

# KNOWLEDGE, ATTITUDE AND USAGE OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING BY THE DENTISTS IN RIYADH: A CROSS-SECTIONAL SURVEY

Shahzeb Hasan Ansari <sup>1</sup>, Rashed Adnan AlRashed <sup>2</sup>, Abdulrahman Meteib AlOtaibi<sup>3</sup>, Basil Jassim Dashti<sup>4</sup>, Salman Nasser AlOtaibi<sup>5</sup>

<sup>1</sup> BDS, MPH, University of Manitoba, Winnipeg, Canada.

<sup>2</sup> BDS, ministry of health, Kuwait .

<sup>3</sup> BDS, ministry of health, Kuwait .

<sup>4</sup> BDS, ministry of health, Kuwait .

<sup>5</sup> BDS, ministry of health, Kuwait.

## Abstract

Artificial Intelligence (AI) and Machine Learning (ML) have shown great potential in revolutionizing healthcare, including dentistry, by improving diagnostic accuracy and treatment planning. However, the adoption and integration of these technologies in dental practices, particularly in Riyadh, Saudi Arabia, remain limited. This study aims to assess the current knowledge, attitudes, and readiness of Riyadh-based dentists to incorporate AI and ML into their clinical practice. A total of 416 participants, including clinicians, postgraduate students, and academicians, were surveyed using a pre-validated questionnaire. The results indicate that while 50% of the dentists had basic knowledge of AI technologies and 55% were aware of their use in dentistry, significant barriers to implementation remain. These include the lack of formal training, high costs of AI tools, and institutional support. The study highlights the need for improved education and support to facilitate AI adoption in dental practices, particularly in both private and government sectors. The findings also reveal that while dentists view AI as a useful assistant tool rather than a replacement for human expertise, ethical concerns about data privacy and job displacement need to be addressed.

## INTRODUCTION

Artificial intelligence (AI) and machine learning (ML) for diagnosing various diseases and general healthcare, including dentistry, are a reality as they have brought changes for the better in diagnosing and planning treatments. These technologies improve clinical values by providing increased efficiency in functioning and utilizing analytical techniques to evaluate radiographic images and estimative therapeutic prescriptions (Deshmukh, 2018; Chen et al., 2020).

Although we see a progressive incorporation of AI and ML in the field of dentistry, the existing development is not very advanced. Among dental practitioners in Riyadh, Saudi Arabia, knowledge and usage are mixed, and some feel that they are not yet prepared to apply the technologies in their practice (Abouzeid et al., 2021). The perception that clients and dentists have towards AI and ML affects their implementation in dental practices. Studies reveal that while some of them look forward to improving their practice with these technologies, others have certain doubts regarding their efficiency, ethical issues, and dependency on these technologies (Yu and Kohane, 2019).

AI and ML have been reported to have the ability to improve diagnostic capabilities and treatment planning in dentistry. It was also observed that AI could produce better results than normal practice, which was depicted through the percentage of correct classification of caries and periodontal diseases above 90%. These promising findings stated there is still little use of AI in dental practices due to the general lack of training among dentists. The study also focuses on a lack of formal education and experience with AI technologies, which could help to overcome this gap (Aboalshamat et al., 2022).

Doğaner's (2021) study was on the barriers to Artificial intelligence, and the research discovered that ethical concerns like data privacy & Job loss could inhibit AI adoption. A survey of Riyadh revealed that 50% of the dentists had basic knowledge about AI technologies, and 55% of the dentists were aware of its use in dentistry; however, majority agreed that AI related training should be a part of dental education. They also stated that the high cost of artificial intelligence tools and lack of support from an institution are the main drawbacks of using AI tools. These findings have

implications for the need to improve the education of dentists and institutions' support to improve the integration of AI in dentistry (Khanagar et al., 2021).

Furthermore, respondents saw computerization not as a potential substitute for human knowledge and abilities but as an assistant tool; therefore, trust in new technologies may be considered in the process of formation (Abouzeid et al., 2021). The authors also pointed out that in addition to teaching dentists the practical application of AI, it was crucial to introduce them to the ethical issues regarding the technology, such as ownership of data and consent from the patient. This integrated approach to implementing artificial intelligence could help in dealing with issues and enhance partnerships among dental experts (Deshmukh, 2018).

Need of the study: Findings of this study will provide an insight on the current level of knowledge and readiness of Riyadh based dentists regarding the use of AI and ML. Moreover, we will discover the factors that are creating obstacles in the implementation of these technologies in their clinical practice.

**Research question:**

Are the Riyadh based dentists aware and ready to utilize the AI and ML in their clinical practice?

