Original Article

Knowledge, Attitudes And Perceptions Of Intern And Dental Practioners In Saudi Arabia Towards Artificial Intelligence

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Abstract

Background: Artificial Intelligence, has evolved as a reality in the field of healthcare. Incorporation of AI in healthcare industry dates back to early 1950s, when health professionals attempted to improve their analysis by means of computer-assisted programs.

AI may aid in proper diagnosis of a wide array of dental diseases like aphthous ulcer, internal derangement of the temporomandibular joint, identification of patients with high propensity to develop oral premalignant lesions and conditions or oral cancers, may be incorporated as patient management software, managing patients follow up and online emergency health consultancy, etc.

Despite its promises, dental practitioners have mixed thoughts and perception regarding the implementation of AI.

Objectives: The current study was thus conducted to evaluate the responses of interns and dental surgeons from Saudi Arabia regarding their knowledge, attitudes, and perceptions regarding the future of AI.

Methodology: The present study was conducted on 200 interns and dental practitioners studying or practicing in KSA. A structured questionnaire comprising of 15 closed-ended questions was circulated among interns and dental practitioners.

The survey included questions pertaining to participant's knowledge, attitude towards AI and their perceptions regarding the future of AI in dentistry. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. The readings were recorded in master chart, and the data analysis was carried out statistically.

Results: The study was conducted on 200 candidates' interns and dental practitioners studying or practicing in KSA. 148 candidates (74%) were familiar with the concept of artificial intelligence. 129 candidates (64.5%) were aware of the application of AI in medical and dental field.

Major chunk of the study sample (n=160, 80%) agreed to all the benefits of AI including faster diagnosis, ability to retrieve clinically relevant high quality data and minimal error. According to 171 candidates (85.5%), application of AI would be valuable. 158 candidates (79%) agreed with the ability of AI to evaluate fine details on radiograph often missed by practitioners. Only 89 candidates (44%) agreed that the diagnostic ability of AI is better than clinical experience of doctor.

Conclusion: The present study concluded that dental professionals were familiar with the concept of AI. AI technology can be used as an ancillary tool to augment diagnostic precision and treatment planning. Educational workshops in form of lecture and seminars must be structured for a better understanding, development, implementation and use of AI in dentistry.

Key Words: artificial intelligence, healthcare, interns, dental practitioners, technology

INTRODUCTION

The term Artificial Intelligence was coined in 1950 and is also referred to as machine intelligence. AI which once implied like a sham, has evolved as a reality in the field of healthcare. It is a prompt poignant technology that facilitates the devices to carry out tasks formerly restricted to mankind.[1] It may be effectively described as recreation of human intelligence processes by virtue of computer systems.[2] It is a unique amalgamation of human intelligence with computer technology to augment the prospective to serve better in every domain. The fruition of AI makes the scrutiny of huge data achievable, thereby endowing unswerving information and improvement in the managerial process.[3]

AI usually emulates machinery assisted by human aptitude, like thinking, erudition, adaptation, engagement, and sensory indulgence. Incorporation of AI in healthcare industry dates back to early 1950s, when health professionals attempted to improve their analysis by means of computer-assisted programs.[4] The need for healthcare services is on a surge with a scarcity of healthcare professionals globally. Evidence supports that AI facilitates healthcare authorities with a wide array of tasks ranging from secretarial metadata handling to clinical documentation in conglomeration with focused support in terms of image analysis, apparatus mechanization, patient monitoring, correlating symptoms with categorization and prognosis of the disease.[5]

Forbes in 2018 stated that most valuable indications of AI for healthcare purposes would be administrative workflows, image analysis, robotic surgery, virtual assistants, and clinical assessment support. AI base expertise will serve a significant part in helping people stay healthy by incessant monitoring and training and will also guarantee prompt diagnosis, bespoke therapeutic modalities and an added benefit of proficient follow-ups.[6]

The use of AI has been incorporated in dentistry to offer value-based care, beside predicting and preventing the prevalence of dental complications. Dentistry has evolved its path from being a pure statistical tool to a more superior data-driven and robotic technology. AI has an immense potential to identify and diagnose oral lesions, which may not be detected by human eye, thereby making its role pivotal in the field of dentistry.[7]

