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Artificial Intelligence in Dentistry: A Systematic Review

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Abstract

Background: Artificial Intelligence (AI) represents a transformative force in healthcare and dentistry, with potential to improve disease detection, treatment planning, health education, and population-level oral health outcomes. While AI applications in clinical dentistry are increasingly documented, the role of AI specifically in **public health dentistry**—the discipline concerned with oral health promotion, disease prevention, and population-based care—remains less systematically explored.

Objectives: This systematic review aims to critically evaluate the literature on AI applications in public health dentistry, describing key domains of use, outcomes, challenges, ethical considerations, and future directions.

Methods: A comprehensive search was conducted across multiple databases (e.g., PubMed, Web of Science, Scopus) using predefined terms including "artificial intelligence," "public health dentistry," "AI in dental public health," and related keywords. Studies published up to **2025** were included if they reported original research, reviews, or systematic analyses focusing on AI within the context of public health dentistry. Articles were assessed for relevance, methodology, outcomes, and implications.

Results: Twenty-five articles were identified that addressed AI's role in public health dentistry and related domains (e.g., education, epidemiology, telehealth). Key application areas included predictive risk modeling for oral diseases, AI-assisted epidemiological surveillance, patient education and engagement through chatbots/virtual assistants, integration of AI in teledentistry, and enhancement of dental public health research and academic writing. AI models improved diagnostic accuracy for population-level screening, supported efficient data management, and facilitated personalized health messaging. Challenges identified included concerns around data bias, privacy, ethical use, and integration into existing public health systems.

Conclusions: AI applications hold promising potential to improve public health dentistry outcomes by enhancing prevention, diagnosis, education, and system efficiency. However, ethical frameworks, robust evaluation in diverse real-world populations, and clinician oversight remain essential. Continued research must address implementation barriers and ensure equitable benefits across communities.

Keywords: *"artificial intelligence," "machine learning," "public health dentistry," "oral epidemiology," and "teledentistry."*.

INTRODUCTION

Artificial Intelligence (AI) encompasses computational technologies that simulate aspects of human intelligence—such as pattern recognition, learning, and decision-making—through machine learning (ML), deep learning (DL), neural networks, and natural language processing (NLP). In dentistry, AI has been increasingly applied to imaging, diagnosis, treatment planning, administrative tasks, and patient communication.

Artificial intelligence (AI) refers to computational systems capable of performing tasks that traditionally require human intelligence, including learning, reasoning, pattern recognition, and decision-making[1]. In recent years, AI has gained substantial attention in healthcare for its ability to process large datasets and improve diagnostic accuracy, efficiency, and personalization of care[2,4]. Dentistry has witnessed rapid expansion of AI-based applications, particularly in radiographic interpretation, caries detection, periodontal assessment, and oral cancer screening[3–7].

Public health dentistry focuses on prevention of oral diseases and promotion of oral health at the population level. The integration of AI into public health dentistry has the potential to revolutionize disease surveillance, risk prediction, oral health education, and service delivery, especially in underserved populations[8,12]. Despite increasing interest, evidence related specifically to AI applications in public health dentistry remains scattered. Most research to date has focused on clinical specialties like radiology and restorative dentistry. However, **public health dentistry**—a discipline that emphasizes the prevention of oral diseases and improvement of oral health at the community level—also stands to benefit from AI innovations, particularly in areas such as disease surveillance, risk prediction, education, and telehealth delivery Therefore, this systematic review aims to synthesize existing literature on AI in public health dentistry and evaluate its benefits, limitations, and future directions.

METHODS

This systematic review was conducted in accordance with the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2025 guidelines**[9]. A comprehensive literature search was performed across PubMed, Scopus, Web of Science, and Google Scholar using combinations of keywords such as *"artificial intelligence," "machine learning," "public health dentistry," "oral epidemiology,"* and *"teledentistry."*

2.1 Search Strategy

Databases including PubMed, Scopus, Web of Science, and Google Scholar were searched up to **2025** using combinations of keywords such as *"artificial intelligence," "AI," "public health dentistry,"* and *"oral health."* Both systematic reviews and empirical articles were included to capture evidence breadth.

2.2 Inclusion and Exclusion Criteria

- **Inclusion:** Articles addressing AI's use in public dental health, health education, epidemiological studies, teledentistry, AI ethics in public health dentistry, and AI-enabled patient engagement.
- **Exclusion:** Studies solely focused on clinical specialties without public health context (e.g., orthodontic AI without population health relevance).

2.3 Data Extraction and Synthesis

Selected articles were reviewed for objectives, AI techniques deployed, study outcomes, limitations, and implications for public health practice. Findings were qualitatively synthesized into thematic domains.

