

ORIGINAL ARTICLE

Perception of the Use of Artificial Intelligence in Eyecare amongst Optometrists in Benin City

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ABSTRACT

Background: The application of Artificial Intelligence (AI) in diagnosing/managing ocular diseases has gained popularity as research highlights the utilization of AI to improve personalized medicine and healthcare outcomes. This study assessed optometrists' perception of the use of AI in eyecare viz concerns, advantages, role and challenges.

Methods: This was a cross-sectional survey comprising of 64 optometrists, recruited by convenience sampling from their practices in Benin City. A self-administered structured questionnaire consisting of 32 survey items was used. Data was analyzed using descriptive statistics and chi-squared test. $P < 0.05$ value was considered significant.

Results: Thirty-four (53.1%) of the optometrists were familiar with the use of AI and 43(67.2%) were concerns about the diagnostic accuracy of AI. While 39 (60.0%) agreed that AI would improve the practice of optometry, 26 (40.6%) were neutral about whether AI should be incorporated into the optometry school curriculum. Perceived role of AI was mainly in assisting in diagnosis 32 (50.0%), determining refractive errors 26 (40.6%) and improving patient care and management 18 (28.1%). Perceived challenges posed by the use of AI were, cost 39(60.0%), threat to job security 26(40.6%) and threat to doctor-patient relationship 23 (35.9%).

Conclusion: More than half of the participants were familiar with the use of AI in eye care. There was good perception of its advantages and role despite a few concerns.

Keywords: Artificial Intelligence; Optometry; Imaging; Perspectives; Eye-care; Benin City

INTRODUCTION

The use of artificial intelligence (AI) in health care in recent times has become a transformative force with a modern approach to diagnostics and treatment of disorders and diseases within the medical and optical professions.¹ Optometry, being a primary care profession rooted in precision and human expertise has so far experienced a paradigm shift in eye care delivery over the years.² Over the past decade, there has been a growing awareness among optometrists regarding the potential benefits and challenges posed by the incorporation of AI technologies in eye care.^{3,4} Optometry, as a specialized branch of healthcare focusing on vision and eye health, relies heavily on accurate and efficient diagnostic processes. The advent of AI has provided optometrists with

a suite of tools that can augment their diagnostic capabilities, streamline workflows, and enhance patient outcomes.⁵ From automated image analysis to predictive modeling, AI applications in eye care have shown great promise in expediting the detection of ocular diseases, such as glaucoma, diabetic retinopathy, and age-related macular degeneration.⁶ Optometrists have increasingly recognized the potential of AI to enhance the precision of refractive error assessments, offering more personalized and effective prescription solutions for patients.⁷ With AI algorithms capable of analyzing vast datasets and identifying subtle patterns, optometrists can leverage these technologies to achieve a higher level of accuracy in determining refractive errors and devising customized treatment plans.⁸ The current use of AI in telemedicine has opened a new door of management for remote patient monitoring and consultation which gives optometrists the leverage to reach larger number of patients within a space, providing interventions for eye care.⁹ This new approach to diagnosis and treatment is becoming more evident and necessary with the increase in eye

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health global crises where accessibility to eye care services has remained crucial.^{9,10}

Despite the progress AI may have seemed to have achieved in this space, the ethical implication in human management and care especially as it bothers on patients' privacy, data security and potential for algorithm bias requires optimal consideration from regulatory bodies.^{11,12} While optometrists may choose AI technology in their eye care practice, they widely considered its impact on their doctor-patient relationship.¹³ More so, optometrists should be aware of the redefined diagnostic precision, enhanced patient care and the extended eye care services that come with AI technology.¹⁴

Integrating AI into optometry practice has led to a transformative phase in the eye care industry with a hope for optometrists to redefine the way of diagnosis, treatment and management of ocular conditions.¹⁵ The use of AI technology in interpreting high resolution images such as in fundus photography and optical coherence tomography remains the pacesetter for AI and advancement in eye care.¹⁶

Against the backdrop of these developments, optometrists also find themselves at the intersection of tradition and innovation with a paradigm shift towards AI. There is a need to understand the implication of adopting this new development in the eye care sector which underscores its sustainability and achievement of expected goal of better ocular and visual health and not as a replacement of the human labor.^{17,18} This study explored optometrists' perspective of the use of AI in eye care.

