

Letter to the Editor

AI Fairness Auditing in Dentistry: Addressing Hidden Bias in Generative Artificial Intelligence



Dear Editor,

Generative artificial intelligence (AI) is increasingly woven into the fabric of modern dentistry, transforming various facets of the profession.^{1,2} Its applications range from supporting dental students in their educational journeys and generating instructional materials to drafting scientific manuscripts, predicting performance metrics, enhancing patient communication, aiding in clinical decision-making and streamlining administrative and practice management tasks.^{3–9} As large language models gain traction in these contexts, there has been a significant focus on evaluating their accuracy, efficiency and ethical implications.^{10,11} However, accuracy alone does not establish whether an AI system is fair. A system may perform well overall while producing systematically different recommendations for patients, learners or professionals from different demographic, linguistic, cultural or socioeconomic backgrounds. This raises an important question for dentistry: *how should the profession systematically evaluate whether AI tools provide equitable outputs across the populations and contexts in which they are used?*

The concept of the hidden curriculum has long been recognised in educational discourse as the set of implicit values, norms and assumptions transmitted outside the formal curriculum.¹² A related concern is emerging with generative AI: beyond the information it provides, AI may implicitly communicate assumptions about what constitutes appropriate clinical reasoning, acceptable treatment modalities, research priorities, scholarly interpretation, effective communication and professional behaviour.¹³ Although generative AI often delivers information with impressive confidence and a veneer of neutrality, its outputs are deeply influenced by the complex patterns derived from vast amounts of human-generated data.¹³ Such data inevitably encapsulate existing cultural norms, historical biases and dominant professional viewpoints. Consequently, AI should not be regarded as a neutral source of professional knowledge. Its outputs warrant critical scrutiny for both evidential accuracy and potential systematic bias.

In dentistry, the impact of these influences can be both subtle and profound. AI-generated responses might unintentionally favour specific treatment philosophies, certain communication styles or predominant oral healthcare frameworks, while inadequately representing alternative methods or culturally diverse perspectives. For students and clinicians, repeated exposure to such outputs could gradually normalise particular approaches, particularly when recommendations are accepted without questioning their underlying assumptions. Generative AI continues to find its place in undergraduate and postgraduate education

and training, ongoing professional development and clinical practice.^{4,14,15} Moreover, cross-disciplinary and interprofessional education is increasingly becoming a pivotal component of dental training curricula, aiming at enhancing holistic care coordination and ensuring patient safety. The incorporation of AI-assisted learning offers significant opportunities for practical, team-oriented experiences within interprofessional education. This encompasses collaborative case-based seminars conducted in conjunction with medicine, nursing and pharmacy programs, joint simulations that utilise AI-driven decision support systems, as well as co-supervised quality improvement initiatives that engage interdisciplinary teams in optimising care delivery.¹⁶ These expanding applications make it increasingly important to ensure that AI does not inadvertently reproduce or amplify inequities while becoming embedded in routine educational and professional practice.

Awareness of these challenges does not necessitate a retreat from AI adoption; rather, it underscores the urgency for responsible implementation that transcends mere technical performance. We therefore propose a Dental AI Fairness Audit: a structured approach to examining whether AI systems produce equitable, consistent and evidence-aligned outputs across clinically or educationally equivalent scenarios. AI fairness refers to AI-generated recommendations free from unjustified bias and supporting equitable care across diverse patient populations.^{17,18} Such an audit could assess whether recommendations remain consistent when equivalent scenarios vary only in relevant characteristics such as patient age, sex, ethnicity, language, cultural background, socioeconomic context, geographic location or educational setting. It could also examine whether the system performs differently when clinical information is presented using different linguistic or contextual formulations.

Consider, for example, an AI system asked to propose an initial management strategy for otherwise clinically equivalent patients who differ only in language or cultural background. If the recommended investigations, treatment options, urgency of referral or communication approach systematically differ without a clinically justifiable reason, this would warrant further investigation. The purpose of the audit would not be to assume that such differences represent bias, but to identify them and determine whether they can be justified by clinical evidence or instead reflect limitations in the data or model.

A second example could arise in dental education. Suppose students use a generative AI tool to obtain feedback on the same clinical case. Educators could submit equivalent cases using different demographic or contextual characteristics and compare the recommendations. They could then ask: Does the AI identify the same diagnostic considerations? Does it recommend comparable treatment options? Does it apply the same

evidential standards? Does its language imply different expectations regarding adherence, health literacy or patient behaviour? Such a process would transform fairness from an abstract ethical principle into an observable component of AI literacy and clinical reasoning.

A Dental AI Fairness Audit should therefore consider at least 4 complementary dimensions: (1) output consistency across equivalent scenarios; (2) representation of diverse patient and professional populations; (3) alignment with contemporary evidence and clinical guidelines; and (4) transparency regarding uncertainty, limitations and the basis for recommendations. Where systematic differences are identified, users should consider whether they arise from legitimate clinical distinctions, incomplete or under-representative training data, model design, prompting effects or other sources of bias.

Importantly, the aim of a Dental AI Fairness Audit is not to assert that an AI system is without bias – an unrealistic expectation, given that all technology is trained on inherently human data. Nor should a single audit be interpreted as proof that an AI system is permanently fair. Instead, the objective is to foster transparency, promote ongoing monitoring and encourage critical reflection among educators, researchers, clinicians, managers and policymakers. Fairness should therefore be understood as a continuing process of evaluation rather than a fixed property that an AI system either possesses or lacks.

