

"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

Running Title: KAP About Artificial Intelligence (AI) Among Dental Health Professionals

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ABSTRACT:

Background: Recent studies have demonstrated effectiveness of Artificial Intelligence in healthcare education, highlighting its role in enhancing personalized learning through improved communication skills and greater student engagement. Assessing knowledge, attitude, and practice of dental healthcare professionals regarding usage of Artificial Intelligence (AI) and Artificial Intelligence in dentistry provides insights from them on this evolving digital era and its role in modernizing patient care. Artificial Intelligence supports teaching, learning, and clinical decision-making; therefore, assessing awareness and educating dentists about these advancements is essential.

Aim: To assess knowledge, attitude and practices regarding Artificial Intelligence among dental healthcare professionals.

Methodology: A questionnaire study was conducted among 246 dental healthcare professionals. Questionnaire consisted of four components (demographic profile, knowledge, attitude and practice). Data collected was compiled, and entered in MS excel sheet. Percentages were calculated using IBM SPSS software (version 22.0 Chicago IL, USA).

Results: Results obtained from this study show that 59.13% participants have adequate knowledge of Artificial Intelligence among which 57.54% show high attitude about its usage in clinical practice, whereas its practice is only 15.87%. Indicating, adequate knowledge and attitude regarding Artificial Intelligence but practice is low. Karl Pearson correlation coefficient between knowledge, attitude and practice gives very high statistical significance with p-value of 0.0001*(p<0.05).

Conclusion: Our study concludes that, in dental healthcare profession also knowledge and attitude about Artificial Intelligence is adequate but clinical practice is low. This study recommends for providing more education and hands on workshop about usage of Artificial Intelligence among dental healthcare professionals.

Keywords: AI, Artificial Intelligence, Dental Healthcare Professionals, Perception, Recent Advances.

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"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

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INTRODUCTION:

The idea of Artificial Intelligence (AI) was conceived in the year 1943, but the term was coined by John McCarthy at a conference in the year 1956, and the concept revolved around manufacturing machines that could replicate the tasks done by mankind. AI is a complex term to define, but in the larger sense, it is a machine algorithm that can reason out and execute cognitive functions.[1]

With the rapid integration of AI in healthcare, language-based models such as Artificial Intelligence have become increasingly prevalent. Artificial Intelligence is an advanced language model that uses deep learning methods to generate answers to inputs that resemble those of humans. The widely used and accessible Artificial Intelligence is an example of the wide-ranging interest and scrutiny received in academia and among medical practitioners.² In academic dentistry, AI models have been found to help and assist dental researchers in having better literature writing and scientific development.³ In the field of dentistry, Artificial Intelligence can provide services in areas such as digital data recording, image analysis, diagnosis and treatment planning, dental telemedicine, dental education and patient education. The ultimate ability to improve patient care and make precise diagnoses of illnesses has revolutionized the world of healthcare .[1] This can increase the accuracy, efficiency, and effectiveness of patient care whilst minimizing the clinical workload and cost.[3] Technological advances have led both healthcare profession also and patients to increasingly turn to Artificial Intelligence as a convenient source for medical and dental information.[4]

Despite its growing potential, studies have reported variable awareness and understanding of AI and Artificial Intelligence among dental professionals. While some investigations show moderate awareness among dental students, others highlight limited knowledge about its ethical use, accuracy, and reliability in clinical decision-making. [5,6] This variation indicates a need to evaluate the current level of awareness and adoption among dental healthcare professionals.

When a literature search was conducted over the past two months, a clear lacuna in research articles addressing the use of Artificial Intelligence and AI among dental healthcare professionals was identified. Hence, this study was designed with the objective of assessing the knowledge, attitude, and practice of dental healthcare

professionals regarding the use of Artificial Intelligence in dentistry.