**Null hypothesis:**

Riyadh-based dentists are not aware of AI and ML, and they are not ready to implement and use these technologies in their practice.

**Aims and Objectives:**

The main aim of this study was determine the level of knowledge and attitude among Riyadh-based dentists regarding the use of Artificial Intelligence and Machine Learning in their practice.

Objectives include:

- To identify variations in knowledge and attitudes among private and public dentists.
- To identify variations in knowledge and attitudes among general practitioners and specialists.
- To identify the knowledge gaps and factors preventing them from implementing the technology in their dental practice.

**MATERIALS AND METHODS:**

**Study Design:** This is a cross-sectional study which used a closed ended questionnaire. Reliability of the questionnaire was found to be Chronbach's value: .845 and validity was carried by sending the questionnaire to experts in research within REU for their comments and modifications.

**Reliability Statistics**

Cronbach's Alpha	N of Items
.845	14

**Inclusion criteria:**

- General and specialist dentists working in Riyadh.
- Participants from all nationalities.
- Participants from both genders and all age groups.

**Exclusion criteria:**

- Dental students and interns.

**Study Sample:** Sample was calculated using [www.raosoft.com](http://www.raosoft.com):

Margin of error: 5%

Confidence level: 95%

Population size: 5000 (Albaker et al., 2017)

Response distribution: 50%

**Recommended sample size: 416**

**Questionnaire components:**

- Demographics including gender, nationality, work sector, and work-experience.

- Questions including knowledge, attitudes and perceptions about AI and ML.

**Data collection:** The questionnaire was constructed using Google Forms, and the link was sent to the dentists in Riyadh using social media platforms and official emails (after obtaining permission from relevant personnel). Data was downloaded from the Google Forms in Excel sheet and transferred to SPSS.

**Data analysis:** SPSS (Statistical Package for Social Sciences) version 22 (IBM Corp 2017) was used to analyze the data. Descriptive analysis was done to present the demographical distribution of participants. Chi-square test was done to present the comparison between groups, and a p-value of 0.05 or less was considered to be statistically significant.

**Ethical Approval:** This proposal was submitted to the REU's ethical committee, and IRB approval was obtained to start data collection.

## RESULTS:

**Table 1: Demographics of the study participants**

Variables	Frequencies
Age	Mean: 37.04 (SD 9.7854)
Work Position	Academicians: 70 (16.8%) Clinicians: 223 (53.6%) Postgraduate students: 123 (29.6%)
Gender	Male: 248 (59.6%) Female: 168 (40.4%)
Work Sector	Private: 233 (56%) Government: 183 (44%)

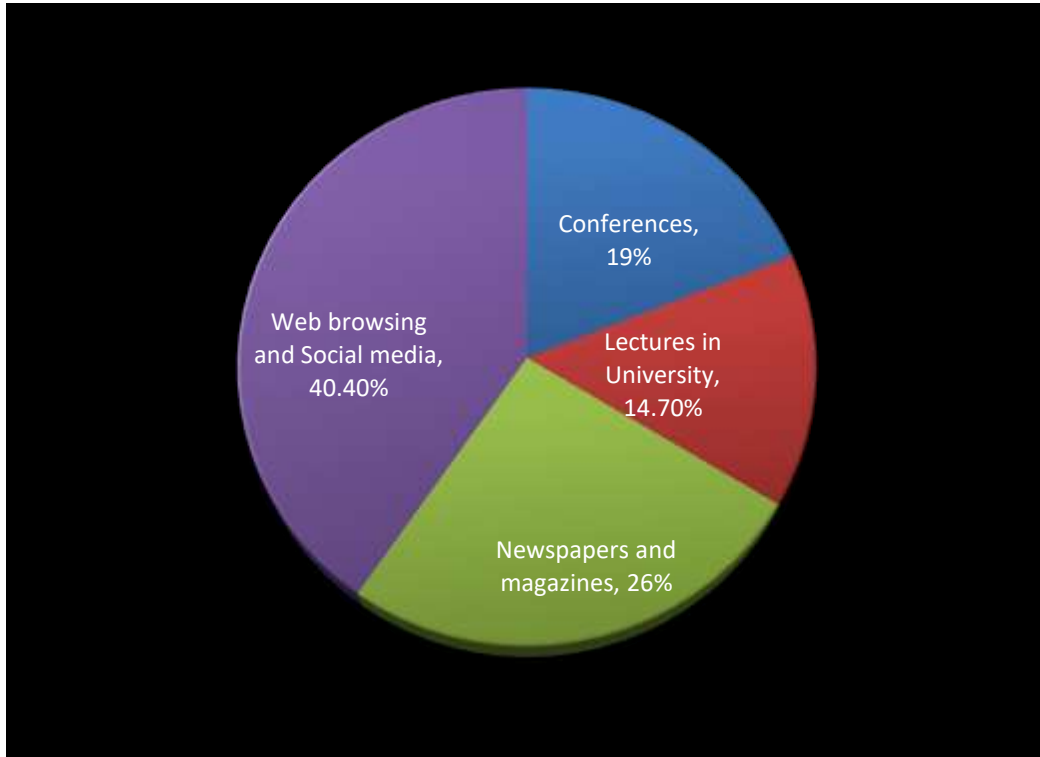
The study included 416 participants with an average age of 37.04 years (SD = 9.78). The majority of participants were clinicians (53.6%), followed by postgraduate students (29.6%) and academicians (16.8%). Gender distribution was skewed toward males (59.6%) compared to females (40.4%), and a larger proportion of participants worked in the private sector (56%) than in the government sector (44%). This demographic distribution (Table 1) provides a diverse sample to explore varying perspectives on artificial intelligence (AI) in dentistry.