RESULTS

A total of 340 records were identified through database searching and manual reference screening. After removal of duplicates, 285 articles were screened by title and abstract. Seventy-five full-text articles were assessed for eligibility, and 25 studies were included in the final qualitative synthesis (Table 1).

Table 1: PRISMA 2025 Flow Diagram

Identification	
Records identified through database searching (n = 312)	**Records identified through other sources (n = 28)**
Records after duplicates removed (n = 285)	
Screening	
Records screened (n = 285)	**Records excluded (n = 210)**
Eligibility	
Full-text articles assessed (n = 75)	**Full-text articles excluded (n = 50)**
Included	
Studies included in qualitative synthesis (n = 25)	

AI applications in public health dentistry were grouped into five thematic domains: disease risk prediction, epidemiological surveillance, health education and promotion, teledentistry, and administrative and research support[10–12].

Disease Risk Prediction and Epidemiological Surveillance
Machine learning and deep learning algorithms have been applied to predict population-level risk for dental caries, periodontal disease, and oral cancer by analyzing clinical, radiographic, and behavioral datasets[13–15]. Studies have shown that AI-based screening tools demonstrate higher sensitivity and diagnostic consistency compared to traditional methods, enabling early detection and targeted preventive interventions[16,22].

Health Education and Oral Health Promotion
AI-powered chatbots and virtual assistants have been increasingly utilized to enhance oral health literacy and promote preventive behaviors. These systems deliver personalized oral hygiene instructions, dietary counseling, and appointment reminders, thereby supporting community-based oral health promotion initiatives[12,17].

Teledentistry and Access to Care
The integration of AI with teledentistry platforms has expanded access to oral healthcare services, particularly in rural and resource-limited settings. AI-assisted image analysis and decision-support systems facilitate remote triaging, early diagnosis, and referral, reducing disparities in oral healthcare delivery[11,18,19].

Ethical Considerations and Challenges
Despite its benefits, AI implementation in public health dentistry presents ethical and legal challenges related to data privacy, algorithmic bias, transparency, and accountability[16,20–22]. Inadequate representation in training datasets may lead to inequitable outcomes, emphasizing the need for rigorous validation across diverse populations[23].

DISCUSSION
The findings of this systematic review indicate that AI holds significant promise for advancing public health dentistry through enhanced disease prediction, efficient surveillance, and personalized health education. Similar advantages of AI have been reported across broader healthcare and epidemiological domains[24,25]. However, successful integration requires clinician oversight, ethical governance frameworks, and continuous real-world validation.

ROLE OF AI IN PUBLIC HEALTH DENTISTRY
Compared to humans, AI-based virtual dental assistants can perform several tasks with greater precision, fewer errors, and less manpower. Some of these tasks include:

- ***Health protection:*** Analysing patterns of data for almost real-time surveillance and disease detection. Providing emergency tele – assistance in cases of dental emergencies when the dental health-care expert cannot be contacted. Ex: Early suspected premalignant and malignant alterations in the mucosa[26,,27]
- ***Health promotion***: AI offers targeted and personalized health advice based on risk profile and behavioural patterns. Ex: Alerting the dental health-care provider about any relevant medical history that might accurately predict a genetic predisposition for oral diseases for a large population[26]
- ***Health education:*** There has been a recent inclusion of AI in intelligent tutoring systems such as the Unified Medical Language System, which has a significant improvement in the quality of feedback provided to students by the preclinical virtual patient. The interactive interphase allows students to evaluate and compare their work to the ideal, resulting in high-quality training environments. This system is evident in achieving a competency-based skill level faster, than with traditional simulator units[28]
- ***Remote patient monitoring:*** To monitor patients in rural areas remotely using telehealth technology, monitoring chronically ill people, and the elderly at home using wearable devices or sensors, but the nonintrusive aspects are also attractive for use in hospitals for post-surgery patients, and those in intensive care units using wireless body sensors. These types of applications can present data related to diagnosing and predicting patient health status and assist with clinical decision-making.[29]

Increasing efficacy of health services
Using machine learning to detect abnormalities
Clinical Decision Support System presents information to medical personnel, patients, or populations to provide efficacious and better health outcomes for both individuals and populations in general. AI is already playing a prominent role in medical imaging. AI powered by artificial neural networks can be just as effective as human radiologists at detecting signs of oral cancer as well as other conditions. In addition, it might help clinicians spot early signs of disease.

Machine learning-facilitated automated evidence synthesis
The most time-consuming step in the traditional approach of evidence synthesis is entering structured data into the computer system. However, this process has become simpler with the introduction of voice recognition and the ability of

AI programs to recognize and extract information from scanned material. Understanding a massive quantity of information more effectively than human assistance while also bridging the gap between the community and the health professional.

