

STATE OF THE SCIENCE

SELF

# Confidence-competence alignment and the role of self-confidence in medical education: A conceptual review

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## Abstract

**Context:** There have been significant advances in competency-based medical education (CBME) within health professions education. While most of the efforts have focused on competency, less attention has been paid to the role of confidence as a factor in preparing for practice. This paper seeks to address this deficit by exploring the role of confidence and the calibration of confidence with regard to competence.

**Methods:** This paper presents a conceptual review of confidence and the calibration of confidence in different medical education contexts. Building from an initial literature review, the authors engaged in iterative discussions exploring divergent and convergent perspectives, which were then supplemented with targeted literature reviews. Finally, a stakeholder consultation was conducted to situate and validate the provisional findings.

**Results:** A series of axioms were developed to guide perceptions and responses to different states of confidence in health professionals: (a) confidence can shape how we act and is optimised when it closely corresponds to reality; (b) self-confidence is task-specific, but also inextricably influenced by the individual self-conceptualisation, the surrounding system and society; (c) confidence is shaped by many external factors and the context of the situation; (d) confidence must be considered in conjunction with competence and (e) the confidence-competence ratio (CCR) changes over time. It is important to track learners' CCRs and work with them to maintain balance.

**Conclusion:** Confidence is expressed in different ways and is shaped by a variety of modifiers. While CBME primarily focuses on competency, proportional confidence is an integral component in ensuring safe and professional practice. As such, it is important to consider both confidence and competence, as well as their relationship in CBME. The CCR can serve as a key construct in developing mindful and capable health professionals. Future research should evaluate strategies for assessing CCR, identify best practices for teaching confidence and guiding self-calibration of CCR and explore the role of CCR in continuing professional development for individuals and teams.

## 1 | INTRODUCTION

Doubt can motivate you, so don't be afraid of it.  
Confidence and doubt are at two ends of the scale,  
and you need both. They balance each other out.

–Barbra Streisand

There has been an increasing emphasis on competency-based medical education (CBME) in health professions education (HPE) in the last decade.<sup>1,2</sup> This reflects a shift of attention from time-based teaching and assessment to observable competence. Approaches to competence that are solely based on observed actions may miss aberrant perceptions and attributions,<sup>1</sup> which will only become apparent if a learner is sufficiently confident to disclose or act on them.<sup>3</sup> Simply put, focusing solely on competence neglects the important dimension of confidence.

Confidence can mean many things, but a common definition is 'the mental attitude of trusting in or relying on a person or thing; feeling sure or certain of a fact or issue'.<sup>4</sup> Confidence can change behaviours and perceptions.<sup>5</sup> Unfortunately, individual self-assessment of skills is poor,<sup>6</sup> which reflects a common mismatch between confidence and competence. Although self-regulation has been proposed as a way of improving performance, it is still contingent on a robust understanding of one's confidence and skills.<sup>7</sup> When confidence and competence are out of sync, problems arise. For instance, a physician who is underconfident may still hesitate to make decisions when needed, whereas an overconfident physician may be reckless or blind to the consequences of their actions; either situation could lead to patient harm.<sup>8,9</sup> Similarly, underconfidence may lead to spending excessive time on information already known, while overconfidence may lead to missed learning opportunities and decreased receptivity to feedback. Safe clinical practice requires an appropriate level of confidence based on the level of training, experience and clinical complexity.

Confidence is influenced by many factors including stress,<sup>10</sup> uncertainty,<sup>11,12</sup> emotion,<sup>13</sup> cognitive load<sup>14</sup> and group dynamics.<sup>15</sup> Although these individual dimensions have received some attention, few have specifically looked at confidence as a multidimensional construct and how it relates to performance.

In this "state of the science" paper, we will revisit these above concepts to reconsider confidence within the context of competence as it relates to medical education. We will examine how learners and teachers might consider confidence when observing performance, how confidence calibration changes over time, and the implications of these considerations for both for practice and future research.

## 2 | METHODS

We undertook a conceptual review<sup>16</sup> to explore confidence and the calibration of confidence against competence not just in medical education but across HPE. We employed an iterative divergent

and convergent approach (exploring differences and similarities in evidence, opinion and theory), drawing on a literature review and a stakeholder consultation to explore our phenomena of interest.<sup>17,18</sup>

This study was deemed exempt by the institutional review board at the Rush University Medical Center.