MATERIALS AND METHOD:

Present study was a cross sectional questionnaire study conducted by Department of Pediatric and Preventive Dentistry among dental healthcare professionals who are willing to participate in study and who did not give their consent to participate in study was excluded. Sample size of 246 was calculated using sample size formula () based on previous studies.[7] Ethical approval was obtained from institutional review board (Registration no. EC/NEW/INST/2021/2435). Questionnaires were obtained from different published articles and questions were condensed to 16 items covering various aspects regarding Artificial Intelligence and its impact. Experts reviewed questionnaire to ensure content validity. Questionnaire had 4 components. First part included demographic profile of participants, second part included knowledge, third part consisted attitude and last part included practices of dental healthcare professionals. [Table No.1] A set of questions was presented to dentists to assess their knowledge, attitude, and practices about Artificial Intelligence in dental healthcare. The responses were collected using a five-point Likert scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree).

Prior to data collection, instructions were given to the participants; questionnaire was distributed as Google forms and written forms. Willing subjects were invited to gather in a lecture hall at convenient date and time. Written informed consent was obtained from all participants before giving the questionnaire. Clear instructions were provided, and sufficient time was given for completion. The completed questionnaires were then collected and the surveys were kept anonymous.

Data was analyzed and Cronbach alpha co-efficient was calculated to test reliability and alpha value of 0.82 was obtained, indicating good internal consistency of the questionnaire. Later, collected data was entered in MS Excel sheet (Microsoft Corp.) and was subjected to statistical analysis using IBM SPSS software (version 22.0 Chicago IL, USA).

RESULTS:

The study included responses from 251 individuals across different age groups and genders. Majority of individuals i.e. 79.76% belonged to the age group of 21-30 yrs. In gender distribution females had a high count of about 63.49%, while male contributed percentage of 36.51%. Regarding professional status, numbers of undergraduate respondents were 47.22%, followed by postgraduates

"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

35.71%, dental practitioner 8.73% and faculty 8.33%. The data was statistically analyzed using IBM SPSS software (version 22.0 Chicago IL, USA) and 'p' value of <0.05 was taken as significant.

The levels of knowledge in relation to age groups, gender, and qualification were evaluated using the Chi-square test. About 85.71% of the dentists were aware of Artificial Intelligence, while 14.28% were not aware of Artificial Intelligence. Among the respondents, 81.75% agreed that Artificial Intelligence could play a role in enhancing education, data recording, decision-making, diagnosis, and treatment planning in patient care, while 18.25% disagreed. Furthermore, 66.27% of dentists considered Artificial Intelligence to be advantageous, convenient, time-saving, and accurate in addressing their queries, whereas 33.73% did not share this view. About 70.24% of dental healthcare professionals expressed willingness to incorporate artificial intelligence tools such as Artificial Intelligence into the dental education curriculum, while 29.76% were unwilling to do so. 69.84% of the dental healthcare respondents were aware of ethical risks of using AI in healthcare practice whereas 30.15% were not aware. [Figure no.1] The calculated values of levels of knowledge stated that 59.13% of respondents have adequate knowledge of Artificial Intelligence while 34.92% of them have moderate knowledge and low knowledge levels were seen in 5.95% of them.[Figure no.2]

Association between levels of knowledge and age was found to be highly statistically significant with a chi-square value 21.5260 and 'p' value of 0.001* ($p < 0.05$) whereas there was no statistical significance between knowledge and gender with a chi-square value of 0.3750 and 'p' value of 0.8290. Statistical significance was found between knowledge and qualification showing a chi-square value 21.5260 and 'p' value of 0.002* ($p < 0.05$). [Table 2] On performing multiple logistic regression, it revealed that there was a statistical significance between knowledge and age group of 21-30 yrs. with odds ratio being 23.57 and 'p' value of 0.0001* ($p < 0.05$). No significant association was found between knowledge and gender with a 'p' value of 0.0650. No significant association was found between knowledge and qualification with a 'p' value of 0.8230 in post graduates, 'p' value of 0.4980 in faculty and 'p' value of 0.0810 in dental practitioners. [Table no.3]