**Table 2: Knowledge related questions and their responses**

Variables	Responses
Which of the following is an AI app ?	Alexa: 27 (6.5%) Siri: 59 (14.3%) Cortona: 67 (16.2%) All: 261 (63%)
What according to you is Artificial Intelligence?	Branch of science dealing with algorithms to simulate human intelligence: 176 (42.3%) Computer programming language: 240 (57.7%)
How did you get to know about AI?	Conferences: 79 (19%) Lectures in University: 61 (14.7%) Newspaper and magazines: 108 (26%) Web browsing and Social media: 168 (40.4%)
What are your concerns of use of AI?	Data privacy: 72 (17.3%) Fear of job replacement: 111 (26.7%) Hacking and cyber security attacks: 92 (22.1%) Less human interaction with the patient: 141 (33.9%)
Do you think you need more knowledge and information on the applications of AI and ML in dentistry?	Definitely not: 15 (3.6%) Somewhat no: 24 (5.8%) May be: 101 (24.3%) Somewhat yes: 89 (21.4%) Definitely yes: 187 (45%)

Participants' knowledge of AI varied significantly. When asked about AI applications, 63% of respondents correctly identified all listed options (Alexa, Siri, Cortona) as examples of AI apps. However, a notable portion of participants misidentified individual applications, with Cortona (16.2%) and Siri (14.3%) being the most common incorrect choices. Regarding the definition of AI, only 42.3% correctly identified it as a branch of science dealing with algorithms to simulate human intelligence, while 57.7% mistakenly associated it with computer programming languages.

Participants primarily learned about AI through web browsing and social media (40.4%), followed by newspapers and magazines (26%). Conferences (19%) and lectures in university (14.7%) were less common sources. These findings (Table 2) highlight the role of digital platforms in disseminating AI knowledge and underscore the need for formal education in this area.



**Figure 1:** Participants' responses to how did they get to know about AI.

The most significant concern among participants was less human interaction with patients (33.9%), followed by fear of job replacement (26.7%) and hacking or cybersecurity risks (22.1%). Concerns about data privacy (17.3%) were relatively lower, suggesting that participants prioritize practical and professional implications of AI over ethical issues. Figure 2 illustrates this distribution, emphasizing the need for addressing these concerns to enhance acceptance of AI in clinical practice.



**Figure 2:** Participants' responses to what are their concerns of use of AI.

**Table 3:** Attitudes and perceptions of study participants regarding AI and ML

Questions	Mean scores (SD) Strongly Disagree 1, Strongly disagree 5
AI can be used as a quality control system to evaluate the treatment results/success	4.0600 (SD 1.0704)
AI can be used as a tool for diagnosis and treatment planning in dentistry	3.9086 (SD 1.1454)
AI can revolutionize dentistry in general.	4.0240 (SD 1.1169)
If there is disagreement between AI judgment and dentist's judgment, I will follow AI's judgment?	3.7620 (SD 1.3492)
Do you agree that the use of AI should be recommended to fellow practitioners	4.0625 (SD 1.1326)
AI will be helpful to budding dentists in diagnosing and for decision making in difficult clinical situations.	4.0649 (SD 1.1335)
AI can be perceived as a partner rather than a competitor in foreseeable future of dentistry	4.1394 (SD 1.1041)
The incorporation of AI to CBCT analysis will be a valuable addition to diagnosis and treatment planning	4.1827 (SD 1.0778)

Participants generally held positive attitudes toward AI in dentistry. The highest level of agreement was for the statement, "The incorporation of AI into CBCT analysis will be a valuable addition to diagnosis and treatment planning" (Mean = 4.18, SD = 1.07). Similarly, respondents widely agreed that AI could be perceived as a partner rather than a competitor in dentistry (Mean = 4.13, SD = 1.10) and that it could significantly aid budding dentists in decision-making for complex clinical situations (Mean = 4.06, SD = 1.13) (Table 3).