AI advancements have the potential to ease postoperative complications, improve quality of life, improve decision-making, and reduce the number of unnecessary surgical intervention in health care. Various AI methodologies applied in dentistry are namely artificial neural networks, genetic algorithms and fuzzy logic.[8] Artificial neural network aids in proper diagnosis of a wide array of dental diseases like aphthous ulcer, internal derangement of the temporomandibular joint, identification of patients with high propensity to develop oral premalignant lesions and conditions or oral cancers, predicting the dimensions of impacted teeth, etc. AI may be incorporated as patient management software, managing patients follow up and online emergency health consultancy, fabrication of customized orthodontic aligners, designing inlays, onlays, crowns and bridges, etc.[9]

Despite its promises, dental practitioners have mixed thoughts and perception regarding the implementation of AI. The current study was thus conducted to evaluate the responses of interns and dental surgeons from Saudi Arabia regarding their knowledge, attitudes, and perceptions regarding the future of AI.

MATERIALS AND METHODS

The present study was conducted on 200 interns and dental practitioners studying or practicing in KSA. A structured questionnaire was designed using Google forms which comprised of 16 closed-ended questions and the link was circulated among interns and dental practitioners.

The survey included questions pertaining to participant's knowledge, attitude towards AI and their perceptions regarding the future of AI in dentistry. Participants were informed about goals of survey and were given brief description of AI in the preface of the questionnaire. The content validity of survey was verified by researchers.

Ethical approval was received from the Institutional Review Board and all the procedures in this study were in compliance with the Helsinki Declaration. Participation was voluntary; data fortification and confidentiality was guaranteed.

Statistical Analysis: Data was analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Descriptive statistics was performed by calculating mean, standard deviation, frequencies and percentages for the Continuous variables. Categorical variables were summarized as frequencies and percentages. Shapiro Wilk test was used to check whether the continuous variables were following normal distribution or not. Inferential statistics for the categorical variables was done using chi-square test. The suitable non-parametric test was used where the data does not follow the normal distribution. Level of statistical significance was set at p-value less than or equal to 0.05.

RESULTS

The study was conducted on 200 candidates' interns and dental practitioners studying or practicing in KSA. The study comprised of 100 males (50%) and 100 females (50%). 102 out of the study sample were interns (51%); whereas 98 were dental practitioners (49%).

Approximately 99 candidates did not mention about their years of expertise in the survey. Out of 101 candidates, majority of the candidates (n=57, 28.5%) had 0-5 years of experience, followed by 26 candidates possessing (13%) more than 10 years of experience

148 candidates (74%; 74 interns and 74 practitioners) were familiar with the concept of artificial intelligence. 129 candidates (64.5%; 64 interns and 65 practitioners) were aware of the application of AI in medical and dental field. Enquiring on the finest means to gain knowledge about AI in dental fraternity was by means of workshops and conferences by majority of the candidates (n=118; 59%; 59 interns and 59 practitioners), followed by internet and peers.

Major chunk of the study sample (n=160, 80%) agreed to all the benefits of AI including faster diagnosis, ability to retrieve clinically relevant high quality data and minimal error. According to 171 candidates (85.5%), application of AI would be valuable. 158 candidates (79%; 87 interns and 73 practitioners) agreed with the ability of AI to evaluate fine details on radiograph often missed by practitioners. Interns had a more positive feedback over the practitioners pertaining to advantages of AI.

Only 89 candidates (44%; 56 interns and 33 practitioners) agreed that the diagnostic ability of AI is better than clinical experience of doctor. Majority of interns agreed that the diagnostic ability is better in comparison to practitioners.

Majority of the candidates (n=158, 79%; 81 interns and 77 practitioners) stated that they would recommend their peers and fellow members to incorporate AI into their practice. 150 candidates (75%; 76 interns and 74 practitioners) agreed that AI must be integrated as an element of undergraduate training program. 156 candidates (78%; 83 interns and 73 practitioners) stated that they may use AI technology while making diagnosis and treatment planning. Majority of the candidates (n=145; 72.5%; 81 interns and 64 practitioners) believe that AI technology would be useful in all of the following including diagnosis, predicting treatment outcomes, minimizing errors, direct treatment (including surgeries with robots). The response of dental interns was more promising than practitioners.

University hospitals and specialized centers should be the first to commercialize AI as per the study group (48 interns and 30 practitioners). 146 (73% candidates; 73 interns and 73practitioners) think that AI has a future amongst emerging dental practitioners in Saudi Arabia. All the findings are mentioned in below table at the end of this manuscript.