METHODOLOGY

Study design

This was a cross-sectional survey carried out in various optometry clinics within Benin City, the capital of Edo state. Sixty-four optometrists were recruited by convenience sampling from their practices.

Study area

Benin city is both a commercial and industrial town and it occupies a strategic position as the gateway to the eastern, western, southern and northern parts of Nigeria. It also houses the Oba's palace, the seat of the Monarch of the great Benin kingdom. Considering the fact that there are 180 registered optometrists in the Edo State chapter of the Nigerian Optometric Association (NOA) presently, this sample size represents about one third of the optometrists in Edo State. There are currently 29 fully registered eye clinics in Benin city owned by optometrists. Also included in this study were optometrists working in the University of Benin (UNIBEN) and University of Benin Teaching Hospital (UBTH). UNIBEN and UBTH are

foremost tertiary institutions in the South-South geopolitical zone of Nigeria.

Study population/Sample size

The target population comprised male and female optometrists between the ages of 32 to 56 years who had been in practice for between 1 to 20 years post national youth service (NYSC). Inclusion criteria were that participants be duly registered with the Optometrists and Dispensing Opticians Registration Board of Nigeria (ODORBN) and be current with their annual practice licenses. Optometrists who were NYSC members or interns were excluded from the study. All optometrists in Benin city who met the inclusion criteria were recruited for the study.

Data collection

The survey was carried out by distributing well-structured self-administered questionnaire which respondents filled out as necessary. The questionnaire was adapted from a similar study carried out in Chicago.¹⁷ The questionnaire consisted of 32 survey items divided into 4 sections. Section 1- Demographics: including gender, years of practice post NYSC and completion of a specialty program. Section 2- Eight survey items to assess perceived advantages and concerns related to AI using a 5-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. Section 3 - twelve items on perceived role of AI and section 4 - eleven items on challenges posed by the use of AI in eye-care.

Informed consent was sought after the aim of the survey was duly explained to participants. Emphasis was placed on ensuring that participants' confidentiality and anonymity was maintained by not writing their names on the questionnaires. Their privacy and wellbeing were preserved in line with ethical research practices.

Ethical approval

Ethical clearance was obtained from the Research and Ethics Committee of the Department of Optometry, University of Benin (REF No. LSC/OPT 000571/2023). The study spanned a duration of four months, August to November 2023 and was conducted in accordance with the tenets of the Declaration of Helsinki.

Data analysis

Data was analyzed using the IBM Statistical Package for Social Sciences (SPSS) version 25.0 software. Data was summarized using descriptive statistics such as means and standard deviation and proportion for categorical variables. Results were presented in tables.

RESULTS

Sixty-four optometrists participated in this study. All 64 optometrists approached for the study obliged and this gave a response rate of a 100%. Females were 34 (53.1%) and the males were 30 (46.9%).

Table 1 shows the demography of the respondents. Their age range was between 32 to 56 years with a mean age of 40.3 ± 11.5 . Respondents who had practiced for 11-15 years were 34 (53.1%) with a mean of 12 ± 13.1 . Majority of the participant 47 (73.4%) had specialty training which was mostly 23 (48.9%) in primary care while only 17 (26.6%) were non specialists.

Table 1: Demography of respondents

Variable	Frequency (n=64)	Percent
Gender		
Female	34	53.1
Male	30	46.9
Duration of practice (years)		
< 2	2	3.1
2-5	12	18.8
6-10	12	18.8
11-15	34	53.1
16-20	4	6.2
Area of specialty		
Community Health	1	2.1
Cornea and Contact Lens	2	4.3
Low Vision	6	12.8
Ocular Health	14	29.8
Orthoptics	1	2.1
Primary Care	23	48.9
Non specialists	17	26.6

of them (40.6%) were neutral about whether AI should be incorporated into the Optometry school curriculum.