However, when faced with conflicting judgments between AI and human dentists, participants expressed caution. The statement, "If there is disagreement between AI's judgment and a dentist's judgment, I will follow AI's judgment", received a lower level of agreement (Mean = 3.76, SD = 1.34). This suggests that while participants see the value of AI, trust in its judgment over human expertise remains a concern.

**Table 4:** Comparisons of knowledge, attitude and usage on the basis of work position

Variables	Academicians	Clinicians	Postgraduate students	P-value
How aware are you about the use of AI in daily life?	Extremely aware: 31% Somewhat aware: 30% Not so aware: 21% Not at all aware: 17%	Extremely aware: 35% Somewhat aware: 35% Not so aware: 21% Not at all aware: 4%	Extremely aware: 34% Somewhat aware: 46% Not so aware: 15% Not at all aware: 4%	.027*
Which of the following is an AI app ?	Alexa: 13% Siri: 11% Cortona: 10% All: 66%	Alexa: 7% Siri: 17% Cortona: 21% All: 56%	Alexa: 2% Siri: 11% Cortona: 11% All: 75%	.003*
What according to you is Artificial Intelligence?	Branch of science dealing with algorithms to simulate human intelligence: 46% Computer programming language: 54%	Branch of science dealing with algorithms to simulate human intelligence: 44% Computer programming language: 56%	Branch of science dealing with algorithms to simulate human intelligence: 37% Computer programming language: 63%	.408
How did you get to know about AI?	Conferences: 27% Lectures in university: 14% Newspaper and magazines: 23% Web browsing and Social media: 36%	Conferences: 18% Lectures in university: 16% Newspaper and magazines: 25% Web browsing and Social media: 41%	Conferences: 16% Lectures in university: 13% Newspaper and magazines: 29% Web browsing and Social media: 41%	.575
What are your concerns of use of AI?	Data privacy: 26% Fear of job replacement: 20% Hacking and cyber security attacks: 14% Less human interaction with the patient: 40%	Data privacy: 19% Fear of job replacement: 26% Hacking and cyber security attacks: 25% Less human interaction with the patient: 30%	Data privacy: 9% Fear of job replacement: 33% Hacking and cyber security attacks: 21% Less human interaction with the patient: 37%	.012*
AI can be used as a quality control system to evaluate the treatment results/success	Strongly disagree: 7% Disagree: 3% Neutral: 11% Agree: 27% Strongly agree: 51%	Strongly disagree: 3% Disagree: 6% Neutral: 17% Agree: 30% Strongly agree: 44%	Strongly disagree: 3% Disagree: 6% Neutral: 15% Agree: 38% Strongly agree: 38%	.381
AI can be used as a tool for diagnosis and treatment planning in dentistry	Strongly disagree: 7% Disagree: 10% Neutral: 11% Agree: 27% Strongly agree: 44%	Strongly disagree: 3% Disagree: 13% Neutral: 17% Agree: 24% Strongly agree: 42%	Strongly disagree: 2% Disagree: 6% Neutral: 20% Agree: 39% Strongly agree: 33%	.023*
AI can revolutionize dentistry in general.	Strongly disagree: 7% Disagree: 10% Neutral: 11% Agree: 27% Strongly agree: 44%	Strongly disagree: 3% Disagree: 13% Neutral: 17% Agree: 24% Strongly agree: 42%	Strongly disagree: 2% Disagree: 6% Neutral: 20% Agree: 39% Strongly agree: 33%	.787
If there is disagreement between AI judgment and dentist's judgment, I will follow AI's judgment?	Strongly disagree: 13% Disagree: 6% Neutral: 20% Agree: 17% Strongly agree: 44%	Strongly disagree: 12% Disagree: 11% Neutral: 16% Agree: 19% Strongly agree: 43%	Strongly disagree: 7% Disagree: 6% Neutral: 16% Agree: 33% Strongly agree: 38%	.091
Do you agree that the use of AI	Strongly disagree: 7% Disagree: 7%	Strongly disagree: 4% Disagree: 9%	Strongly disagree: 2% Disagree: 7%	.288

