American Glaucoma Society Position Statement: Electronic Data Standards for Clinical Practice

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Glaucoma is a data-intensive specialty and those data are increasingly electronic. A typical clinical encounter with a glaucoma patient includes collection of intraocular pressure and corneal thickness, and tests of optic nerve structure (imaging) and function (visual field). Synthesis of these data by the clinician is then required to diagnose new or progressive disease. The fact that these data are most frequently converted to paper reports (or an image of that report), clearly limits the ability of the clinician to use computer-based tools to analyze data that are amenable to quantitative analysis. Even if one wanted to go to the trouble of accessing the currently available tests of optic nerve structure and function in their native digital format, they are frequently trapped in vendor-specific silos. This is always a limitation when transferring records between practices and can even be the case within a practice, where data cannot even be shared between multiple instances of identical devices. In this situation, patients have to sit at the same machine to be tested at each visit to allow progression analysis to be performed. The model of device-centric data storage and analysis therefore compromises clinic efficiency and the quality of patient care.

One approach to overcome the problem of extracting and using data from digital systems is the use of open standards. The Digital Imaging and Communications in Medicine (DICOM) standard has been under active development since the mid 1980s, and is most relevant to the types of data encountered in glaucoma practice.[1] Originally developed by the American Academy of Radiology and the National Electrical Manufacturers Association, DICOM arose out of the need of hospitals to integrate digital data from imaging devices produced by multiple vendors. Largely because of the existence of DICOM, Radiology Departments and practices are now able to select imaging devices based on features and performance and then review the images they produce on a common Picture Archiving and Communication System (PACS).[2]

Based on the success of DICOM in radiology, the American Academy of Ophthalmology (AAO) has sponsored DICOM working group 9 since 1999. As the result of significant effort by both ophthalmologists and vendors, DICOM standards have been developed for ophthalmic photography,[3] ophthalmic tomography (includes optical coherence tomography),[4] ophthalmic refractive measurements,[5] ophthalmic axial length measurements (for intraocular lens calculations),[6] and ophthalmic visual fields (static perimetry).[7] This collection of ophthalmology-specific additions to DICOM represents most of what is needed to integrate current testing devices with image management systems and electronic health records (EHR).

The standards for tomography and visual fields are of particular interest to glaucoma specialists and both serve to illustrate the kind of data that are addressed by DICOM and those that are not. The tomography standard, for example, defines the way patient information like name and birth date, study information like the date of the test and device parameters, and image data should be communicated. It does not, however, include the analyses of those data like retinal thickness or the change since the last test. Similarly, the visual field standard defines how patient data, study data, reliability data, and point-by-point test results can be communicated from one system to another. Although the standard does include fields for the probability values derived from comparing each patient to the device's

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normative data, it does not include analysis of progression across multiple tests (e.g. Guided Progression Analysis-GPA).

It is important to note, however, that although the available standards do not address all possible analyses of test data, the fact that the raw data can be exported from each device will allow for analysis by third party systems. Such analysis outside the vendor's "box" is currently not practical for most ophthalmic testing devices. In addition, DICOM includes the concept of structured reports, which define how specific analyses should be communicated. Working group 9 has already defined such a standard for reporting macular thickness from optical coherence tomography devices.[8] All that is needed for adding structured reports to the DICOM standard is commitment of effort from the ophthalmic community.

Another standard already adopted by the AAO is the Systematized Nomenclature of Medicine (SNOMED). SNOMED is a structured hierarchy of medical terminology and the AAO has worked to extend the standard to ensure inclusion of terms specific to ophthalmology.[9] The ophthalmology extensions to SNOMED are sufficiently complete that the AAO now utilizes it to categorize its clinical education materials. Although SNOMED is not intended to be used directly by clinicians, it is ideally suited for representing the data collected electronically as part of a clinical encounter. Encoding data using SNOMED terms allows for computerized analysis of those data aimed at clinical decision support, quality improvement, and future data extraction.

The potential impact of SNOMED and DICOM standards on ophthalmology has been limited by the fact that ophthalmologists have so far not widely adopted EHR.[10] The adoption of EHRs is likely to increase significantly, however, now that the Centers for Medicare and Medicaid Services will be providing financial incentives to use EHRs.[11,12]

Ophthalmology is therefore facing the convergence of large quantities of clinical data from devices, a diverse collection of available standards for exchanging those data between systems, and an increase in EHR use by clinicians. This convergence affords us the opportunity to tie all of these elements together in ways that will improve practice efficiency and patient care. To help bring about this change, ophthalmologists should demand that their clinical hardware and software vendors make data available using open standards. Device vendors should, in turn, implement the standards relevant to their devices, and image management picture archiving and communication system vendors should make their systems capable of ingesting and storing DICOM data and displaying it. Finally, EHR vendors should facilitate the use of coded terminology (SNOMED) in their products and, where appropriate, import data from DICOM-enabled devices.

The American Glaucoma Society supports improved integration of electronic data to benefit glaucoma patients. Integration of clinical data is particularly important for the care of glaucoma because diagnosis of incident and progressive disease is frequently dependent on analysis of longitudinal data from multiple sources. Allowing physicians' easier access to their patients' data, sharing those data within and between practices, and facilitating quantitative analysis of those data will undoubtedly improve patient care and should therefore be the goal of the entire community responsible for the care of glaucoma patients.

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