

"Making better clinical decisions: How doctors can recognise and reduce bias and noise in medical practice": Correspondence

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Dear Editor,

We read with great interest the recent commentary by Ng et al.¹ and commend the authors for their timely and thoughtful synthesis of key concepts in clinical reasoning, especially their articulation of cognitive bias and noise as distinct yet intertwined contributors to decision variability. Their proposals for workplace and pedagogical interventions are both practical and mostly grounded in contemporary literature.

That said, we would like to offer several reflections that could add nuance to the conversation.

First, while the authors rightly point out the role of system 1 intuitive reasoning in everyday clinical work, we feel the article underemphasises the fallibility of system 2 analytic reasoning. Deliberate, effortful cognition is also prone to error, especially in the presence of incomplete knowledge, faulty logic or overreliance on data.² System 2 failures, such as base-rate neglect, confirmation bias under the guise of rationalisation or anchoring during premature analytic framing, have been well-documented.³ Clinical reasoning curricula should therefore treat both systems as fallible, and foster skills that support reasoning depending on context and task demands.

Second, while the article alludes to reasoning processes, we note a relative de-emphasis on knowledge structures. Intuitive reasoning is effective, as it is underpinned by richly developed, context-sensitive knowledge structures.⁴ The growing enthusiasm for teaching reasoning strategies should not eclipse the critical role of continuous knowledge acquisition and epistemic calibration. Studies have shown that experts' superior reasoning derives more from their organised knowledge base than from formal logical skill alone.⁵

Third, we share the authors' interest in cognitive bias, but caution against overstating the utility of debiasing strategies. A growing body of literature highlights that most bias recognition or checklist-based strategies have modest or uncertain real-world

efficacy, and some authors speculate that they may foster overconfidence in one's immunity to error.⁶ Instead, we suggest a stronger focus on metacognitive regulation, which has shown more promise in supporting reflective diagnostic reasoning. Guided reflection and "second-look" reasoning strategies may offer more enduring gains than attempts to target individual biases in isolation.⁷

Finally, the emphasis on Bayesian reasoning as a foundational model is conceptually sound, but it requires careful contextualisation. In clinical practice, accurate prevalence estimates or likelihood ratios are often inaccessible, outdated or simply not established for many presentations. While heuristics such as treatment thresholds are helpful, these are approximations, and Bayesian reasoning in clinical settings is often intuitive rather than formalised. Embedding Bayesian reasoning in practice may require not only teaching principles but also supportive tools (e.g. decision aids, clinical calculators or smartphone apps) to scaffold real-time probability updating.⁸ Furthermore, clinical decisions are made within complex environments, influenced by factors such as electronic health records, institutional protocols and interdisciplinary communication. Understanding these contexts is crucial for developing robust clinical reasoning skills and minimising errors.⁹

In summary, Ng et al. have contributed a timely and grounded piece on improving clinical decisions. However, sustained progress in clinical reasoning education will require an integrated focus on knowledge structures, metacognitive practices and pragmatic supports, not only on bias and noise. As the landscape of clinical decision-making evolves with new cognitive and technological tools, it is crucial that we retain a nuanced view of reasoning—not merely as a process to be refined, but as a complex interplay of knowledge, cognition, context and care.

Ethics statement

Not applicable.

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Authors' reply

We thank Mucheli et al. for their kind interest in our paper on improving real-world clinical decision-making through tackling bias and noise in professional judgments.¹

First, we fully agree with the authors' view that system 2 (slow analytical thinking) has significant shortcomings as well, besides lacking practicality in naturalistic clinical practice environments. However, given that the intent of our commentary was to create awareness among clinicians of the dual entity of "bias" and "noise" that can adversely affect real-world clinical judgments, which we contend are predominantly intuitive, we did not explore this area further. Instead, this was discussed in a separate paper on a Bayesian intuitionist model of clinical reasoning, where the authors argued that intuition could, contrary to popular belief, be superior to analytical judgments in ecologically rational environments, such as complex and uncertain situations, where robust pre-

dictions come about with less redundant information or "overfitting".² This suggestion is corroborated by previous studies, which showed that slow analytical thinking is not necessarily more accurate than rapid intuitive responses.^{3,4} Clinicians who performed well tended to have correct intuitions initially (suggesting good foundational knowledge), rather than possessing an ability to revise initially erroneous answers.^{5,6}

Second, we also concur with the view that the role of bias in cognitive errors might be overstated⁷ (itself subject to hindsight bias⁸), and de-biasing interventions have limitations, given that real-world studies evaluating their efficacy have yielded mixed results.² Nonetheless, cognitive biases certainly exist and are more commonly associated with rapid intuitive judgments. Consequently, we argued that there could be a role for practical, heuristics-based de-biasing approaches, such as pivot-and-cluster strategy or contemplation of counter-diagnostic/red-flag features, which we foresee are more likely to be efficacious and easily habituated in routine practice.^{2,9} As the authors rightly pointed out, there is significant value in training metacognitive regulation and engaging in reflective practice to re-calibrate/refine internal illness scripts based on past clinical experiences for improved accuracy in future encounters. Additionally, based on Fleming's suggested metacognitive model of propositional confidence,¹⁰ regularly practising level of confidence/certainty in clinical decision-making with follow-up of outcome improves self-awareness of one's predictive accuracy.² When decisional confidence is closely linked to the accuracy of clinical judgments, it acts as a healthy safeguard against decisional errors where low confidence situations will prompt information-seeking behaviours.²

Third, we thank the authors for elaborating on how the usage of Bayesian-based heuristics, such as testing and treatment thresholds, can be practicalised through the use of diagnostic adjuncts and decisional aids. The utilisation of pedagogical methods, such as simulation practice (with standardised patients and realistic case scenarios) and script concordance tests, can help trainees to contextualise diagnostic and treatment principles to the individual patient in a specific clinical setting.

Moving forward, it may be worth exploring how we could evolve our understanding of clinical thinking as skilled intuition, and consider how such expertise can be developed and adaptable across real-world clinical contexts and practice environments.

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