Knowledge and Perceptions of Artificial Intelligence Use in Screening for Diabetic Retinopathy in Botswana: Survey for Eye Care Clinicians

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Abstract . Diabetic retinopathy (DR), is one of the most prevalent visual impairments in the country and is on the rise. The study seeks to investigate eye care physicians' knowledge and perceptions on the use of artificial intelligence (AI) in screening for DR in the country. Materials and Methods A convenience sample of voluntary willing participants completed an online survey. All information was entered in Microsoft excel and analyzed utilizing SPSS v22.0. Results 83% of clinicians indicated no awareness of AI fundus examinations. 66.7% had no understanding what the word AI meant. 100% of clinicians said they have never used AI software for DR screening. The study’s knowledge of the use of AI was tested using "AI fundus exams", and as a result, it was poor. There was a 66.7% positive attitude towards employing AI-integrated workflow vs a 33.3% negative attitude. 50% strongly agreed that artificial intelligence would help the field of DR screening. Conclusion Overall, clinicians have limited knowledge on the use of AI technology. Regardless, they are optimistic about its possibilities, thus AI adoption and training for eye care practitioners on how to use it should be considered in the country's public health system.

Keywords: Artificial Intelligence, Diabetes mellitus, Diabetic retinopathy, Knowledge, Perception.

1. Introduction

Themost effective method to preserving vision in diabetes mellitus (DM) is early screening, early asymptomatic stage, early detection is critical, as timely intervention can reduce visual impairment [2]. Fundus photography has been acknowledged as a technique of screening for DR, with grading executed by skilled certified retina specialists or ophthalmologists. Because of the continued increase in the number of diabetics and the limited supply of trained retinal specialists, an automated approach based on artificial intelligence (AI) for DR screening has begun to pique the interest of healthcare providers [3]. AI techniques are used on digital images obtained from a fundus camera. Which then provides a detailed image from within the eye (the retinal image). Such automated techniques provide cost-effective solutions to the existing screening challenge [4].

AI-based solutions techniques have shown medically comparable results to human assessment in existing DR screening programs [5]. Traces of establishment of AI has been observed in Singapore and United Kingdom where they have shown to be robust and cost effective [6]. A study in Nakuru, Kenya concluded that AI could be incorporated into health systems and assisted eye care specialist who were already in short supply in low-income countries [7]. As AI is seamlessly being launched and subsequently incorporated into healthcare, healthcare professionals will be anticipated to use AI technology to manage, diagnose, and treat their patients. Several studies have been carried out to evaluate the perceptions and knowledge of healthcare providers and medical students on AI [8]. To implement AI tools in healthcare that will be satisfactory for everyone, it is very important to initiate a collaborative effort between all those involved. There is no traceable evidence suggesting that AI application in DR screening has been established in the country, particularly in government health facilities. In its establishment, it is vital to capacitate personnel to use these kinds of technologies to meet the intended objectives. As well as to avoid “white elephants” due to lack of
knowledge on utilization of the equipment. As a result, eye care clinicians input is amongst the most influential signifiers of organizational preparedness, and it must be taken into account in this new age of technological advancement [9]. The first pillar (suitable economic development) of the country’s Vision 2036 encompasses Information and Communications Technology (ICT). It states “We will leverage leading ICT as a key contributor to economic growth and employment whilst also enabling an efficient and public sector” [10]. Similarly, this study hopes to provide information on the use of AI as a technology to assist the public health sector in addressing the already-existing shortage of critical eye healthcare specialists, such as DR graders/screeners.

2. Materials and Methods

Ethical approval was sort, and subjects consent to participate in the study. They were informed that they were not compelled to participate and thus had the right to voluntarily consent or decline participation. It was also stated that there will be no costs or incentives provided in the study. According to information gathered at a meeting with the management of the diabetes department, only 15 eye nurses in the country had been trained for DR screening and grading. The nurses were placed in the main 5 diabetic center of excellence health facilities across the country, with only a few ophthalmologists that were identified. A decision was made to survey the entire population due to the small population size. With that information 15 eye nurses and 2 ophthalmologists, who were registered eye care clinicians having received training for DR screening/grading and providing services in government health facilities were recruited. A web-based Google forms survey link was distributed via their work WhatsApp group. Only 6 successfully completed and returned the questionnaires. Excluded subjects consisted, demographics outside of inclusion criteria. Subjects completed a 19-point questionnaire.

A detailed search in the literature on past published reports [11] for a study population yielded a guideline for the questionnaire's preparation. Before commencing the study, the questionnaire was pre-tested according to the inclusion criteria to ensure validity and feasibility. The questionnaire was then modified based upon the responses given to meet the study objectives. The questionnaire comprised basic demographic data, knowledge of eye diseases, current knowledge and use of artificial intelligence in DR screening, and perceived impact of artificial intelligence on the profession. All collected data were entered, stored in Microsoft excel, and analyzed using the Statistical Package for Social Science (SPSS v22.0).

3. Results

3.1 Demographics

There were two age groups in the sample both evenly distributed at 50%. These age groups were 35-44 and 45-54. Overall respondents in the sample were between 35 and 54 years old. There was only 1 male in the sample making up 17% of the sample whilst female eye care clinicians dominated the sample at 83%. The only profession of respondents was eye nurse (100% response rate). Majority of the respondents worked in a city (50%) whilst 33% worked in a village and only one (17%) worked in a town.