### 2.1 | The team

The study team was composed of three clinician educators in the field of Emergency Medicine and one PhD scientist, all of whom also identify as researchers within the field of HPE. For the clinicians, one author was in her first few years of clinical practice and two were further along in their academic careers. One educator has participated in her local competence committee and has been immersed in CBME for nearly a decade. Our PhD education scientist is broadly familiar with multiple domains of HPE research and focused on helping the clinician educators maintain their reflexivity and engagement with theory. We built a reflexive component into the study through declaring and unpacking our assumptions and conceptualisations of our core phenomena throughout the process.

### 2.2 | Team discussions

The first step involved a pilot literature review to identify theories from within and beyond HPE to use as sensitising concepts for our theoretical work.<sup>19</sup> Terms identified through iterative group discussion included self-efficacy,<sup>20</sup> self-assessment,<sup>7,21-23</sup> professional identity formation,<sup>24</sup> Schön's concepts of reflection-in-action/reflection-on-action<sup>25</sup> and imposter syndrome.<sup>26</sup> This enabled us to begin scaffolding our initial ideas and subsequent literature reviews. Next, we engaged in a series of interactive discussions that allowed us to alternate between inductive and deductive reasoning using collaborative memo-ing and concept-building. Our goal was to support ideation and theoretical synthesis, as well as question and reframe ideas which lacked clarity. We used screen capture technology to obtain rough visuals sketched out on paper and also software (eg Zoom™ Whiteboards) to generate visual notes. We engaged in nine rounds of these collaborative discussions, each of which was approximately 1-2 hours in length. This was also supplemented by numerous asynchronous discussions via email and shared Google documents.

### 2.3 | Literature review and writing

After creating our initial conceptualisations, we began a more in-depth, targeted literature review. We utilised literature in the field of HPE and adjacent domains/fields (eg psychology, business, non-health professions education) to triangulate and augment the concepts that we described in our problem formulation and our new proposed theoretical frameworks. A full list of the concepts reviewed

for this paper is included in the Appendix S1. Articles were selected based upon group discussion and consensus. We then converted the existing outlines and frameworks to text and figures. We engaged in iterative revisions through comments, discussion and edits to ensure that the flow and concepts were congruent and reflective of the literature. We created general axioms to summarise the key themes identified.

## 2.4 | Stakeholder consultation

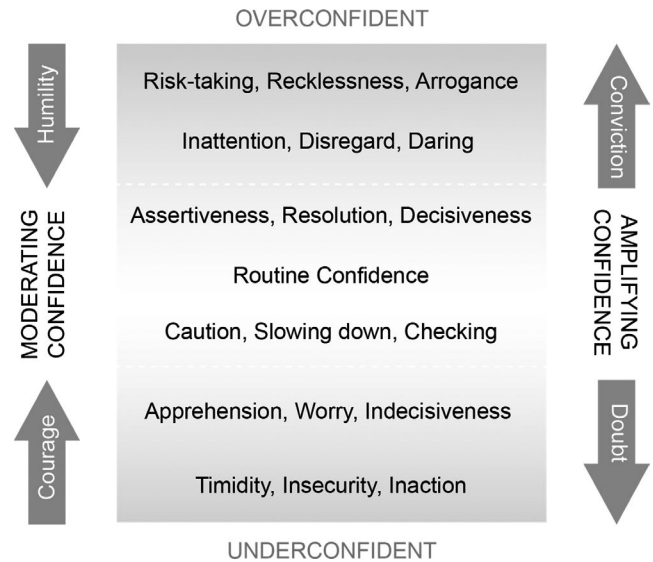
Similar to methods used in scoping reviews, we next sought formative feedback on our provisional findings from experts (eg scientists and scholars in the field of HPE) and frontline individuals (eg clinician educators, fellow physicians, resident physicians and medical students).<sup>27-29</sup> We intentionally selected the stakeholders to include diversity of institution, country, specialty and stage of training. Stakeholders were contacted and provided a draft of the manuscript. Eight individuals provided their reflections on our provisional findings via extensive written comments and optional video consultation. Based on these comments, which focused primarily on clarifications and intersections with other research, we discussed the implications and rewrote sections to incorporate their feedback. One example of the stakeholder feedback was to expand the discussion of distributed confidence with a tangible example.