DISCUSSION

The role of AI in the field of healthcare is pivotal; so is its involvement in the field of oral health. The study was conducted on 200 candidates practicing or studying in Kingdom of Saudi Arabia to assess knowledge, perceptions and attitudes about AI among them.

The present study reflects that majority of the participants (n=160, 80%) conceded with the role of AI in the field of oral health. In the present study, 148 candidates (74%) were familiar with the concept of artificial intelligence and 129

(64.5%) were aware of the application of AI in medical and dental field. Our findings were in concordance with the one conducted by *Abouzeid et al* who in their study acknowledges that majority of the candidates agreed that AI is valuable for oral health.[10]

Major chunk of the study sample (n=160, 80%) agreed to all the benefits of AI including faster diagnosis, ability to retrieve clinically relevant high quality data and minimal error. A study conducted by *Sur et al* stated that the advantages of using AI are its ability to quickly obtain vast amounts of clinically relevant, high-quality data in real time, speed up processes in health care and decrease the number of medical errors.[11]

158 candidates (79%) agreed with the ability of AI to evaluate fine details on radiograph often missed by practitioners. *Pakdemirli et al* in their research avowed that AI has been a basis of vast modernization and a major topic of debate within radiological societies and ground-breaking research in recent years.[12]

A study conducted by *Wong et al* recommended that AI has the likely hood to revolutionize the setting of modern clinical radiology to be able to keep up with future developments.[13] Only 89 candidates (44%) agreed that the diagnostic ability of AI is better than clinical experience of doctor. Our results were in concordance with the views of Asmatahasin et al.[14] Mupparapu et al. pointed out that dentists could gain from the opulence of having a second opinion in nanoseconds with the use AI technologies, which may in turn augment the diagnosis and finally help patients.[15]

150 candidates (75%) agreed that AI must be integrated as an element of undergraduate training program. Hosny et al in their research stated that the use of AI as a teaching apparatus has increased exponentially and the students conferred about their interests to learn the technology could be evaluated from their assenting response about learning about the same by means of lectures, workshops, working in a team with a robot being a one of the participant or a trainer. This demands the need of a well defined curriculum, learning material and training.[16]

Majority of the candidates in our study strongly consider that AI technology would be valuable in diagnosis, predicting treatment outcomes, minimizing errors, direct treatment. The overall acuity of this study was positive towards AI. 146 (73% candidates) think that AI has a future amongst emerging dental practitioners in Saudi Arabia.

AI plays an important role in the field of healthcare as it promises to improve health in many ways including the oral health. AI is are expected to perk up the accuracy of diagnosis, offer envisioned anatomic guidance for therapy, simulate probable results, and project the occurrence and prognosis of oral diseases. It is of prime importance to be aware of the feasibility to incorporate AI technology for a gratifying and successful practice.

Limitations of the present study included a smaller sample size. These studies should be carried out in association with the government authorities aiming a larger sample size in order to attain a perception and attitudes of all the working dental professionals. Another limitation is that the dental curriculum does not include AI content, thereby; this basic questionnaire might be insufficient to generalize the theory. The study was carried out only on interns and practitioners and did not include post graduates and specialists.

CONCLUSION

It could be concluded that that dentistry can significantly gain from the contemporary growth of digital human-centered mechanization and be reallocated towards a robotic, AI enable epoch. In coming years, AI will surely improve dependability, reproducibility, precision and effectiveness in dentistry through the standardized use of up to date dental technologies, such as medical robot systems.

AI will enhance our perception of disease pathogenesis, make the risk-assessment-policies get better, help in prompt and accurate diagnosis, disease prediction and thereby lead to better treatment outcomes. Educational workshops in form of lecture and seminars must be structured for a better understanding, development, implementation and use of AI in dentistry.

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TABLE

Parameters		**Dental intern**		**Practitioner**		**Total**	
		Count	Column N%	Count	Column N%	Count	Column N%
Gender	Female	60	58.8%	40	40.8%	100	50.0%
	Male	42	41.2%	58	59.2%	100	50.0%
	No	16	15.7%	11	11.2%	27	13.5%