should be recommended to fellow practitioners	Neutral: 17% Agree: 19% Strongly agree: 50%	Neutral: 15% Agree: 25% Strongly agree: 47%	Neutral: 11% Agree: 33% Strongly agree: 49%	
AI will be helpful to budding dentists in diagnosing and for decision making in difficult clinical situations.	Strongly disagree: 10% Disagree: 10% Neutral: 13% Agree: 17% Strongly agree: 50%	Strongly disagree: 3% Disagree: 6% Neutral: 13% Agree: 31% Strongly agree: 46%	Strongly disagree: 4% Disagree: 7% Neutral: 10% Agree: 33% Strongly agree: 46%	.148
AI can be perceived as a partner rather than a competitor in foreseeable future of dentistry	Strongly disagree: 6% Disagree: 7% Neutral: 9% Agree: 20% Strongly agree: 59%	Strongly disagree: 4% Disagree: 7% Neutral: 15% Agree: 24% Strongly agree: 50%	Strongly disagree: 1% Disagree: 6% Neutral: 15% Agree: 28% Strongly agree: 50%	.435
The incorporation of AI to CBCT analysis will be a valuable addition to diagnosis and treatment planning	Strongly disagree: 4% Disagree: 4% Neutral: 10% Agree: 30% Strongly agree: 51%	Strongly disagree: 4% Disagree: 10% Neutral: 9% Agree: 23% Strongly agree: 54%	Strongly disagree: 1% Disagree: 7% Neutral: 10% Agree: 34% Strongly agree: 49%	.317
Do you think you need more knowledge and information on the applications of AI and ML in dentistry?	Definitely not: 6% Somewhat no: 10% Maybe: 23% Somewhat yes: 19% Definitely yes: 43%	Definitely not: 4% Somewhat no: 7% Maybe: 24% Somewhat yes: 19% Definitely yes: 47%	Definitely not: 2% Somewhat no: 2% Maybe: 25% Somewhat yes: 28% Definitely yes: 43%	.196

Significant differences in AI awareness and perceptions were observed based on participants' work positions. Postgraduate students demonstrated the highest accuracy in identifying AI apps, with 75% correctly recognizing all listed options, compared to 56% of clinicians and 66% of academicians ( $p = 0.003$ , Table 4). Awareness levels also varied significantly ( $p = 0.027$ ), with clinicians having the highest proportion of "extremely aware" responses (35%) and postgraduate students excelling in "somewhat aware" responses (46%).

Concerns about AI also differed by profession. Academicians were primarily worried about less human interaction with patients (40%), while clinicians were equally divided between fear of job replacement (26%) and hacking risks (25%). Postgraduate students, on the other hand, expressed balanced concerns across all categories ( $p = 0.012$ , Table 4). Additionally, postgraduate students showed higher optimism for AI's potential as a diagnostic tool (39% strongly agreed,  $p = 0.023$ , Table 4).

**Table 5:** Comparisons of knowledge, attitude and usage on the basis of work sector

Variables	Private	Government	P-value
How aware are you about the use of AI in daily life?	Extremely aware: 31% Somewhat aware: 39% Not so aware: 21% Not at all aware: 8%	Extremely aware: 38% Somewhat aware: 36% Not so aware: 17% Not at all aware: 10%	.397
Which of the following is an AI app ?	Alexa: 6% Siri: 17% Cortona: 19% All: 58%	Alexa: 7% Siri: 11% Cortona: 13% All: 69%	.095
What according to you is Artificial Intelligence?	Branch of science dealing with algorithms to simulate human intelligence: 45%	Branch of science dealing with algorithms to simulate human intelligence: 38%	.083