Evaluation of levels of attitude in dental healthcare professionals was done with Chi-square test. A total of 80.16% of respondents agreed that they would seek more knowledge about updated versions of Artificial Intelligence on iOS and Android platforms, while 19.84% disagreed. Similarly, 63.49% of dentists believed that Artificial

Intelligence could improve communication with pediatric patients and parents, whereas 36.51% did not. 70.63% of respondents felt that using Artificial Intelligence might provide ready-made answers, thereby reducing intellectual effort and critical thinking, while 29.37% disagreed. Furthermore, 84.12% of dentists considered Artificial Intelligence a supportive tool but emphasized that it cannot replace the clinical judgment of qualified dental healthcare professionals, while 15.88% disagreed. Lastly, 51.59% of dental healthcare professionals expressed concern that AI might replace certain roles in healthcare in the future, whereas 48.41% did not share this concern. [Figure no.1] Evaluation of levels of attitude revealed that 57.54% of dental healthcare professionals have high attitude, followed by 36.11% showing moderate attitude and 6.35% show low attitude towards use of Artificial Intelligence in healthcare practice. [Figure no.2]

Association between attitude and age was not statistically significant with a chi-square value of 11.0720 and 'p' value of 0.0860. No statistical significance is observed between attitude and gender with a chi-square value of 4.8050 and 'p' value of 0.0900. No statistical significance is observed between attitude and qualification with a chi-square value of 10.7350 and 'p' value of 0.0970. On performing multiple logistic regression, it revealed that there is very high statistical significance in association between attitude and age group of 21-30 yrs. with an odds ratio of 8.46 along with 'p' value of 0.0001* ($p < 0.05$). High statistical significance is also seen in association between attitude and gender with an odds ratio of 3.88 along with 'p' value of 0.0030* ($p < 0.05$). No significant association was found between attitude and qualification with a 'p' value of 0.3420 in post-graduates and 'p' value of 0.6870 in faculty and 'p' value of 0.2850 in dental practitioner. [Table no.2]

The levels of practice in relation to age groups, gender, and qualification were evaluated using the Chi-square test. Among the respondents, 54.36% reported that they use Artificial Intelligence in their daily professional work, while 45.63% do not use Artificial Intelligence. A total of 39.29% used Artificial Intelligence to educate patients or parents about oral diseases, whereas 60.72% chose not to. 39.28% of the respondents experienced challenges while using Artificial Intelligence, whereas 60.72% did not encountered such issues. Additionally, 31.35% believed that patient health and emotional requirements are solely driven by AI-generated recommendations, whereas 68.65% disagreed. 35.72% of dental healthcare professionals felt that information generated by Artificial Intelligence could be considered for diagnosis and treatment planning, while the remaining 64.29% opposed this view.

"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

Furthermore, 70.64% of dentists recommended using Artificial Intelligence to stay updated with the latest healthcare advancements, whereas 29.36% did not recommend it.[Figure no.1] The data obtained from evaluation of levels of practice shows that, only 15.87% good practice of Artificial Intelligence among dental healthcare professionals, average practice rates 59.52% and 24.60% is poor practice rate. [Figure no.2]

Association between levels of practice and age was not significant with a chi-square value of 9.2750 and 'p' value of 0.1590. No statistical significance is seen between practice and gender with a chi-square value of 0.3690 and 'p' value of 0.8310. No statistical significance is seen between practice and qualification with a chi-square value of 11.605 and 'p' value of 0.0710. The study of multiple logistic regression here suggests that there is a statistically significant association between good practice and age group of 21-30 yrs. with an odds ratio of 4.78 and 'p' value of 0.0001*($p < 0.05$). No significance is seen between good practice and gender with an odds ratio of 1.10 and 'p' value of 0.7380, whereas statistical significance is seen between good practice and dental practitioners with an odds ratio of 0.33 and 'p' value of 0.0420*($p < 0.05$) whereas no statistical significance is seen for post-graduates with an odds ratio of 0.56 and 'p' value of 0.1110 and faculty with an odds ratio of 1.05 and 'p' value of 0.9500($p < 0.05$).[Table no.3]