Familiarity with the concept of artificial intelligence	Yes	74	72.5%	74	75.5%	148	74.0%
	Maybe	12	11.8%	13	13.3%	25	12.5%
Awareness with the application of Artificial Intelligence in medical and dental field	No	17	16.7%	23	23.5%	40	20.0%
	Yes	64	62.7%	65	66.3%	129	64.5%
	Maybe	21	20.6%	10	10.2%	31	15.5%
Distribution of the sources of information about the artificial intelligence	Workshops & conferences	59	57.8%	59	60.2%	118	59.0%
	Fellow dentist	3	2.9%	11	11.2%	14	7.0%
	Internet	40	39.2%	28	28.6%	68	34.0%
Distribution of the sources of information about the artificial intelligence	Workshops & conferences	59	57.8%	59	60.2%	118	59.0%
	Fellow dentist	3	2.9%	11	11.2%	14	7.0%
	Internet	40	39.2%	28	28.6%	68	34.0%
Distribution of benefits of artificial intelligence	Faster diagnosis	9	8.8%	4	4.1%	13	6.5%
	Clinically relevant high quality data retrievable in real time	2	2.0%	11	11.2%	13	6.5%
	Minimal error	4	3.9%	10	10.2%	14	7.0%
	All of the above	87	85.3%	73	74.5%	160	80.0%
Distribution of thoughts on usefulness of AI in dentistry	No	1	1.0%	6	6.1%	7	3.5%
	Yes	88	86.3%	83	84.7%	171	85.5%
	Not sure	13	12.7%	9	9.2%	22	11.0%
Distribution of thoughts on ability of AI evaluate fine details on radiograph	No	5	4.9%	6	6.1%	11	5.5%
	Yes	81	79.4%	77	78.6%	158	79.0%
	Not sure	16	15.7%	15	15.3%	31	15.5%
Distribution of thoughts on diagnostic ability of AI being better than clinical experience.	No	25	24.5%	35	35.7%	60	30.0%
	Yes	56	54.9%	33	33.7%	89	44.5%
	Not sure	21	20.6%	30	30.6%	51	25.5%
Distribution of recommendation to incorporate Artificial Intelligence into routine practice	No	4	3.9%	9	9.2%	13	6.5%
	Yes	81	79.4%	77	78.6%	158	79.0%
	Not sure	17	16.7%	12	12.2%	29	14.5%
Distribution on thoughts of AI to be integrated as an element of undergraduate training program	No	12	11.8%	10	10.2%	22	11.0%
	Yes	76	74.5%	74	75.5%	150	75.0%
	Not sure	14	13.7%	14	14.3%	28	14.0%
Distribution of thought if opinion differs with Artificial Intelligence	AI opinion	25	24.5%	12	12.2%	37	18.5%
	Your opinion	61	59.8%	69	70.4%	130	65.0%
	Patients choice	16	15.7%	17	17.3%	33	16.5%

Distribution on thoughts of using Artificial Intelligence on personal basis while making diagnosis and treatment planning	No	4	3.9%	9	9.2%	13	6.5%
	Yes	83	81.4%	73	74.5%	156	78.0%
	Not sure	15	14.7%	16	16.3%	31	15.5%
Distribution on thoughts pertaining to fields Artificial Intelligence can be useful	Making diagnosis	8	7.8%	9	9.2%	17	8.5%
	Predicting treatment outcomes	7	6.9%	8	8.2%	15	7.5%
	Minimizing errors	5	4.9%	13	13.3%	18	9.0%
Distribution on thoughts of health care sector first to commercialize Artificial Intelligence	Direct treatment (including surgeries with robots)	1	1.0%	4	4.1%	5	2.5%
	All of the above	81	79.4%	64	65.3%	145	72.5%
	University hospitals	48	47.1%	30	30.6%	78	39.0%
	Specialized centers	35	34.3%	42	42.9%	77	38.5%
	Private clinics	13	12.7%	12	12.2%	25	12.5%
	Primary Health care centers	6	5.9%	14	14.3%	20	10.0%
Distribution of thought that Artificial Intelligence has a future amongst emerging dental practitioners in Saudi Arabia	No	9	8.8%	6	6.1%	15	7.5%
	Yes	73	71.6%	73	74.5%	146	73.0%
	Not Sure	20	19.6%	19	19.4%	39	19.5%
Distribution on thoughts of using Artificial Intelligence when making decisions in future	No	13	12.7%	14	14.3%	27	13.5%
	Yes	66	64.7%	61	62.2%	127	63.5%
	Not Sure	23	22.5%	23	23.5%	46	23.0%
Distribution of thought that Artificial Intelligence will replace your job	No	69	67.6%	67	68.4%	136	68.0%
	Yes	18	17.6%	12	12.2%	30	15.0%
	Not Sure	15	14.7%	19	19.4%	34	17.0%