Editorial

Ensuring that glaucoma clinical decision support meets the needs of providers and patients

Bryce Baugh^, Benton Tullis^, Afua O. Asare, Moussa A. Zouache, Brian C. Stagg

John Moran Eye Center, Department of Ophthalmology and Visual Sciences, University of Utah, Salt Lake City, UT, USA

Correspondence to: Brian C. Stagg, MD, MS. John Moran Eye Center, Department of Ophthalmology and Visual Sciences, University of Utah, 65 Mario Capecchi Dr, Salt Lake City, UT 84132, USA. Email: Brian.Stagg@hsc.utah.edu.

Comment on: Goldmann N, Skalicky SE, Weinreb RN, *et al*. Defining functional requirements for a patient-centric computerized glaucoma treatment and care ecosystem. J Med Artif Intell 2023;6:3.

Keywords: Glaucoma; clinical decision support (CDS); machine learning

Received: 20 April 2023; Accepted: 25 June 2023; Published online: 20 July 2023.

doi: 10.21037/jmai-23-33

View this article at: https://dx.doi.org/10.21037/jmai-23-33

Glaucoma is an optic neurodegenerative disease and is the leading cause of blindness in the world after cataracts (1). Prompt detection and effective management are essential, as progression of this disease may lead to irreversible blindness. Glaucoma care is multi-faceted, which can make adequate management of glaucoma challenging. Holistic glaucoma management involves seamlessly integrating information obtained from the patient history, the ocular exam, diagnostic studies, as well as several different imaging modalities (2). Additionally, as treatments for glaucoma continue to progress, the clinician must stay up to date with relevant research and current practices regarding glaucoma therapy. Compiling and considering all the available data in relation to one patient's treatment plan can be a taxing and time-consuming process. In this era of rapid technological progression, clinical decision support (CDS) and machine learning could be a solution to several of the issues faced in glaucoma care today (3).

CDS systems are digital aids used to improve practitioner's individualized clinical decision making (4). CDS systems have already been successfully adopted in the management of multiple conditions from diabetes, sepsis, acute respiratory distress syndrome, hyperglycemia to neonatal hyperbilirubinemia (5-9). An intuitive and accessible interface is necessary for an effective CDS system. A well-planned and executed CDS system has the potential to be a highly beneficial tool for practitioners in the treatment of glaucoma.

In the article, "Defining functional requirements for a patient-centric computerized glaucoma treatment and care ecosystem", Goldmann *et al.* propose a potential CDS system that could be integrated into glaucoma care (10). This study lays down the necessary requirements for a digital healthcare tool that uses artificial intelligence (AI) to enhance glaucoma care with a goal of improving efficacy and patient satisfaction. This article identifies the biomedical, quality of life, and health status outcome requirements needed to develop an AI algorithm that is not only effective, but patient centered. Such a CDS system recognizes the importance of focusing on patient quality of life rather than just improving management of the disease alone. The article suggests a potential framework necessary for a glaucoma support engine which could be developed in the next 5–20 years. Although this venture would be expensive and require a large investment, Goldmann and colleagues indicate that the cost of development would be offset due to less overtreatment, less overdiagnosis, fewer provider visits, and more optimal outcomes for patients (10). Goldmann concludes that machine learning and CDS in glaucoma could help improve patient quality of life, provide more personalized care, and simplify glaucoma diagnosis and decision making for providers.

CDS systems have the potential to improve glaucoma care. However, many CDS systems are not actually used

^ ORCID: Bryce Baugh, 0000-0002-1203-9792; Benton Tullis, 0000-0003-4744-8550.

in practice even though they have been shown to improve patient outcomes (11). CDS systems that increase the burden of use, and therefore do not integrate seamlessly into clinical workflow, are less likely to be utilized (11). The use of user-centered design would lead to an intuitive and efficient system, increasing the likelihood of incorporation. User-centered design understands the users, tasks and environment and works to meet those needs (12). Furthermore, the system is continuously evaluated with the users to implement quality improvement throughout the design process (12). The care ecosystem described by Goldmann appropriately uses a human-centered approach to addressing functional requirements.

As the authors addressed, a large investment is needed to develop such an expansive digital healthcare tool. Due to this large investment, returns will need to be made and this falls upon the customers (the clinics). Will these systems be beneficial enough for clinics to justify their cost? Interest and willingness to pay are important factors to consider in the design process.

Creating an all-encompassing glaucoma care tool is no small undertaking. The proposal outlined in the article represents one possible path towards creating solutions to the challenges faced in glaucoma care today. A well-designed CDS systems would undoubtedly be beneficial to both clinicians and patients. In one study of 105 clinicians, 88.6% were either definitely or probably interested in using CDS for glaucoma, which suggests that a clinical tool could help overcome cognitive limitations of overburdened clinicians (13,14). The use of machine learning is already being applied and evaluated within the realm of glaucoma treatment with some success. One study investigated the efficacy of predicting eyes at risk for glaucoma using an initial visual field test (15). Another relevant study evaluated AI's ability to predict the likelihood of the necessity for surgical intervention in glaucoma using systemic data (16). Although these studies offer encouraging results, they do not examine all the factors that should be considered when treating glaucoma. The framework for a CDS system as described by Goldmann, aims to approach glaucoma care from all sides of the disease through considering all treatment and management strategies.