	Computer programming language: 55%	Computer programming language: 62%	
How did you get to know about AI?	Conferences: 19% Lectures in university: 15% Newspaper and magazines: 30% Web browsing and Social media: 36%	Conferences: 19% Lectures in university: 14% Newspaper and magazines: 20% Web browsing and Social media: 46%	.067
What are your concerns of use of AI?	Data privacy: 14% Fear of job replacement: 30% Hacking and cyber security attacks: 24% Less human interaction with the patient: 31%	Data privacy: 21% Fear of job replacement: 22% Hacking and cyber security attacks: 19% Less human interaction with the patient: 37%	.055
AI can be used as a quality control system to evaluate the treatment results/success	Strongly disagree: 3% Disagree: 8% Neutral: 18% Agree: 33% Strongly agree: 38%	Strongly disagree: 5% Disagree: 2% Neutral: 12% Agree: 31% Strongly agree: 50%	.012*
AI can be used as a tool for diagnosis and treatment planning in dentistry	Strongly disagree: 4% Disagree: 13% Neutral: 16% Agree: 33% Strongly agree: 34%	Strongly disagree: 3% Disagree: 8% Neutral: 19% Agree: 23% Strongly agree: 48%	.019*
AI can revolutionize dentistry in general.	Strongly disagree: 3% Disagree: 9% Neutral: 19% Agree: 30% Strongly agree: 40%	Strongly disagree: 5% Disagree: 6% Neutral: 11% Agree: 27% Strongly agree: 50%	.086
If there is disagreement between AI judgment and dentist's judgment, I will follow AI's judgment?	Strongly disagree: 9% Disagree: 9% Neutral: 17% Agree: 27% Strongly agree: 38%	Strongly disagree: 13% Disagree: 8% Neutral: 16% Agree: 17% Strongly agree: 46%	.118
Do you agree that the use of AI should be recommended to fellow practitioners	Strongly disagree: 7% Disagree: 7% Neutral: 17% Agree: 19% Strongly agree: 50%	Strongly disagree: 4% Disagree: 9% Neutral: 15% Agree: 25% Strongly agree: 47%	.288
AI will be helpful to budding dentists in diagnosing and for decision making in difficult clinical situations.	Strongly disagree: 4% Disagree: 8% Neutral: 13% Agree: 33% Strongly agree: 42%	Strongly disagree: 5% Disagree: 7% Neutral: 11% Agree: 25% Strongly agree: 52%	.272
AI can be perceived as a partner rather than a competitor in foreseeable future of dentistry	Strongly disagree: 3% Disagree: 7% Neutral: 14% Agree: 29% Strongly agree: 47%	Strongly disagree: 4% Disagree: 5% Neutral: 14% Agree: 20% Strongly agree: 57%	.176
The incorporation of AI to CBCT analysis will be a valuable addition to diagnosis and treatment planning	Strongly disagree: 2% Disagree: 9% Neutral: 10% Agree: 32% Strongly agree: 47%	Strongly disagree: 4% Disagree: 7% Neutral: 8% Agree: 22% Strongly agree: 59%	.070
Do you think you need more knowledge and information	Definitely not: 3% Somewhat no: 6%	Definitely not: 4% Somewhat no: 5%	.012*

on the applications of AI and ML in dentistry?	Maybe: 27% Somewhat yes: 26% Definitely yes: 38%	Maybe: 21% Somewhat yes: 15% Definitely yes: 54%	
--	--	--	--

Participants from the private and government sectors exhibited contrasting perceptions. In the private sector, participants were less optimistic about AI's potential for quality control systems and diagnostic tools, with significant differences noted ( $p = 0.012$  and  $p = 0.019$ , respectively, Table 5). Government sector participants demonstrated greater confidence in AI's ability to enhance clinical practice, with a higher proportion strongly agreeing on its value in these areas.

Differences in how participants learned about AI were also observed. While both sectors cited web browsing and social media as the primary source, government employees were more likely to report learning about AI through conferences (19%), compared to private sector participants (15%) ( $p = 0.067$ , Table 5). These findings suggest that organizational environments influence exposure to and perceptions of AI.

## DISCUSSION

The present study aimed to assess the knowledge, attitudes, and usage of Artificial Intelligence (AI) and Machine Learning (ML) among dental professionals in Riyadh. A total of 416 participants were included in the study, with a mean age of 37.04 years ( $SD = 9.78$ ). The majority of the participants were clinicians (53.6%), followed by postgraduate students (29.6%) and academicians (16.8%). The gender distribution was skewed towards males (59.6%), and a larger proportion of participants worked in the private sector (56%) compared to the government sector (44%). This demographic diversity allows for an exploration of varying perspectives on AI's application in dentistry. By examining factors such as knowledge of AI applications, concerns, and professional differences, the study provides valuable insights into the current state of AI integration within the field.

### Knowledge of AI

The present study highlights a moderate level of knowledge about AI among participants, with 63% of dentists correctly identifying major AI applications such as Alexa, Siri, and Cortana. However, it also reveals significant gaps in understanding, as 57.7% of participants mistakenly associated AI with computer programming languages rather than the algorithms that simulate human intelligence. This trend is consistent with previous studies, such as Aboalshamat (2022) and Khanagar et al. (2021), which also reported varied levels of awareness and knowledge regarding AI (Aboalshamat, 2022; Khanagar et al., 2021).

Past studies such as those by Sur et al. (2020) and Keser & Pekiner (2021) found a higher proportion of participants in Saudi Arabia, India, and Turkey were aware of AI, with the percentage of correct identification in these countries ranging from 68% in Central India to 71.6% in Saudi Arabia (Sur et al., 2020; Keser & Pekiner, 2021). However, similar to the present study, these past studies noted that while general awareness of AI was prevalent, detailed understanding of its applications in dentistry was often limited. This aligns with findings from the present study, where participants demonstrated knowledge of AI but had little understanding of its practical applications in dentistry.