## 3 | RESULTS

First, we consider confidence as a phenomenon, including self-confidence and relational confidence. Then, we consider how confidence is and can be calibrated with a particular focus on the confidence-competence ratio (CCR). We close this section by considering how the CCR can be used in medical education.

### 3.1 | Confidence as a phenomenon

While certainty is an epistemic phenomenon primarily constructed around knowledge, confidence centres on action. Being certain about something can create the confidence to act.<sup>30,31</sup> Over time, if the outcomes of the action reinforce the sense of certainty, then certainty can initiate confidence and sustain it.<sup>32</sup> In the philosophy of science, epistemic confidence reflects both knowledge and the ability to verify that knowledge in different conditions.<sup>33</sup> Epistemic confidence is (or should be) regulated by epistemic humility, a moderating virtue that recognises the limits of knowledge and knowing. Although epistemic confidence should reflect verifiable certainty and reliability, if confidence exceeds verifiability then it can lead to arrogance or recklessness. At other times, confidence may fall below verifiable certainty and lead to timidity or insecurity. Confidence is subjective, emotional and interpretive. It is a gestalt sense about something that may or may not draw on reason or logic.



**FIGURE 1** Confidence can vary in terms of its proportionality to the circumstances and in response to different modifiers

Confidence is dynamic (Figure 1). It can change rapidly in response to different modifiers, some of which can amplify confidence (eg, courage, conviction) while others moderate it (eg, doubt, humility). Moreover, the level of confidence should reflect the dynamics of the specific situation that an individual finds themselves in. Small variances in routine confidence are often warranted (eg, resolution in the face of an emergency or caution in the face of growing uncertainty),<sup>11</sup> whereas significant excesses or absences of confidence should be avoided (eg, timidity in the face of clarity, recklessness in the face of risk).<sup>6,26,34</sup>

*AXIOM: Confidence can shape how we act in our reality and is optimised when it closely corresponds to reality.*

### 3.2 | Self-confidence

We all express levels of confidence; in other people, in our educational and health systems and in our broader technical and societal systems. However, confidence in the educational literature has more often been framed in terms of self-efficacy, 'the belief that one can successfully execute a specific activity'.<sup>35</sup> While self-efficacy is often task-specific (ie one can be adept at one thing and inept at another), an accumulation of positive or negative confidences can shape an individual's overall sense of competence. It can also shape their motivation, emotional reactions, thinking and behaviours.<sup>5</sup> While Bandura and others have used the term 'self-efficacy', we found that it was effectively synonymous with self-confidence, and we used the latter term for the sake of consistency. The degree to which self-confidence matters depends upon how much responsibility an individual is afforded to carry out a given task without supervision; the more options available to us, the more our self-confidence matters.<sup>5</sup> Contexts that are more individualistic and tolerant of ambiguity may require more self-confidence than those that are more rule-based or

hierarchical. Self-confidence is therefore about directing actions as well as the ability to complete these actions successfully.

Self-confidence is also shaped by an individual's character, experiences, expectations and social and cultural conditioning. An individual's prior experiences and baseline confidence can inform their future confidence, such that confidence can build upon itself in a positive or negative manner. For instance someone who has been enculturated to lead or believe in themselves is likely to have more self-confidence than someone who has not. Individuals of lower social standing (however constructed) may be conditioned or expected to have less confidence, particularly around and compared to those of higher social status (eg teachers vs learners, experts vs non-experts).<sup>36</sup> This phenomenon may be further exacerbated by social inequity around gender, sexuality, race, ethnicity, (dis)ability and socio-economic status. For example asymmetries of confidence between genders have been described even in light of equivalent abilities.<sup>37</sup> In this capacity, internalised self-confidence can be impacted by biases, stereotypes, roles, division of labour and rewards; those in more dominant groups are often afforded greater self-confidence than those in less dominant groups.