Public health surveillance

AI-based epidemiological surveillance is a promising approach in detecting, monitoring, and predicting the spread of diseases that employs AI technologies to analyse the data from multiple sources, such as electronic health records, social media, and news articles.[47] The main objective of public health surveillance and response is to analyse and predict disease trends through modelling the disease transmission dynamics and assess public health responses.[49] With the help of these numerous organizations at the national and international levels, including hospitals, pharmacies, public, state, and political health organizations, one can achieve a timely, focused, and effective response to emerging health events through early, automatic notification of things like bioterrorist attacks, radiation exposure, contaminated food or water supplies, and other population-related health patterns (such as periodontal disease, oral cancer, or malnutrition).[26]

Various AI applications for enabling and enhancing public health surveillance and response approaches are provided in Figure 1.

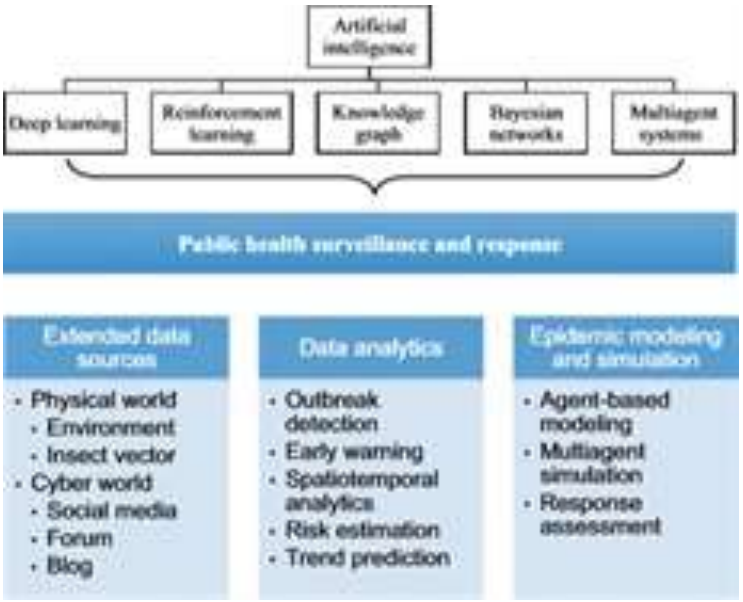

Figure 1: Enabling and enhancing public health surveillance and response approaches through artificial intelligence applications[30]

In research:

AI based tools for literature review

The literature review process involves both creative and mechanical tasks, which creates exciting opportunities for advanced AI-based tools to reduce prospective authors' efforts for time-consuming and repetitive tasks and to dedicate more time to the creative tasks that require human interpretation, intuition, and expertise. Various AI-based tools are available for the steps of the review process such as[31]

Benefits for Public Health Dentistry

AI enhances diagnostic consistency, reduces workload, and supports preventive care strategies at scale. Tools like predictive models and automated screenings can empower early interventions across populations. Moreover, AI-driven educational platforms may improve community engagement and self-management behaviors.

Challenges and Limitations

Key concerns include data privacy and security, algorithmic bias arising from unrepresentative datasets, insufficient regulatory frameworks, and the risk of overreliance on automated outputs without clinician oversight. These limitations underscore the need for robust governance and ethical standards in integrating AI into public health dentistry.

Ethical and Societal Considerations

AI deployment in public health must balance innovation with equitable access and ethical safeguards. Bias mitigation, transparent algorithms, and informed consent are crucial, especially when dealing with vulnerable communities.

Future Directions

Emerging research should prioritize large-scale prospective evaluations of AI tools within diverse population settings.

Additionally, collaborations between technologists, public health professionals, and policymakers are needed to ensure responsible adoption. Investment in training public health dentists to effectively interpret and apply AI insights is also essential.

CONCLUSION

AI holds significant promise for advancing public health dentistry through disease prediction, personalized education, telehealth expansion, and enhanced epidemiological monitoring. Its integration into practice can support improved oral health outcomes at population levels, especially when combined with ethical standards and clinician involvement. Ongoing research and policy planning will determine how AI reshapes preventive oral health care in the coming decades.
Artificial intelligence represents a transformative tool for public health dentistry by strengthening preventive strategies, expanding access to care, and improving population-level oral health monitoring. Future research should focus on longitudinal validation studies, ethical implementation, and policy development to ensure equitable and sustainable adoption of AI technologies.