### Sources of Knowledge

In the present study, participants primarily learned about AI through digital platforms like web browsing and social media (40.4%), followed by newspapers and magazines (26%). Conferences and university lectures were less common sources, which aligns with the results of previous studies such as those by Khanagar et al. (2021), who found that social media was the primary source of information for dental students (Khanagar et al., 2021). This finding suggests that informal, digital sources play a significant role in disseminating knowledge about AI, a trend also noted by Alanizy et al. (2024), who reported that 78.6% of students in Saudi Arabia used social media for learning about AI in endodontics (Alanizy et al., 2024).

Interestingly, past studies have shown more significant reliance on formal sources like university lectures and conferences, particularly in studies conducted in countries like Saudi Arabia and India. For example, Khanagar et al. (2021) found that while 40.9% of participants in Saudi Arabia learned about AI from social media, 20.8% reported gaining knowledge from university lectures, underscoring the role of structured educational settings in knowledge acquisition (Khanagar et al., 2021).

### Attitudes Toward AI

The present study reveals a generally positive attitude toward AI, with participants strongly agreeing that AI could be valuable in enhancing diagnosis and treatment planning, especially in CBCT analysis. However, participants expressed caution when it came to trusting AI's judgment over that of a human dentist. This is consistent with past

studies, which similarly report that while dental students are optimistic about the potential of AI to improve clinical outcomes, they remain hesitant to trust AI completely, especially in situations where it conflicts with human judgment (Khanagar et al., 2021; Alanizy et al., 2024). This reluctance is likely rooted in concerns about AI's reliability and the irreplaceable nature of human expertise in dentistry.

In contrast to the present study, which reports a lower level of agreement regarding the replacement of human dentists by AI, previous studies such as those by Aboalshamat (2022) found that many Saudi dentists were less confident about AI's role in patient care and worried about job displacement. Alwadani et al. (2024) reported that while 45.87% of medical students believed AI would replace some specialties, the attitude toward AI replacing human expertise was more pronounced in the medical field than in dentistry (Alwadani et al., 2024).

### **Concerns about AI**

Concerns about AI were a significant theme in both the present and past studies. In the present study, the primary concern among participants was the reduction of human interaction with patients (33.9%), followed by fears of job replacement (26.7%) and cybersecurity risks (22.1%). These concerns echo the findings of Sur et al. (2020), who identified job replacement as a major concern among dental professionals (Sur et al., 2020). However, concerns regarding data privacy were less pronounced in the present study, suggesting that practical issues such as patient interaction and job security are prioritized over ethical considerations.

In contrast, past studies by Alwadani et al. (2024) and Khanagar et al. (2021) highlighted that concerns over AI's potential to displace human practitioners were more widespread, with nearly half of the participants in some studies fearing job loss. This suggests that while AI's role in healthcare is widely acknowledged, skepticism about its long-term impact on professional roles remains significant (Alwadani et al., 2024).

### **Limitations**

While this study provides important insights, there are several limitations to consider. First, the study's cross-sectional design limits the ability to infer causality between participants' characteristics and their knowledge or attitudes toward AI. Second, the skewed gender distribution (59.6% males vs. 40.4% females) may not be fully representative of the dental profession in Riyadh, potentially affecting the generalizability of the results. Third, while a large proportion of participants were from the private sector (56%), the study's findings may not fully reflect the views of clinicians in the government sector, where exposure to AI applications may differ. Lastly, the reliance on self-reported data may introduce bias, as participants may overestimate their knowledge or comfort with AI.

### **Future Recommendations**

Future studies could address these limitations by employing a longitudinal design to observe changes in AI knowledge and attitudes over time, as AI technology evolves. Additionally, a more balanced gender distribution would enhance the generalizability of the findings to both male and female professionals in the dental field. It would also be valuable to conduct qualitative studies to gain deeper insights into specific concerns or barriers to AI adoption, especially within the government sector. Expanding the scope of the study to include a broader range of regions and dental specialties may also provide a more comprehensive understanding of AI's impact on the profession. Finally, educational interventions, such as targeted training programs, could be designed to bridge knowledge gaps and alleviate concerns about AI replacing human expertise, fostering a more collaborative view of AI in clinical practice.