With the implementation of CDS in glaucoma care it will be critical to ensure careful evaluation of the CDS systems and rules (4). CDS systems need to be rigorously evaluated before and after implementation. Continuous evaluation of CDS systems is especially important when applied to new patient populations (4). This is because, generalizability of a CDS system is highly dependent on the data from which it is pulled. For example, results from a tertiary medical center may not be applicable to rural patients. Also, the creation of an interoperable CDS tool across different electronic health records (EHRs) is imperative to successful integration. An interoperable, standards-based platform already exists and can be used for CDS systems (17). This platform can be used itself, or as a model, to allow for operability across different settings and sites. Clearance or approval from regulatory agencies such as the Food and Drug Administration in the United States is key to ensure that CDS systems maximize returns for patient care and to make them appealing to all clinicians. Further research on CDS systems and incremental iterations will help identify and address their shortcomings and increase the likelihood of obtaining approval from regulatory agencies.

As we consider the barriers faced in glaucoma care today, CDS offers a promising solution to ease the burden on clinicians and provide better care to patients. Machine learning and CDS have been successfully applied in the management of many different diseases. Several studies have considered the application of CDS in certain diagnostic aspects of glaucoma, however, universal tools capable of considering all necessary features in the management of this disease are currently lacking (3,4). There is a great need for this type of technology to assist medical decision making in glaucoma care and therefore, effort and resources should be allocated towards its development. The CDS system framework as proposed by Goldmann could become an indispensable tool in the hands of providers if it can be successfully integrated into clinician workflow. However, successful integration will take time and these systems should continue to be researched and be carefully monitored before being universally accepted in the management of glaucoma.

Acknowledgments

Funding: This work was supported by National Institutes of Health (No. K23EY032577 to BCS) and an Unrestricted Grant from Research to Prevent Blindness, New York, NY, to the Department of Ophthalmology & Visual Sciences, University of Utah (to BCS).

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Journal of Medical Artificial Intelligence*. The article did not undergo external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jmai.amegroups.com/article/view/10.21037/jmai-23-33/coif). BCS reports that this work was supported by National Institutes of Health (No. K23EY032577 to BCS) and an Unrestricted Grant from Research to Prevent Blindness, New York, NY, to the Department of Ophthalmology & Visual Sciences, University of Utah (to BCS). The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

1. Allison K, Patel D, Alabi O. Epidemiology of Glaucoma: The Past, Present, and Predictions for the Future. Cureus 2020;12:e11686.
2. Gedde SJ, Vinod K, Wright MM, et al. Primary open-angle glaucoma preferred practice pattern. Ophthalmology 2021;128:71-150.
3. Zheng C, Johnson TV, Garg A, et al. Artificial intelligence in glaucoma. Curr Opin Ophthalmol 2019;30:97-103.
4. Stagg BC, Stein JD, Medeiros FA, et al. Special Commentary: Using Clinical Decision Support Systems to Bring Predictive Models to the Glaucoma Clinic. Ophthalmol Glaucoma 2021;4:5-9.
5. Edholm K, Lappé K, Kukhareva P, et al. Reducing Diabetic Ketoacidosis Intensive Care Unit Admissions Through an Electronic Health Record-Driven, Standardized Care Pathway. J Healthc Qual 2020;42:e66-74.
6. Stipelman CH, Smith ER, Diaz-Ochu M, et al. Early-Onset Sepsis Risk Calculator Integration Into an Electronic Health Record in the Nursery. Pediatrics 2019;144:e20183464.
7. McKinley BA, Moore FA, Sailors RM, et al. Computerized decision support for mechanical ventilation of trauma induced ARDS: results of a randomized clinical trial. J Trauma 2001;50:415-24; discussion 425.
8. Morris AH, Orme J Jr, Truwit JD, et al. A replicable method for blood glucose control in critically Ill patients. Crit Care Med 2008;36:1787-95.
9. Kawamoto K, Kukhareva P, Shakib JH, et al. Association of an Electronic Health Record Add-on App for Neonatal Bilirubin Management With Physician Efficiency and Care Quality. JAMA Netw Open 2019;2:e1915343.
10. Goldmann N, Skalicky SE, Weinreb RN, et al. Defining functional requirements for a patient-centric computerized glaucoma treatment and care ecosystem. J Med Artif Intell 2023;6:3.
11. Van de Velde S, Heselmans A, Delvaux N, et al. A systematic review of trials evaluating success factors of interventions with computerised clinical decision support. Implement Sci 2018;13:114.
12. User-Centered Design Basics Usability.gov: Department of Health and Human Services; 2017. Available online: https://www.usability.gov/what-and-why/user-centered-design.html
13. Stagg B, Stein JD, Medeiros FA, et al. Interests and needs of eye care providers in clinical decision support for glaucoma. BMJ Open Ophthalmol 2021;6:e000639.
14. Morris AH, Horvat C, Stagg B, et al. Computer clinical decision support that automates personalized clinical care: a challenging but needed healthcare delivery strategy. J Am Med Inform Assoc 2022;30:178-94.
15. Shuldiner SR, Boland MV, Ramulu PY, et al. Predicting eyes at risk for rapid glaucoma progression based on an initial visual field test using machine learning. PLoS One 2021;16:e0249856.
16. Baxter SL, Marks C, Kuo TT, et al. Machine Learning-Based Predictive Modeling of Surgical Intervention in Glaucoma Using Systemic Data From Electronic Health Records. Am J Ophthalmol 2019;208:30-40.
17. Mandel JC, Kreda DA, Mandl KD, et al. SMART on FHIR: a standards-based, interoperable apps platform for electronic health records. J Am Med Inform Assoc 2016;23:899-908.

doi: 10.21037/jmai-23-33
Cite this article as: Baugh B, Tullis B, Asare AO, Zouache MA, Stagg BC. Ensuring that glaucoma clinical decision support meets the needs of providers and patients. J Med Artif Intell 2023;6:12.