3.2 Knowledge of eye diseases

None of the eye care clinicians were familiar with ametropia and external ophthalmoplegia (0%). All eye care clinicians were aware of cataracts, retinopathy as well as blindness. 50% of eye care clinicians were aware of glaucoma as well as iritis. Most eye care clinicians (83.3%) knew the best time interval for fundus examinations for patients with different DM types, whilst 17% did not. All eye care clinicians knew the right treatment plan after clinical therapy. Most eye care clinicians (83%) knew how to evaluate the quality of fundus photography whilst 17% did not. Most eye care clinicians (83%) knew the relationship between the fundus of the eye and other diseases of the body,
while 16.7% did not know. All eye care clinicians had participated in lectures on films of fundus reading (100%).

3.3 Current knowledge and use of artificial intelligence in DR screening.

Most eye care clinicians did not know what the term AI meant (66.7%). Most respondents reported no knowledge about AI fundus exams (83%). All the interviewed eye care clinicians (100%) reported never having used AI software for DR screening. The knowledge of AI use in DR screening was measured with the knowledge about AI fundus exams.

3.4 Perceived impact of artificial intelligence on the profession

The most commonly stated perception about advantage of using AI for DR was that it could improve patient access to disease screening (21%) and that it would lead to more cost-effective healthcare (16%) (Figure 1A). The most commonly perceived concern for utilizing AI systems in DR screening was about data security and privacy concern (39%). This concern was followed by concerns of healthcare being divested to large technology and data companies (28%). A common concern was also medical liability due to machine errors (22%) (Figure 1B). There were mixed feelings about whether AI will replace eye care clinicians’ jobs with only 16.7% reporting being extremely worried. With most (50%) being moderately worried and 33% not being worried at all.

![Fig. 1: Perceived advantages (A) and concerns (B) on utilization of AI](image)

4. Discussion

This study reveals most eye care clinicians (66.7%) did not know what the term AI meant. This may explain why most eye care clinicians had no knowledge of AI fundus examinations (83%). Furthermore all eye care clinicians reported never having used AI software for DR screening. This trend has been observed in most African countries [12]. However, the use of AI has been observed in a few African countries like Kenya [7]. Interestingly, in contrast other past survey [11] observed that eye care clinicians were found to be more than twice as likely as other health professionals to use AI in their everyday clinical practice. The results of this study show that there is inadequate knowledge about the use of AI in DR screening among participants. The knowledge of the use AI was measured with the knowledge about AI fundus exams. Reasoning may be that majority may be familiar with traditional methods of conducting fundus exams as these may be the methods that the eye care clinicians are currently using in their line of work.

Most eye care clinicians believe that AI fundus screening has clinical significance (50%). It has been reported that AI DR tools can help clinicians with fundus image analysis, which then allows them to swiftly determine subsequent steps in the patients’ treatment [13]. However, 33.3% believed it had no clinical significance. Although none has ever used AI software for screening...
before, most eye care clinicians had positive perceptions on the introduction of AI for screening for DR. Previous research has found that eye care clinicians generally have positive attitudes towards AI across a wide range of medical specialties [14]. This positive perception about AI has also been reported both in France [15] and abroad [16].

This study has reported a positive perception generally towards the use of workflow that integrates AI among eye care clinicians. A recent Canadian Royal College of eye care clinicians and surgeons’ survey had similar findings [17]. That being the case only 33% are in disagreement with the statement in this study. The most influential transition and adoption of AI by healthcare workers would work if AI would be integrated into clinical workflows in a way that it enhances efficiency and delivers acceptable levels of performance [18].

The most commonly stated perception about advantages of using AI for DR was that it could improve patient access to disease screening (21%). Introducing AI-based care models would alleviate workforce shortage currently found in the eye care industry [19]. The second most perception was that it would lead to more cost-effective healthcare (16%). Respondents perceive potential benefits to using AI for screening.

The most commonly perceived concern for utilizing AI systems in DR screening was about data security and privacy concern (39%). This concern has been brought up by other studies [20]. Therefore it is important for various regulatory agencies to collaborate and contribute to the implementation of security measures that ensure AI technologies take security and privacy into consideration, particularly when used in health care services [21].

The following second concern was that healthcare being divested to large technology and data companies (28%). This concern however was ranked the highest among ophthalmologist in a previous study [11]. A common mistrust in large technology companies specifically in healthcare has been observed [22]. According to a recent survey in Canada, e-health literacy standards must be implemented, and governing authorities should start taking a proactive approach to AI [17].

According to our findings, a very small amount of our study population is aware of the use of AI for screening for DR. The reason for this could be that AI is almost nonexistent in the country’s government health care system. Furthermore, if it is, it may not have reached the eye care clinicians' places of work. Eye care clinicians, on the other hand, have a significantly high level of knowledge of eye diseases and DR management. Mainly because it is what they practice on a daily basis as part of their job. They however expressed optimism about the use of AI in DR screening. It is critical that all stakeholders be involved and receive appropriate training prior to the implementation of any AI implementation.

5. Conclusion

To the best of our knowledge, this survey is the first of its kind in the country as artificial intelligence is a relatively new concept. There is a clear indication of eye care clinicians' shortage in the field of eye care in the country. As a result, the use of AI as an alternative screening tool for DR could be extremely beneficial to the diabetes population.

References


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