*AXIOM: Self-confidence is task-specific but also inextricably influenced by the individual self-conceptualisation, the surrounding system and society.*

### 3.3 | Relational confidence

Confidence can reflect the relational dynamics between individuals working together, as well as the system in which the learner is situated. In a team-based setting, confidence can be shared across multiple team members, allowing team members to compensate for differences in individual confidence levels or alter the baseline confidence among other team members. As an example, a more junior attending physician may experience increased confidence if they are working alongside a more experienced nurse. Similarly, a learner may experience more diminished confidence if their supervising physician is not supportive. A person's confidence in those around them may also be influenced by the confidence these individuals project. We should therefore consider 'projected confidence', which may not reflect an individual's internal confidence, and 'distributed confidence' that reflects how confidence changes as a product of the group dynamic.<sup>5,31</sup>

Medical leaders (eg attending physicians, teachers) are typically expected to project confidence which naturally convinces others to follow them, while subordinates may downplay their actual confidence to protect themselves from criticism.<sup>38,39</sup> This can be compounded by the high-stakes view of the current CBME environment taken by some trainees, reflected in a perceived emphasis on performance over learning.<sup>38,40</sup> In this capacity, learners must have sufficient confidence to develop appropriate levels and forms of autonomy, while avoiding overconfidence that may interfere with their ability to learn and receive feedback. Indeed, learners who



**FIGURE 2** Five components that can contribute to the refinement of confidence. Identity and beliefs can include professional identity and sociocultural identity, as well as imposter syndrome. When one's professional identity or sociocultural identity are supportive and in alignment with one's current position, this can enhance confidence, whereas a discordant identity or feelings of impostor syndrome can detract from confidence. Past experience and prior track record can influence confidence by elevating confidence in the case of prior positive experiences, while lowering confidence when there are limited or negative prior experiences. Evidence and precedent can increase confidence when they provide evidentiary support for a given situation. Expertise and authority can also enhance confidence when strengthened, though may worsen confidence when undermined. The distributed confidence of the group can further increase or decrease confidence depending upon the confidence of the other group members

exhibit excessive confidence to mask a lack of self-confidence may be further limiting their learning opportunities as well as risking dyscompetence.<sup>41</sup>

Finally, the relational nature of confidence is reflected in the many contextual and contingent factors that can shape it. For example, if the learner is in a maladaptive system with a strict hierarchy and limited support, their confidence may be lower than if they were in a more supportive learning environment. Figure 2 highlights some of the key internal and external components contributing to confidence based upon our iterative analyses. When there is greater uncertainty, confidence will tend to be lower than in routine or simple situations.<sup>11,12</sup> As stated before, the contextual factors such as culture and environment inevitably permeate all situations, and thus have not been included in Figure 2. Confidence is also influenced by reflecting-on-action and reflecting-in-action,<sup>42</sup> moderating when one might proceed with ease or should slow down.<sup>7,43</sup> In the worst-case scenario, it can reflect sociopathy if confidence becomes fully dissociated from reality.

*AXIOM: Confidence is shaped by many external factors and the context of the situation.*

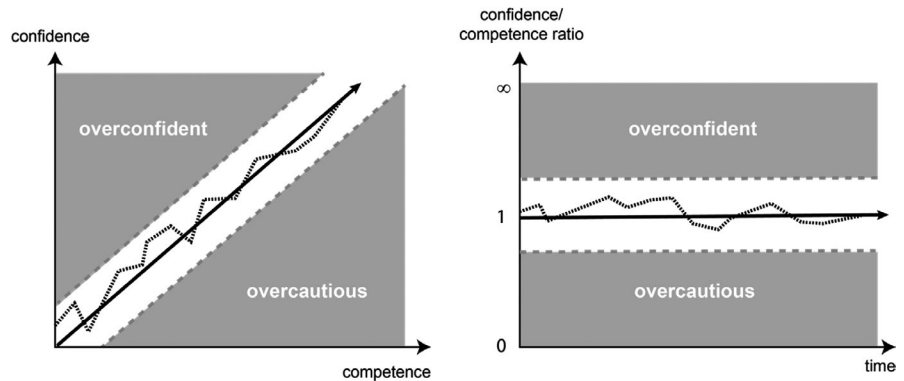
### 3.4 | Calibrating confidence

We have argued that confidence should reflect the circumstances on hand; an individual's confidence should change as their situation changes. We have also suggested that certainty is a precursor for, but not a direct analogue for confidence. Generally, with greater

certainty, confidence should increase. However, confidence may be modified by a wide range of external factors including emotion, hierarchy and experience.<sup>44,45</sup> The ability of an individual to perceive and interpret the situations they find themselves in is directly linked to their ability to act on these perceptions and interpretations. If any stage of this is interrupted, then the feedback loop can be disrupted.