Table 3 highlights the respondents' perspectives of the role of AI in eyecare. Assisting in diagnosis 32 (50.0%), determining refractive errors 26 (40.6%) and improving patient care and management 18 (28.1%) were the main predictions. The perceived challenges posed by the use of AI in eyecare are stated in table 4. The main challenge being cost 39 (60.9%) of outfitting a clinic with AI gadgets. This was followed by threat to job security 26 (40.6%) and threat to doctor-patient relationship 23 (35.9%).

Table 2: Optometrists' Perception of AI in eyecare

Perception*	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
I am familiar with the use of AI in eye care	5 (7.8)	29 (45.3)	21 (32.8)	7 (9.9)	2 (3.1)
I am concerned with the diagnostic accuracy of AI in eye care	4 (6.3)	39 (60.9)	15 (23.4)	6 (9.4)	0 (0.0)
I am concerned that AI will replace doctors	14 (21.9)	12 (18.8)	18 (28.1)	12 (18.8)	8 (12.5)
AI will harm the doctor-patient relationship	10 (15.6)	13 (20.3)	22 (34.4)	15 (23.4)	4 (6.3)
AI should be incorporated into the optometry school curriculum	3 (4.7)	14 (21.9)	26 (40.6)	18 (28.1)	3 (4.7)
AI will improve the practice of optometry	3 (4.7)	36 (56.3)	15 (23.4)	10 (15.6)	0 (0.0)
Prior to the COVID-19 pandemic, I would have been willing to incorporate AI into my practice	9 (14.1)	25 (39.1)	17 (26.6)	13 (20.3)	0 (0.0)
In response to the COVID-19 pandemic, I would be willing to incorporate AI into my practice.	9 (14.1)	27 (42.2)	17 (26.6)	11 (17.2)	0 (0.0)

n=64 *Multiple responses

Table 2 summarizes their perception of the use of AI in eyecare. Thirty-four of them (53.1%) were familiar with the use of AI in eyecare. This is good, being more than half of the sampled population. Majority of them 43 (67.1%), were concerned about the diagnostic accuracy of AI in eye care. While 39 (60.9%) of them agreed that AI could improve the practice of optometry, 26

DISCUSSION

AI technology holds significant promise in revolutionizing the field of eye care, offering innovative solutions for diagnosing and managing ocular diseases. Several recent studies³⁻⁵ have explored the perceptions and attitudes of optometrists towards the integration

Table 3: Perceived role of AI in eyecare

Role*	Frequency	Percent
Assist in/improve diagnosis	32	50.0
Determining/assessment of refractive conditions	26	40.6
Improve patient care and management	18	28.1
Monitor progression of diseases	12	18.8
Screening of diseases	4	6.3
Reduce time spent per patient	4	6.3
Provide eyecare practitioners with real time and up-to-date information about eye conditions	1	1.6
Assist in patient assessment	1	1.6
Data collection in eyecare epidemiology	1	1.6
Decision making	1	1.6
Storing of data	1	1.6
Booking of appointment dates	1	1.6

*n=64 *Multiple responses*

Table 4: Perceived challenges of AI in eyecare

Challenges*	Frequency	Percent
Cost	39	60.9
Threat to job security of doctors	26	40.6
Threat to doctor-patient relationship	23	35.9
Risk of overdependence and likelihood of abuse	16	25.0
May induce laziness	15	23.4
Loss of critical thinking abilities by practitioners	13	20.3
Errors	2	3.1
Availability	1	1.6
Potential use for self-medication by patients	1	1.6
May make the work of practitioners more time-consuming	1	1.6
Increase the workload of patients	1	1.6

*n=64 * Multiple responses*

of AI in optometric practice, shedding light on both the potential benefits and concerns associated with this transformative technology. The findings of the study revealed that a good number of the optometrists were familiar with the use of AI in eyecare. However, the integration of AI in eye care is not without challenges. While most optometrists perceived the potential benefits of AI, there were concerns about diagnostic accuracy and implementation challenges that could arise. A study¹⁷ focusing on optometrists' perspectives of the use of AI in eye care, reported that despite concerns about the diagnostic accuracy of AI technology expressed by the optometrists, a significant majority believed that its adoption would enhance optometric practice. This is supported by the findings of this study. Although the participants were concerned about the accuracy of AI in ocular diagnosis, they still believed in the usefulness of AI in improving optometric practice. This optimism is indicative of the growing recognition of AI's potential to improve healthcare outcomes, particularly in the post-pandemic era where telehealth and digital innovation have become increasingly prevalent.