### **CONCLUSION**

In conclusion, while the present study found generally positive attitudes toward AI in dentistry, with significant awareness and optimism for its clinical applications, similar to past studies, it also highlighted notable gaps in knowledge and concerns about job displacement. Both present and past studies indicate that informal sources, such as social media, are crucial in disseminating knowledge about AI, but formal education and training remain essential for improving understanding and alleviating concerns. Sector-based differences further emphasize the need for tailored educational initiatives and support systems to ensure successful AI integration across various professional environments.

### **REFERENCES**

1. Abouzeid HL, Chaturvedi S and Abdelaziz KM (2021) Role of robotics and artificial intelligence in oral health and preventive dentistry - knowledge, perception and attitude of dentists. *Oral Health & Preventive Dentistry* 19:353-363. DOI: 10.3290/j.ohpd.b1693873
2. Aboalshamat KT (2022) Perception and utilization of artificial intelligence (AI) among dental professionals in Saudi Arabia. *Open Dentistry Journal*, 16: 1-7. DOI: 10.2174/18742106-v16-e2208110

3. Alwadani FAS, Lone A, Hakami MT, Moria AH, Alamer W, Alghirash RA, Alnawah AK and Hadadi AS (2024) Attitude and understanding of artificial intelligence among Saudi medical students: an online cross-sectional study. *Journal of Multidisciplinary Healthcare*, 17: 1887. Doi: 10.2147/JMDH.S455260
4. Alanizy SO, Alanazi OAF, Dutta SD and Alsalem R (2024) Knowledge and attitude of dental students toward the role of artificial intelligence in endodontics in dental clinics at Qassim Region, Saudi Arabia. *Journal of International Dental & Medical Research*, 17(3): 1207-1213. Doi:10.7759/cureus.27405.
5. Aboalshamat K, Alhuzali R, Alalyani A, Alsharif S, Qadhi H, Almatrafi R, Ammash D and Alotaibi S (2022) Medical and dental professionals readiness for artificial intelligence for Saudi Arabia Vision 2030. *International Journal of Pharmaceutical Research and Allied Sciences* 11(4):52-59. DOI: 10.51847/NU8y6Y6q1M
6. AlBaker AM, Al-Ruthia, YSH, AlShehri M and Alshuwairikh S (2017) The characteristics and distribution of dentist workforce in Saudi Arabia: A descriptive cross-sectional study. *Saudi Pharmaceutical Journal* 25(8):1208-1216. DOI: 10.1016/j.jsps.2017.09.005
7. Allam AH, Eltewacy NK, Alabdallat YJ, Owais TA, Salman S and Ebada MA (2024) Knowledge, attitude, and perception of Arab medical students towards artificial intelligence in medicine and radiology: A multi-national cross-sectional study. *European Radiology* 34(7):1-14. DOI: 10.1007/s00330-023-10509-2
8. Chen YW, Stanley K and Att W (2020) Artificial intelligence in dentistry: current applications and future perspectives. *Quintessence International* 51:248-257. DOI: 10.3290/j.qi.a43952
9. Deshmukh S (2018) Artificial intelligence in dentistry. *Journal of International Clinical Dentistry Research Organization* 10:47. DOI: 10.4103/jicdro.jicdro\_17\_18
10. Doğaner A (2021) The approaches and expectations of the health sciences students towards artificial intelligence. *Karya Journal of Health Sciences* 2(1):5-11. DOI: 10.2174/18749445-v15-e2203290
11. Keser G, and Pekiner FMN (2021) Attitudes, perceptions and knowledge regarding the future of artificial intelligence in oral radiology among a group of dental students in Turkey: a survey. *Clinical and Experimental Health Sciences*, 11(4): 637-641. doi:10.33808/clinexphealthsci.928246
12. Khanagar S, Alkathiri M, Alhamlan R, Alyami K, Alhejazi M and Alghamdi A (2021) Knowledge, attitudes, and perceptions of dental students towards artificial intelligence in Riyadh, Saudi Arabia. *Medical Science*, 25(114): 1857-1867. DOI: 10.2174/18742106-v16-e2208110
13. Sur J, Bose S, Khan F, Dewangan D, Sawriya E and Roul A (2020) Knowledge, attitudes, and perceptions regarding the future of artificial intelligence in oral radiology in India: a survey. *Imaging Science in Dentistry*., 50(3): 193-198. DOI: 10.5624/isd.2020.50.3.193
14. Yu KH and Kohane IS (2019) Framing the challenges of artificial intelligence in medicine. *BMJ Quality & Safety* 28(3):238-241. DOI: 10.1136/bmjqs-2018-008551
15. Yüzbaşıoğlu E (2021) Attitudes and perceptions of dental students towards artificial intelligence. *Journal of Dental Education* 85(1):60-68. DOI: <https://doi.org/10.1002/jdd.12385>