Levels of confidence can be measured using different psychometric instruments.<sup>46-48</sup> While there are a number of validated tools for assessing confidence, they are often limited to specific applications (eg musculoskeletal examination, student learning skills).<sup>47,48</sup>

**FIGURE 3** Mapping confidence and competence as a ratio helps to identify an ideal zone (left); as a learner's competence in a given area increases, so should their confidence. However, given that competence does not increase linearly or indefinitely (ie learning curves are asymptotic), it is more appropriate to track the confidence/competence ratio over time (right)



**TABLE 1** Example vignettes of different trainee confidence-competence ratios

Vignette Example	
Reckless	A resident sees an elderly woman with hypertension, diabetes mellitus and two prior coronary artery stents who presents to the emergency department with concerning chest pain. She performs an ECG which is normal and wants to send the patient home without any further testing or evaluation. She comments that the chest pain can't be cardiac because the ECG was normal.
Inattentive	The trauma resident is seeing a patient who fell off a ladder. He focuses on the obvious knee deformity and neglects to complete a full head-to-toe examination believing that his visual assessment was sufficient. He misses two spinal fractures and a calcaneus fracture in the patient.
Overconfident	A resident presents a case of a patient that they are certain has necrotising fasciitis. She informs you that she has already given antibiotics, consulted plastic surgery, and told the patient they will need surgery prior to reviewing the case with you. You examine the patient and determine that it is typical cellulitis with no concerning features of necrotising fasciitis.
Overcautious	A resident working at a family medicine clinic sees a 23-year-old healthy male who slipped and fell on the ice yesterday. The patient is complaining of left-sided chest pain. His vital signs are normal, and his examination reveals point tenderness to his left lateral chest. The resident states he wants to send them to the emergency department for cardiac investigations as he doesn't want to miss any 'can't miss' diagnoses.
Timid	A resident is assigned to perform the bedside ultrasound examination on a trauma patient coming in at a level one trauma centre. There are many people around the bed during the initial assessment of the patient. The resident waits for space to be made as she is concerned she will get in the way of others. The trauma surgeon gets frustrated and grabs the probe from the resident and makes room to do the scan themselves.
Action Paralysed	A patient is admitted to the medicine service after overdosing on bupropion. The overnight resident is called to the bedside as the patient suddenly begins to seize. The resident is frozen at the foot of the bed and he is unable to lead the team on the next steps in care.

Therefore, it would be necessary to establish proper validity evidence for any new confidence assessment tools used. Importantly, the ramifications of this confidence level require an understanding of what levels of confidence are appropriate to the particular individual and situation. This proportionality and contextualisation is reflected, albeit tangentially, in the entrustment scales often used in CBME (eg had to do, had to talk them through, had to prompt them, needed to be in the room just in case, did not need to be there).<sup>49,50</sup> Regardless of the exact tool, the ability to account for confidence in response to changing circumstances, need and degree of certainty is a necessary part of establishing entrustment. Many of the aforementioned tools rely upon self-assessment of confidence. These are typically measured using Likert scales that can be anchored by terms such as 'not at all confident' and 'very confident'. When assessing confidence, we believe it important to consider both self-confidence and perceived confidence. The latter concept may be considered in light of the former to identify differences in portrayed versus actual confidence and guide alignment when appropriate (eg the perception of overconfidence leading the team to avoid questioning incorrect information). Given that humans are notoriously bad at self-assessment, maintaining appropriate levels of confidence can be challenging if left entirely to the individual to resolve.<sup>21-23,51,52</sup>

Rather than measuring confidence as an independent variable or construct, we can consider it as being linked to (but not as a surrogate for) competence. The interaction of confidence and competence in HPE has long been considered,<sup>53-58</sup> and individuals are viewed to be problematic when confidence and competence are decoupled.<sup>37</sup> While competence and confidence are hard to assess independently,<sup>21,56</sup> they may be more trackable as a ratio. This may be calculated as the ratio of self-confidence (assessed using a Likert scale) to a competence score for a given skill. Alternatively, educators could map confidence anchors to competence anchors, such that they mirror the progression through stages of competency. Ideally, confidence should align with competence, such that the more competent a person is, the more confident they are and vice versa (Figure 3, Table 1). However, it is when the CCR is miscalibrated that problems can arise.<sup>6,26,34</sup>

