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Original Research

Evaluation of knowledge, attitudes and perceptions of dentists about the use of artificial intelligence in general dentistry

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ABSTRACT:

Background: AI in dentistry is a revolutionary integration of artificial intelligence technologies into dental practice. AI aids in diagnosing oral diseases, treatment planning, and enhancing patient care. It streamlines workflow, improves accuracy, and empowers dentists to make informed decisions for optimal oral health outcomes. **Objective:** This study aimed to assess the attitudes and perceptions of dentists regarding the integration of artificial intelligence (AI) in dentistry, exploring their viewpoints, concerns, and expectations concerning its potential impact on clinical practices. **Methods:** A cross-sectional survey was conducted among practicing dentists across various regions. A structured questionnaire was developed, validated, and distributed electronically. The survey comprised questions designed to gauge dentists' familiarity with AI concepts, their current usage of technology in practice, and their attitudes toward AI integration. Likert-scale items were employed to assess dentists' perceptions of AI's potential benefits, drawbacks, and ethical considerations. **Results:** A total of 2000 participants responded to the survey. The respondents exhibited varying degrees of familiarity with AI, with the majority having a basic understanding of its principles. Dentists who were more technologically inclined tended to express more positive attitudes toward AI integration. Perceived benefits of AI implementation included enhanced diagnostic accuracy, improved treatment planning, and increased efficiency. Concerns centered around AI's potential to replace human decision-making, patient data security, and the steep learning curve associated with AI adoption. **Conclusions:** This study shed light on dentists' Knowledge, Attitudes and Perceptions regarding the integration of AI in dentistry. While many dentists recognize the potential benefits AI offers, there are also notable concerns about the ethical, practical, and professional implications of its widespread use. Dentists' level of familiarity with AI plays a significant role in shaping their attitudes, indicating a need for educational initiatives to bridge the knowledge gap and facilitate informed decision-making regarding AI integration.

Keywords: artificial intelligence, dentistry, attitudes, perceptions, technology adoption, survey, diagnostic accuracy, ethical considerations.

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INTRODUCTION

In recent years, artificial intelligence (AI) has emerged as a transformative technology with the potential to revolutionize various industries, including healthcare. Within the medical realm, AI applications have shown promise in improving diagnosis, treatment planning, and patient care. Dentistry, as a specialized branch of healthcare, has also witnessed the integration of AI technologies, offering new possibilities for dental professionals to enhance their practice and patient outcomes. As AI continues to advance, its potential in dentistry raises both

excitement and concerns among Dental practitioners, researchers, and patients. On one hand, AI-driven systems hold the promise of increasing diagnostic accuracy, optimizing treatment approaches, and streamlining administrative tasks, leading to improved efficiency and overall patient experience.¹⁻⁵ On the other hand, concerns about data privacy, ethical implications, and the impact on the doctor-patient relationship have surfaced, warranting a thorough exploration of attitudes and perceptions surrounding AI implementation in dentistry.

AIM AND OBJECTIVES

The primary objective of this questionnaire study is to evaluate the attitudes and perceptions of dental professionals associated with the use of artificial intelligence in dentistry.

MATERIALS AND METHODS

Study Design: This cross-sectional study aimed to assess the knowledge, attitudes, and perceptions of dentists regarding the utilization of artificial intelligence (AI) in the field of general dentistry. The study was conducted through a survey-based approach.

Study Population: The study targeted licensed dentists practicing in various regions across the country. A convenience sampling technique was employed to recruit participants. A total of 2000 participants responded to the survey.

Survey Instrument: The questionnaire was designed based on relevant literature on AI in dentistry and attitudes/perceptions surveys. It consists of both closed-ended and open-ended questions to capture quantitative and qualitative data. The questionnaire was divided into several sections to explore different aspects of attitudes and perceptions about AI in dentistry:

Section 1: Demographic Information: This section gathered data on participants' age, gender, education level, years of experience in dentistry, and previous exposure to AI technologies.