Correlation between knowledge, attitude and practice scores are studied by Karl Pearson Correlation Coefficient, it shows a linear graph with steady rise indicating a very high statistically significant correlation between knowledge and attitude with a 'r' value of 0.6121 and 'p' value of 0.0001*($p < 0.05$). Similarly, the Karl Pearson Correlation Coefficient shows very high statistical significance between knowledge and practice with a 'r' value of 0.4527 and 'p' value of 0.0001*($p < 0.05$). The correlation between attitude and practice also shows very high statistical significance with a 'r' value of 0.4207 and 'p' value of 0.0001*($p < 0.05$).[Figure no.3]

DISCUSSION:

Artificial Intelligence is a recent technological advance that has swiftly acquired traction in the field of science and technology.[1] Artificial Intelligence, an AI program that generates text in response to written instructions has become quite popular as indicated by its availability on the web through open AI.[2] Rahul h et al. study emphasizes that Artificial Intelligence can offer a wide range of educational and healthcare services. For instance, it can assist students academically by answering questions and simplifying complex topics, thereby enhancing their understanding. As a teaching

tool, it has the potential to transform the way students learn biomedical sciences.[8] Belaldavar et al's study suggests that one promising application of Artificial Intelligence in dentistry is its use in developing clinical decision support systems. Such systems can analyze patient data and provide recommendations for managing pain and other oral health conditions. In this study, many participants believed that Artificial Intelligence could assist with promptly responding to patient inquiries, translating languages, explaining dental procedures in detail, and offering post-treatment instructions such as do's and don'ts. Since Artificial Intelligence relies on Natural Language Processing (NLP) to understand and interpret human language, it serves as an effective communication tool for patients who speak different languages. Moreover, Artificial Intelligence offers distinct advantages in dental practice, including 24/7 real-time assistance, enabling users to access information and support more efficiently.[2]

Marwa et al stated that beyond educational applications, research has also explored Artificial Intelligence's accuracy and usefulness across multiple dental specialties. Studies have assessed the model in fields such as oral surgery, preventive dentistry, oral cancer, and oral and maxillofacial radiology. Findings indicate that Artificial Intelligence performs strongly in tasks like identifying radiographic landmarks and advising on preventive care. However, its performance declines when addressing more specialized or complex tasks, including postoperative instructions and detailed pathology.[9] Gugnani's study tells us that responses generated by Artificial Intelligence to the queries raised by parents regarding concerns about their child's oral health were generally logical, comprehensive, and clearly expressed, with very few instances of "hallucination". These findings suggest that Artificial Intelligence can serve as a valuable tool and may be effectively integrated as a chatbot within health-related platforms to provide accessible information to patients and parents.[10] Ethical and legal challenges also represent a major barrier to implementation. Since Artificial Intelligence functions based on pre-existing data, there is a potential risk of misinformation or bias, which could influence clinical decisions if not properly validated. Therefore, it is crucial that dental professionals use Artificial Intelligence as a supportive tool rather than a replacement for clinical judgment.[11]

In the present study, higher levels of knowledge, attitude, and practice were observed among participants aged 21–30 years, with dental practitioners demonstrating comparatively greater practical application of Artificial Intelligence in their clinical workflow. Whereas for overall dental healthcare professionals in spite of the increased