Dentistry has a long-standing tradition of rigorously assessing new materials, instruments and clinical technologies before incorporating them into standard practice. AI should be subject to the same culture of scrutiny, but with an additional requirement: its performance must be evaluated not only in terms of whether it is accurate, but also in terms of for whom it is accurate and whether its recommendations remain equitable across different populations and contexts. As generative AI increasingly becomes an influential partner in educational, research, clinical settings and healthcare management, the profession must remain vigilant not only regarding the accuracy of the information provided but also concerning the values, biases and societal and professional norms that such technology quietly endorses.

The hidden curriculum remains relevant because repeated interaction with AI may influence what students and professionals come to regard as normal, appropriate or authoritative. However, this influence should not distract from the more immediate need to identify and evaluate algorithmic inequities. A Dental AI Fairness Audit could provide a practical mechanism for doing so.

By systematically examining AI outputs across diverse and equivalent scenarios, dentistry can move beyond asking whether AI works to asking whether it works fairly. This distinction will be increasingly important as AI becomes embedded in the education, research, clinical practice and governance

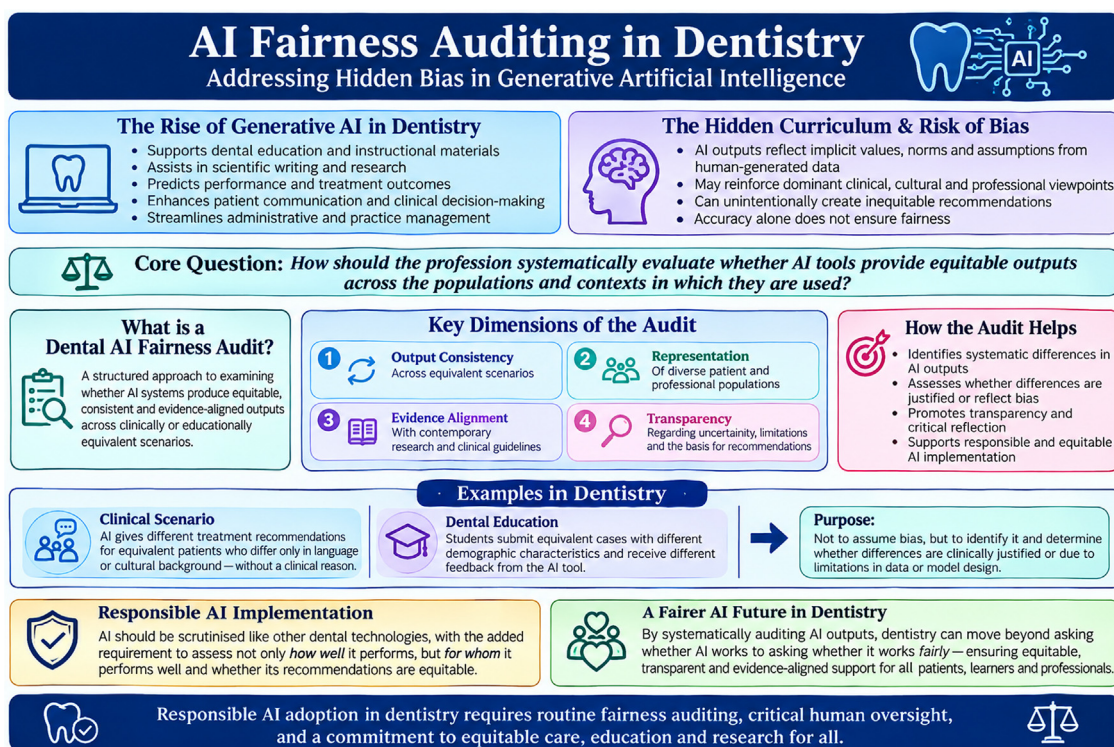


Fig – Conceptual framework for AI fairness auditing in dentistry. The figure illustrates the expanding applications of generative artificial intelligence (AI) in dentistry, the potential for hidden bias arising from human-generated data and embedded professional and cultural assumptions and the proposed Dental AI Fairness Audit. The audit incorporates 4 complementary dimensions: output consistency across equivalent scenarios, representation of diverse populations, alignment with contemporary evidence and clinical guidelines and transparency regarding uncertainty, limitations and the basis for recommendations. Examples from clinical practice and dental education demonstrate how systematic auditing can identify differences in AI outputs and assess whether they are clinically justified or may reflect bias. The framework emphasises that fairness is a continuous process requiring routine evaluation, critical human oversight and responsible implementation.

of dentistry. Responsible AI adoption should therefore be accompanied by routine fairness auditing, critical human oversight and a willingness to question outputs that appear confident but may not be equitable.

The proposed framework is summarised in [Figure](#), which illustrates the key dimensions and potential applications of a Dental AI Fairness Audit.

Declaration of generative AI and AI-assisted technologies in the writing process

During the revision process, an artificial intelligence tool, ChatGPT (OpenAI, GPT-5.5), was used to draft the conceptual figure and its accompanying legend and to assist with language refinement in select paragraphs to enhance clarity and readability. The authors critically reviewed and edited all AI-assisted content and hereby take full responsibility for the accuracy, integrity and originality of the final manuscript.

Author contributions

Methodology: Turkey. *Formal analysis:* Turkey, Dummer. *Investigation:* Turkey. *Resources:* Turkey. *Drafting of the manuscript:* Turkey. *Critical revision of the manuscript for important intellectual content:* Turkey, Dummer. *Supervision:* Dummer.

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Declaration of competing interest

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