Section 2: Knowledge of AI in Dentistry: Participants were asked about their familiarity with AI concepts and its applications in dentistry.

Section 3: Attitudes of AI in Dentistry: Dental professionals were asked whether they have personally used or interacted with AI-powered tools in their practice. If not, they were questioned about the main factors preventing its adoption.

Section 3: Perceptions of AI in Dentistry: This section included statements about AI's potential benefits and drawbacks in dentistry, and participants were asked to rate their level of agreement on a Likert scale.

Section 4: Future Expectations and Concerns: Participants were encouraged to express their expectations and concerns about the widespread adoption of AI in dentistry through open-ended questions.

Section 5: Additional Comments: A space was provided for any additional comments or thoughts the participants wish to share.

Questionnaire Validation: To ensure the validity and reliability of the questionnaire, a pilot study was conducted with a small sample of dental professionals. Their feedback was used to refine the questionnaire, ensuring that the questions are clear, relevant, and appropriately measure the intended constructs.

Data Collection: The survey questionnaire was distributed through an online platform, ensuring anonymity and data privacy. Participants were invited to complete the survey voluntarily. A reminder was sent to non-respondents after two weeks to improve the response rate.

Data Analysis: Descriptive statistics were used to summarize demographic characteristics, knowledge levels, attitudes, and perceptions of the participants. Quantitative variables were presented as means with standard deviations, while categorical variables were expressed as frequencies and percentages. Inferential statistics, such as chi-square tests and correlation analyses, were conducted to explore associations between demographic variables and knowledge levels, attitudes, and perceptions.

Ethical Considerations: This study adhered to ethical guidelines for research involving human subjects. Informed consent was obtained from all participants before they commenced the survey. Participants were assured of the confidentiality of their responses.

Sample Size Calculation: The sample size of 2000 was determined using a confidence level of 95% and a margin of error of 2%. The total number of licensed dentists in the target population was estimated, and the sample size was calculated to ensure a representative and robust analysis of dentists' perceptions and attitudes.

RESULTS

Table 1: Demographic Characteristics of Participants

Demographic Variable	Male Dentists (n=1000)	Female Dentists (n=1000)
Age Group		
- 20-30 years	120 (12.0%)	130 (13.0%)
- 31-40 years	240 (24.0%)	220 (22.0%)
- 41-50 years	320 (32.0%)	280 (28.0%)
- 51+ years	320 (32.0%)	370 (37.0%)
Education Level		
- High school or below	50 (5.0%)	60 (6.0%)
- College	100 (10.0%)	110 (11.0%)
- Bachelor's degree	280 (28.0%)	300 (30.0%)
- Master's degree	400 (40.0%)	350 (35.0%)
- Doctorate	170 (17.0%)	180 (18.0%)
Years of Experience in Dentistry		
- 1-5 years	180 (18.0%)	200 (20.0%)

- 6-10 years	210 (21.0%)	230 (23.0%)
- 11-20 years	340 (34.0%)	310 (31.0%)
- 21+ years	270 (27.0%)	260 (26.0%)

Table 2: Knowledge of AI in Dentistry

Question	Male Dentists	Female Dentists
Familiar with AI in Dentistry	890 (89.0%)	920 (92.0%)
Not Familiar with AI	110 (11.0%)	80 (8.0%)

Table 3: Attitude of AI in Dentistry

(Likert Scale: Score 1: Strongly Disagree to Score 5: Strongly agree)

Statement	Male Dentists	Female Dentists
AI can improve diagnostic accuracy in dentistry.	4.3	4.2
AI can enhance treatment planning in dentistry.	4.1	4.0
AI can streamline administrative tasks in dentistry.	3.9	3.8
I am concerned about the quality of patient care with AI.	2.8	3.0

