainty, the ability of students to identify such uncertainty in real world

settings is still to be determined. Perceiving a dimension of ontological uncertainty, rooted in the very limits of scientific knowledge rather than one's own knowledge, requires students to fully engage in solving the problem. Aligned with the concept of motivation, such engagement necessitates assigning students a high-value task in an authentic environment, all with a level of guidance tailored to the student's autonomy. Lastly, providing students with the opportunity to perceive uncertainty involves exposing them to complex and ill-defined problems. Guiding students towards a patient-centered approach and engaging them in interprofessional reflective processes has the potential to enrich their perception of uncertainty. This exposure would bring forth diverse perspectives on the situation, thereby unveiling the myriad challenges inherent in the issue at hand. Clinical supervision should thus focus not only on ensuring that the proposed learning situations expose students to sufficiently explicit sources of uncertainty but also on ensuring their perception of the uncertain dimensions of the issues at hand.

The 'culture of doubt': The influence of the academic environment on uncertainty perception

The culture of doubt instilled in several academic environments, based on the exposure of students to the incomplete and unstable nature of scientific knowledge, and on evaluation methods that foster reasoning rather than obtaining a black or white answer, is crucial in students' ability to identify sources of uncertainty. Some studies suggest that initiatives aimed at fostering 'epistemic maturity' in students - which could be seen as a source of 'humility' that acknowledges the inherent limitations of scientific and personal knowledge - may foster their ability to handle uncertainty (Patel et al. 2022). Such a stance will facilitate identification of potential sources of uncertainty involved in ill-defined clinical situations.

The situated nature of uncertainty: Deciphering the interrelations between the task, the context, and uncertainty perception

Acknowledging the 'situated' nature of uncertainty involves addressing uncertainty as a state, stemming from the complex and dynamic interactions between the context, the clinical task, and the individual, rather than an objective, independent domain within a specific problem. Previous works suggested that the nature of the task shapes the experience of uncertainty. Cristancho et al. showed that in surgical settings, surgeon's recognition of uncertainty was directly influenced by external factors, including time pressure, or having to deal with multiple tasks concomitantly -such as being on call while operating (Cristancho et al. 2013). They also identified how surgeons used contextual features including patient-related characteristics -such as problematic anatomy, medical history, or social situation- and of information incompleteness, pertaining to ambiguous, unanticipated or conflicting sources of information, as cues to recognize uncertainty. The critical significance of contextual factors in practitioners' recognition of the uncertain nature of a problem aligns with Dewey's perspective, viewing a situation as the result of interactions among

individuals, their environment, and the problem to be solved. Hence, the influence of the situation as a whole depicted by Dewey as an 'environing experienced world,' on uncertainty perception, remains to be elucidated.

These efforts would help better identify the contextual factors contributing to the emergence of uncertainty in real clinical settings, alternately fostering an earlier perception of uncertainty in trainees.

Implications for research

Several studies have investigated professionals' UT through psychometric measures. However, these instruments tend to conceptualize UT more as a personality trait than as a state emerging from a specific problem, neglecting the influence of the situation on uncertainty perception. Furthermore, UT measures do not incorporate identification of uncertainty as a distinct assessment domain, hindering the quantification and measurement of the impact of the perception process on overall tolerance. As a result, we propose that future approaches could delve into students' perception of uncertainty through observational ethnographic studies in real-world settings. Longitudinal studies exploring the development of students' ability to identify uncertainty stimuli in clinical setting throughout curricula could complement such an ethnographic approach. Notably, comparing diverse student cohorts across countries and educational stages in medical education could provide valuable insights into the curricular specificities shaping students' posture in clinical uncertainty.

Conclusion

Preparing future healthcare professionals to navigate clinical uncertainty is now widely acknowledged as a fundamental training goal. Fostering uncertainty tolerance in students entails immersing them in a state of uncertainty. However, the capacity of students to discern uncertain aspects in the situations they encounter remains insufficiently documented. Thus, there is a need to investigate the factors influencing their identification of uncertainty stimuli within clinical situations. Consequently, upcoming ethnographic studies could focus on exploring, within professional contexts, the individual, contextual, and situational elements that contribute to students' perception of uncertainty. Such endeavors are essential for identifying the features of the learning environment that enhance students' uncertainty perception, ultimately aiming to bolster their comfort in complex situations or when confronted with ill-defined problems.

Authors' contributions

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