REFERENCES

1. Schwendicke F, Samek W, Krois J. Artificial intelligence in dentistry: chances and challenges. **J Dent Res.** 2020;99(7):769–774.
2. Tiwari T, Jamieson L, et al. Artificial intelligence and ChatGPT in public health dentistry: opportunities and ethical concerns. **Community Dent Oral Epidemiol.** 2023;51(6):543–549.
3. Wadher R, Bhandari P, Patil S. Artificial intelligence in public health dentistry: a narrative review. **Int J Adv Dent.** 2023;5(2):45–52.
4. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. **Nat Med.** 2019;25(1):44–56.
5. Krois J, Ekert T, Meinhold L, et al. Deep learning for the radiographic detection of periodontal bone loss. **Sci Rep.** 2019;9:8495.
6. Lee JH, Kim DH, Jeong SN. Detection and diagnosis of dental caries using a deep learning-based convolutional neural network algorithm. **J Dent.** 2018;77:106–111.
7. Chen YW, Stanley K, Att W. Artificial intelligence in dentistry: current applications and future perspectives. **Quintessence Int.** 2020;51(3):248–257.
8. Alsharif AT, Alsharif AT. Applications of artificial intelligence in dentistry: a review. **Saudi Dent J.** 2022;34(3):223–232.
9. Esteva A, Kuprel B, Novoa RA, et al. Dermatologist-level classification of skin cancer with deep neural networks. **Nature.** 2017;542:115–118. *(Foundational AI diagnostic study relevant to oral cancer screening models)*
10. Khanagar SB, Al-Ehaideb A, Vishwanathaiah S, et al. Developments, application, and performance of artificial intelligence in dentistry – A systematic review. **J Dent Sci.** 2021;16(1):508–522.
11. Mertens S, Van der Sanden WJM, et al. Teledentistry: a systematic review of the literature. **Int Dent J.** 2020;70(6):423–435.
12. Hung M, Hon ES, et al. Artificial intelligence in oral health promotion and disease prevention. **J Public Health Dent.** 2022;82(3):256–264.
13. Chattopadhyay A, Shetty V. Artificial intelligence and big data in oral epidemiology. **Dent Clin North Am.** 2018;62(2):285–298.
14. Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. **Future Healthc J.** 2019;6(2):94–98.
15. Gandomi A, Haider M. Beyond the hype: Big data concepts, methods, and analytics. **Int J Inf Manage.** 2015;35(2):137–144.
16. Naik MG, Jaiswal A. Ethical implications of artificial intelligence in dentistry. **Indian J Public Health Dent.** 2023;21(1):1–6.
17. World Health Organization. Ethics and governance of artificial intelligence for health. Geneva: WHO; 2021.
18. European Commission. Ethics guidelines for trustworthy AI. Brussels: European Union; 2019.
19. Liu Y, Chen P-HC, Krause J, Peng L. How to read articles that use machine learning: users' guides to the medical literature. **JAMA.** 2019;322(18):1806–1816.
20. Shah P, Kendall F, Khozin S, et al. Artificial intelligence and machine learning in clinical development: a translational perspective. **NPJ Digit Med.** 2019;2:69.
21. Rajpurkar P, Irvin J, Ball RL, et al. Deep learning for chest radiograph diagnosis. **NPJ Digit Med.** 2018;1:18. *(Methodological relevance for population-level screening)*
22. Bhatia S, Kumar P. Role of artificial intelligence in oral cancer detection and prevention. **Oral Oncol.** 2022;134:106040.
23. Jiang F, Jiang Y, Zhi H, et al. Artificial intelligence in healthcare: past, present and future. **Stroke Vasc Neurol.** 2017;2(4):230–243.

24. Chen M, Decary M. Artificial intelligence in healthcare: an essential guide for health leaders. **Healthc Manage Forum.** 2020;33(1):10–18.
25. Kalenderian E, Ramoni RL, White JM, et al. The development of a dental diagnostic terminology. **J Dent Educ.** 2011;75(1):68–76.
26. Tariq SA, Gupta NI, Gupta PR, Sharma AD. Artificial intelligence in public health dentistry. Int Health Res J. 2021;5(9):1-5.
27. Khanna SS, Dhaimade PA. Artificial intelligence: transforming dentistry today. Indian J Basic Appl Med Res. 2017 Jun;6(3):161-7
28. Mitra R, Tarnach G. Artificial intelligence –A boon for dentistry. IDJSR 2022;10:37–42
29. Shaik T, Tao X, Higgins N, Li L, Gururajan R, Zhou X, et al. Remote patient monitoring using artificial intelligence:Current state, applications, and challenges. WIREs Data Min Knowl Discov 2023;13:e1485
30. Zeng D, Cao Z, Neill DB. Artificial intelligence –Enabled public health surveillance –From local detection to global epidemic monitoring and control. In:Artificial Intelligence in Medicine. Elsevier Applied Science:united States 2021 437–53
31. Wagner G, Lukyanenko R, Pare G. Artificial intelligence and the conduct of literature reviews. JIT 2022;37:209–26