The CCR is typically articulated such that confidence needs to follow competence, with the former being a behavioural disposition, while the latter is the more critical and essential construct. The argument is that they should be aligned and proportional. When they are aligned, things proceed as expected and confidence recedes as a concern. It is when the CCR drifts towards overconfidence or underconfidence that we seek to re-establish the balance. We, therefore, suggest that confidence is a mediator of competence. A trainee might be technically competent but if they lack confidence then their ability to use that potential competence is compromised, suggesting a general formula such as:

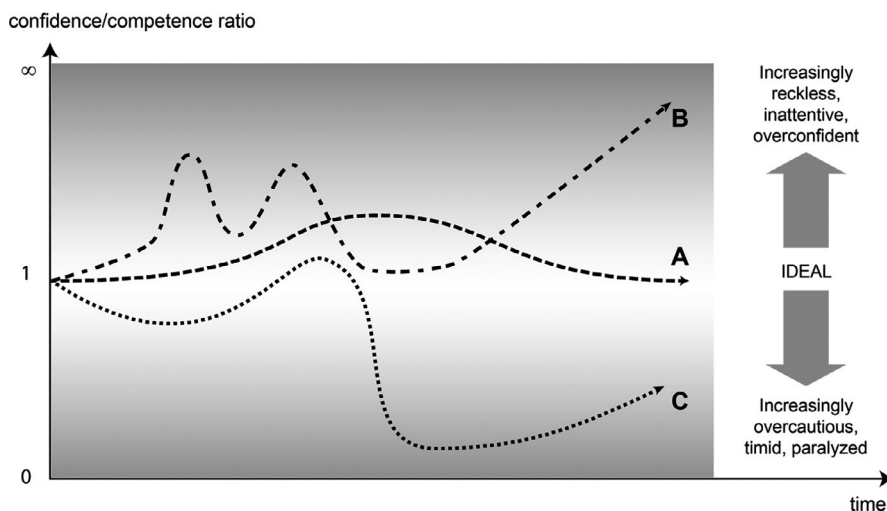
$$\text{Manifest Competence} = \text{Actual Competence} / \text{CCR}$$

For example an overconfident learner (ie high CCR value) may manifest lower competence by over-aggressively pursuing an incorrect diagnostic plan and ignoring potential cognitive biases. Meanwhile, a learner's imposter syndrome (ie a low CCR value) may manifest with holding back on correct answers or second-guessing themselves out of an apt plan. Educators and professionals should therefore be more focused on the CCR construct than on confidence as an independent variable.

*AXIOM: Confidence must be considered in conjunction with competence.*

### 3.5 | CCR and CBME

The CCR is dynamic (Figure 4). The goal is to maintain a balance between overconfidence and underconfidence. The ideal CCR may vary slightly by person and situation. At the individual level, some learners may excel in areas of slight over- or under-confidence, and this may in fact be beneficial for creating a more balanced team. Moreover, some areas such as complex medical cases or rare diagnoses may require a lower CCR, while other scenarios (eg leading a resuscitation of a critical patient, assuming a new leadership position) may need a higher CCR to portray confidence. The current view



**FIGURE 4** Different learners may display different confidence/competence trajectories over time. Learner A is relatively stable and a slight overconfidence is adjusted without mishap. Learner B tends towards significant overconfidence despite several corrective attempts. Learner C is a little underconfident and an adverse event causes a collapse in their confidence that takes a while to be restored