"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

awareness and knowledge about Artificial Intelligence, its integration into daily clinical practice remains limited. This may be attributed to concerns related to data privacy, accuracy of responses, and the absence of professional training on AI-based systems. Several studies have emphasized the importance of developing guidelines and educational programs to facilitate the safe use of Artificial Intelligence in healthcare.[12,13] Results of our study is similar to a study conducted by Morris et al. which states that younger age groups have been consistently reported to demonstrate greater familiarity, confidence, and adaptability toward modern technologies compared to older individuals. This difference is largely attributed to early and continuous exposure to digital tools, which enhances perceived ease of use and willingness to adopt new technologies. In contrast, older age groups, despite possessing greater professional and clinical experience, may show comparatively lower levels of technology adoption due to later exposure and increased cognitive or usability barriers. These generational differences highlight the need for strategies that combine the technological proficiency of younger individuals with the experiential knowledge of older professionals to optimize education and service delivery.[14]

Furthermore, future research should focus on evaluating the reliability of Artificial Intelligence-generated responses for clinical decision-making, developing dentistry-specific AI models trained on verified datasets, and integrating AI with electronic dental record systems. This will help in optimizing workflow efficiency, enhancing diagnostic precision and ensuring responsible use of AI in dentistry. This study has some limitations including its restriction to specific regions, which may limit the generalization of the findings to the entire dental population, as well as the reliance on subjective responses that may change over time.

CONCLUSION:

Our study concludes that, knowledge levels are higher among the younger age group compared to the older age group. Therefore, integrating the technological skills of younger generation with the extensive clinical experience of older age groups can enhance teaching effectiveness, improve learning outcomes, and ultimately lead to better patient care.

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TABLES:

Table 1: Table 1 showing the Questionnaire used in the study.

KNOWLEDGE
1. Do you have knowledge about usage of Chat GPT?
2. Do you know Chat GPT could have role in enhancing education, data recording, decision making, diagnosis, and treatment plan in patient care?
3. Do you think Chat GPT is advantageous, convenient, time saving and gives accurate responses to your problems?
4. Should artificial intelligence tools such as Chat GPT be adopted into the dental education curricula?
5. Are you aware of potential ethical risks of using AI in health care practice?
ATTITUDE
6. Will you make an attempt to get more knowledge about different upgraded versions of Artificial Intelligence on iOS and android platforms?
7. Do you think Artificial Intelligence helps you to improvise your communication with pediatric patients and parents?
8. Do you feel the usage of Artificial Intelligence will search and display readymade answers, which reduces intellectuality and thinking capabilities?
9. Do you think Artificial Intelligence serves as supportive tool but cannot replace the clinical judgment of a qualified dental health care professional?
10. Are you concerned that AI could replace certain roles of healthcare professionals in the future?

PRACTICE

11. Currently are you using Artificial Intelligence for day to day work in your profession?
12. Do you use Artificial Intelligence to educate patient or parent regarding oral diseases?
13. Have you faced any challenges while using Artificial Intelligence app?
14. Do you think patient's health and emotional requirements are solely driven by AI-generated recommendations?
15. Do you feel information generated by Artificial Intelligence can be considered for diagnosis and treatment plan in patient?
16. Should Chat GPT be used to stay updated with latest advancements in healthcare?

Table 2: Table showing the Association Between Levels of Knowledge with Age, Gender and Qualification.

*p<0.05

Table 3: Table showing the Multiple Logistic Regression Analysis of Adequate Knowledge, Attitude and Practice with Age Groups.

Levels of knowledge	Inadequate		Moderate		Adequate		Total	%	χ ²	p-value
	n	%	n	%	n	%				
Age groups										
≤20yrs	1	5.88	6	35.29	10	58.82	17	6.75	21.526	0.0010*
21-30yrs	7	3.48		31.83	126	62.69	201	79.76		
31-40yrs	1	9.09	3	45.45	5	45.45	11	4.37		
>=41yrs	6	26.09	9	39.13	8	34.78	23	9.13		
Gender										
Male	6	6.52	30	32.61	56	60.87	92	36.51	0.375	0.829
Female	9	5.63	58	36.25	93	58.13	160	63.49		
Qualification										
DG	4	3.36	38	31.93	77	64.71	119	47.22	21.256	0.0020*
PG	4	4.44	30	33.33	56	62.22	90	35.71		
Faculty	2	9.52	8	38.1	11	52.38	21	8.33		
Dental practitioner	5	22.73	12	54.55	5	22.73	22	8.73		
Total	15	5.95	88	34.92	149	59.13	252	100		