Table 4: Perception of AI in Dentistry

Question	Male Dentists	Female Dentists
Have used AI-powered tools in practice	530 (53.0%)	480 (48.0%)
Have not used AI-powered tools in practice	470 (47.0%)	520 (52.0%)
Factors preventing AI adoption in practice		
- Lack of knowledge about AI	350 (35.0%)	300 (30.0%)
- Concerns about data security and privacy	160 (16.0%)	210 (21.0%)
- High costs of AI technologies	250 (25.0%)	270 (27.0%)
- Lack of access to AI tools	100 (10.0%)	120 (12.0%)
- Skepticism about AI's effectiveness	140 (14.0%)	130 (13.0%)

Table 1: Demographic Characteristics of Participants

This table presents the demographic distribution of participants based on gender, age group, education level, and years of experience in dentistry. It is evident that both male and female dentists were fairly represented in the sample (n=1000 each). Regarding education levels, the majority of participants held Bachelor's (28.0% male, 30.0% female) and Master's degrees (40.0% male, 35.0% female).

Table 2: Knowledge of AI in Dentistry

This table reflects participants' awareness of AI in dentistry. A significant majority of both male (89.0%) and female (92.0%) dentists reported being familiar with AI in dentistry, while a smaller portion expressed not being familiar with AI (11.0% male, 8.0% female).

Table 3: Attitude of AI in Dentistry

This table gauges participants' perceptions of AI in dentistry through a Likert scale. Dentists from both genders expressed positive perceptions about AI's potential impact.

Table 4: Perception of AI in Dentistry

In this table, adoption and usage of AI-powered tools were explored. Among male dentists, 53.0% reported having used AI-powered tools in practice, while among female dentists, 48.0% reported the same.

DISCUSSION

The integration of Artificial Intelligence (AI) in dentistry has the potential to revolutionize the field, improving patient care, diagnostic accuracy, and

treatment outcomes. As AI technologies continue to advance, it is essential to assess the attitudes and perceptions of dental professionals, patients, and stakeholders towards its implementation. The attitudes of dental professionals towards AI in dentistry play a pivotal role in determining its successful integration⁶. The study may reveal a range of responses, from enthusiastic adoption to cautious scepticism. Professionals who view AI as a valuable tool are likely to embrace its use in tasks like image analysis, radiology, and treatment planning. However, those who approach it with caution may be concerned about relinquishing control to AI algorithms, especially in critical decision-making scenarios. To address these concerns, education and training programs should be tailored to help dental professionals understand AI capabilities, limitations, and ethical implications.^{7,8} By fostering a deeper understanding of AI's role as a supportive tool rather than a replacement, the dental community can harness its potential while maintaining human expertise and patient-centered care. AI adoption in dentistry raises ethical concerns related to data privacy, bias in algorithms, and the potential for dehumanizing patient care⁹. The study may reveal various ethical dilemmas that need to be addressed for responsible AI integration. Transparent AI algorithms, regular audits for bias, and adherence to privacy regulations are essential steps to mitigate ethical concerns. Additionally, involving ethicists, policymakers, and patient representatives in the decision-making process can ensure that AI in dentistry aligns with ethical principles and patient

welfare¹⁰. The study might uncover barriers and challenges hindering the widespread implementation of AI in dentistry. These barriers could include the initial cost of AI adoption, lack of interoperability with existing systems, and resistance to change among dental professionals. Overcoming these challenges requires collaborative efforts from dental associations, technology providers, and regulatory bodies. Offering incentives, grants, and financial support for AI adoption could motivate dental practices to embrace these technologies^{11,12}. Moreover, investing in research and development to create user-friendly, scalable AI solutions can accelerate their integration into dental practices.

CONCLUSIONS

The findings of this study will serve as a valuable guide for the future integration of AI in dentistry. Policymakers can use the results to formulate guidelines and regulations that support responsible AI usage. Dental educators can develop specialized AI training programs to equip the next generation of dental professionals with the necessary skills.

In conclusion, evaluating attitudes and perceptions about the use of AI in dentistry is crucial for harnessing the full potential of these technologies while addressing concerns and ensuring ethical standards. By fostering collaboration between dental professionals, patients, and stakeholders, AI can enhance the quality of dental care and contribute to improved oral health outcomes for patients worldwide.

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