**TABLE 2** Strategies to realign learners' confidence-competence ratios

	Addressing Confidence	Addressing Competence
Overconfident (High CCR)	<ul style="list-style-type: none"> <li>• Identify if the overconfidence is related to a specific scenario or whether trends are present.</li> <li>• Assess the learner's perceived confidence and discuss why this may be inconsistent with the specific instance.</li> <li>• Elicit what prompted the disproportionately higher confidence and review strategies of cognitive bias checking.</li> <li>• Play devil's advocate and present this as a malpractice case, highlighting how this would be presented in the case of a missed diagnosis.</li> <li>• Utilise teamwork simulations and discussions with allied healthcare professionals to identify strategies to balance the level of confidence with the level of competence.</li> </ul>	<ul style="list-style-type: none"> <li>• Explore the trainee's reasoning. What supports their decision making? Was it a lack of knowledge? Professionalism? Burnout? Cognitive overload?</li> <li>• Use evidence-based risk assessment tools to demonstrate objective measurements of management.</li> <li>• Discuss what standards of practice typically are at your institution.</li> <li>• Identify any biases that may drive decisions.</li> </ul>
Underconfident (Low CCR)	<ul style="list-style-type: none"> <li>• Explore the residents preconceived notions and fears. Was there a previous case that is informing their decision?</li> <li>• Assess for evidence of imposter syndrome and address it by reviewing learner strengths.</li> <li>• Assess for evidence of a medical hierarchy issue and work to create a more supportive learning environment.</li> <li>• Empower the learner to take the lead.</li> <li>• Make space for the learner to take the lead (with support) in resuscitation scenarios.</li> <li>• Practice leading resuscitations (or other clinical scenarios) in a simulated environment.</li> </ul>	<ul style="list-style-type: none"> <li>• Explore the evidence or pretest probability of a certain diagnosis.</li> <li>• Discuss appropriate resource allocation.</li> <li>• Utilise allied healthcare professionals to help assist with steps.</li> </ul>

Abbreviation: CCR, confidence-competence ratio.

of clinician competence suggests that there are multiple domains of ability and for each domain there is a corresponding spectrum from novice to master.<sup>59</sup> Thus, confidence must be able to adapt to reflect the degree of competence for each domain. However, as one drifts farther from their ideal CCR, there is a greater need to revert course back towards the centre of their CCR.

We therefore argue that confidence should be tracked alongside competence when assessing learners. These measurements could be gathered as part of the questions during examinations for knowledge assessment, as well as in simulation cases and real-life patient encounters as part of a more comprehensive learner assessment model. This could then be mapped to each entrustable professional activity (EPA) within CBME, ensuring that confidence and competence follow a similar trajectory for each component.

When a deviation in CCR has been identified, efforts should be made to return the individual to a more balanced CCR. While remediation efforts are often focused on improving competence, we propose that confidence should be addressed in remediation as well as in day-to-day teaching. Given that self-confidence is intimately tied to one's sense of agency,<sup>20,30,60</sup> concentrating on knowledge alone will also be insufficient. Rather, working to rebalance their CCR could be more effective in addressing their difficulties. Alternatively, helping overconfident learners identify where their confidence may

be excessive may challenge them to think harder, discard biases and seek out a deeper understanding of a given topic.<sup>61-65</sup>

Both underconfidence and overconfidence may therefore benefit from targeted feedback and coaching efforts,<sup>5,66,67</sup> with a goal of guiding learners to develop their own confidence-competence feedback loops. To that end, helping learners identify their successes and limitations with the support of specific incidences and performance data may be particularly valuable for linking confidence to their degree of competence.<sup>5,26,68-71</sup> Table 2 sets out some strategies that could be employed to help realign learners' CCR.

*AXIOM: CCR is dynamic over time. It is important to measure CCR and work with learners to realign their CCR towards their ideal ratio.*

## 4 | DISCUSSION

In this paper, we have explored how confidence and competence are linked within HPE, specifically within the current context of CBME. By better understanding and contextualising confidence, we can begin to better calibrate it by addressing individual and systemic changes. Moreover, we propose that approaching confidence in the context of competence will allow for a more enhanced and comprehensive evaluation of our learners.

The concept of confidence and the relationship with competence is particularly interesting when viewed in the context of the speech act theory and the concept of performativity.<sup>72,73</sup> For instance, Austin proposed that words could serve to consummate an action.<sup>72</sup> By declaring something, it can actually constitute the action in certain cases (eg choosing to admit or discharge a patient). This concept was expanded upon by Butler to discuss the subsequent power and identity formation associated with this.<sup>73</sup> When viewed in light of this, confidence influences speech, which can subsequently drive action. Therefore, when the CCR is misaligned, there can be a direct impact on action.