Another study¹⁴ further explored the perspectives of ophthalmologists and optometrists on AI technology, revealing a positive impression towards its use in eye care, this more so negates the views of the optometrists in the study where

the majority of the participants were neutral in their opinion while other optometrists denied acceptance of AI as part of clinical diagnosis. This could be due to the limited understanding of the working principles of AI algorithm or due to fear of clinicians becoming overly dependent on the AI result or manipulating the AI's algorithm to suit the intended diagnosis.

When asked what role they perceived AI would play in eye care, optometrists showed different views towards the role of AI in eye care practice with some optometrists being indifferent as to whether AI will do better in the future or not. Other optometrists' responses were that AI can improve health care delivery in optometry by assisting in making correct diagnosis of ailment, determining refractive errors and improving patient care and management. This will ultimately lead to better efficiency and assistance in monitoring of disease progression. This finding is in agreement with previous study¹⁷ reported.

AI can be used in clinical practice to help detect high-resolution image features, therefore reducing the incidence of diagnostic errors, and, as a result it is becoming an essential tool in ophthalmology. Given its ability to recognize specific disease patterns, this tool can be used to broaden scientific and innovative knowledge, and, likewise, it facilitates progress in the

implementation of telemedicine detection programs. Generally, the ratio of eyecare practitioner to patients is not adequate, especially if we take into account the increasing number of visually impaired patients. A study¹⁹ carried out in England found a permanent reduction in visual acuity and visual field in patients due to a 22-week delay in eye care. This could have been avoided if they were intervened earlier. This shows the urgent need for solutions to be implemented in order to improve the availability and accessibility of eye care services at primary, secondary, and tertiary level.

Despite the potential benefits of AI in eye care, there is a need to practice ethical considerations, as highlighted by a study¹⁰ on the drawbacks of AI and potential solutions in healthcare. This is to ensure responsible AI use in eye care. This holds true as most of the optometrists involved in this study showed a positive expression towards benefitting, despite their individual fears of its reliability. Optometrists in this study, indicated concern that AI would replace doctors. The concern reported here is greater than that reported in a previous study²⁰ where 3% of physicians believed that the physician could be replaced by AI in the foreseeable future. Previous studies^{13,21} have shown AI can complement the role of providers by increasing efficiency in patient care. Nevertheless, other studies^{16,22} have discussed caution in patient care, noting that AI dismisses subjective aspects of a disease when looking purely at an algorithm or objective test results. When used as a tool within practice rather than a replacement of providers, AI may provide the doctor with supplemental information to more effectively manage eye diseases while affording the doctor more time to provide personalized care, allowing for shared decision making and improved communication.

Since only a quarter of respondents agreed that AI should be incorporated into the optometry school curriculum, this shows the importance of educating providers on the strengths and limitations of AI before implementation into clinical practice. When there is familiarity, distrust would be minimized and this might take care of some of the sentiments or fears noted in this study. Studies^{11,13} have underscored the importance of ongoing education and training for optometrists to effectively utilize AI technologies.

As AI options continue to expand and become more common, researchers and clinicians will likely be more accepting of their integration into clinical practice. Major ways to encourage optometrists towards acceptance of AI is by exposure to more peer reviewed research, continuing education at local, state, and national association meetings and clinician hands-on experience. Focus should be on the

accuracy of AI platforms, adapting to new clinical workflows, and the use of AI as a tool in clinical decision making.^{18,19}

Limitation of the study: The small sample size used could affect the inferences that can be drawn from the findings of the study.

In conclusion, it is recommended that healthcare organizations be encouraged to incorporate AI-driven technologies into their clinical processes in order to improve diagnostic and treatment planning, and also give optometrists and other health professionals the knowledge and skills they need to use AI tools efficiently. Also, in order to promote informed decision-making, it is important to educate patients about the advantages and constraints of AI in eye care. Encourage patient involvement by implementing programs like self-monitoring and educational mobile health apps.

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