Characteristics	OR	95% CI for OR		p-value	21-30yrs	8.46	3.45	20.78	0.0001*
		Lower	Upper		31-40yrs	4.52	0.32	62.99	0.2620
(Knowledge)Age groups					>=41yrs	2.66	0.38	18.58	0.3230
<=20yrs	Ref.				(Practice)Age groups				
21-30yrs	23.57	6.85	81.06	0.0001*	<=20yrs	Ref.			
31-40yrs	10.09	0.67	151.36	0.0940	21-30yrs	4.78	2.56	8.94	0.0001*
>=41yrs	2.01	0.29	13.83	0.4770	31-40yrs	1.75	0.37	8.32	0.4840
(Attitude)Age groups					>=41yrs	1.63	0.43	6.25	0.4750
<=20yrs	Ref.								

FIGURES:

"Assessments of Knowledge, Attitude and Practice About Artificial Intelligence (AI) Among Dental Healthcare Professionals: A Cross-Sectional Questionnaire Study"

Figure 1: Graph showing the Question wise responses of respondents (Dental Health Professionals) about Artificial Intelligence.

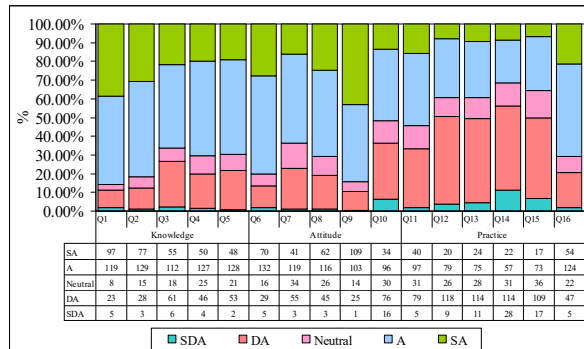


Figure 2: Graph showing the Levels of Knowledge, Attitude and Practice of Artificial Intelligence among Dental Health Professionals

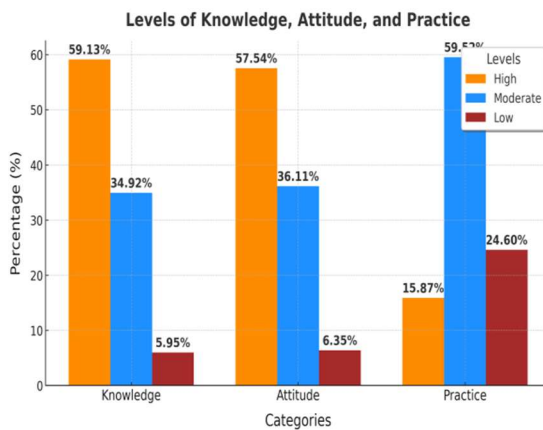
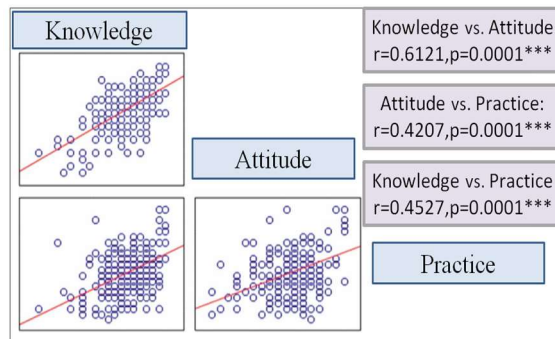


Figure 3: Scatter Diagram Showing Karl Pearson Correlation coefficient between Knowledge, Attitude and Practice Scores about Artificial Intelligence among Dental Health Professionals.



* $p<0.05$