This reinforces our argument that confidence and the CCR need to be factored into our approach to CBME. Without adequate attention to CCR calibration, the development of competency will likely be harder to manage. We propose that CCRs should be routinely assessed and tracked within the CBME framework. Simulated cases could be performed with concomitant assessments of confidence and competence, guiding more targeted remediation strategies. Feedback should include a discussion of competency in the context of confidence, as opposed to competency in isolation and CCRs should be incorporated into EPAs and factored into advancement decisions. Moreover, CCR imbalances could be used to identify and predict 'near misses', thereby identifying a teachable moment before a bad outcome occurs. An accurately calibrated CCR could also help a learner best align with their zone of proximal development to maximise their growth.<sup>74</sup>

Further research needs to identify the ideal tools for measuring confidence and whether this varies by situation (eg simulated cases, procedures, real-life scenarios). Studies should further assess CCRs within CBME and whether there are specific CCR thresholds that may impact outcomes for learners, as well as for patients. This could be used to inform what CCR levels should trigger interventions or remediations. The traditional clinical competency committees that play a key role in CBME could be reframed as 'confidence and competency committees', assessing learners' confidence in their skill sets and linking them to entrustment decisions—perhaps as part of CCBME (competency and confidence-based medical education).

Research should also determine what are the most effective approaches for teaching confidence and guiding others to self-calibrate their confidence. This could include personalised coaching and simulation-based strategies. The relationship between confidence and competence also emphasises the importance of ensuring psychological safety among our learners and developing mitigation strategies for those suffering from imposter syndrome and similar unwarranted anxieties.<sup>26</sup>

Additionally, studies should assess how to incorporate this into continuing professional development (CPD) after completion of training. As feedback is often less robust at this time,<sup>75</sup> it presents an ideal arena to identify areas for improvement as part of the continuous pursuit of clinical excellence. Future efforts should determine how best to build and support CPD efforts to calibrate confidence post-training. This could include peer observation or co-management of patients or surgical cases during

resident conference days. Moreover, professional societies should consider incorporating confidence assessment into certification examinations.

Finally, the relational aspects of confidence and competence are an exciting area to explore. The relationships between trainers and trainees will be crucial to more fully examine, as well as the relationship between an individual's self-confidence and external perceptions of their apparent confidence. Understanding distributed confidence and the interaction of shared confidence across organisations and teams could inform the creation of more effective and balanced teams, as well as how teams can be utilised to strengthen confidence calibration across members.

## 5 | LIMITATIONS

This work has several limitations. As a 'state of the science' paper, we have sought to deductively explore and reflect on issues that face this domain of research going forward. This paper is meant to highlight what might be considered empirically and does not seek to supplant or replace the scientific work that must spring forth from this juncture. Additionally, this was not a systematic or a scoping review, as we are not looking to examine a well-defined domain within a field. Indeed, those with the familiarity of these types of reviews would note that in an emerging field it would be either inappropriate or premature to conduct these types of knowledge syntheses. Our review is meant to inspire others to consider the issues we have brought forth and suggest a way forward for further work. We also admit fully that our current concepts overlap with many preceding discourses, theories and areas of inquiry. It was our intention in this case to draw linkages to other prominent bodies of work within the field of HPE and advance the field through our deductive process, adding new ways to combine and revisit ideas that have come before. Finally, while we have tried to be inclusive, our theoretical and conceptual products are co-constructions of the authorship team with feedback from experts within the field. We are, therefore, limited by our own awareness of the literature from within the health professions and beyond.

## 6 | CONCLUSION

Confidence is a construct that can be influenced by a variety of modifiers and circumstances, ranging from the individual to society at large. CBME currently focuses primarily on competency with limited emphasis on confidence. However, confidence is an integral component of competency assessment and we believe it is important to consider them both in conjunction as part of the CCR. As one begins to deviate from the ideal CCR, it is important to recognise this and intervene to guide the learner to avoid approaching either extreme. Future research should evaluate strategies for assessing CCR, best practices for teaching confidence and guiding self-calibration, and the role of CCR in CBME, CPD and among teams.



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## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

## AUTHOR CONTRIBUTIONS

All authors conceptualized the study, designed the study methodology, directly contributed to the drafting of the manuscript, and contributed to its critical revision. All authors approved the final manuscript for submission and have agreed to be accountable for all aspects of the work in ensuring its accuracy and integrity.

## ETHICAL APPROVAL

This study was deemed exempt by the institutional review board at Rush University Medical Center.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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