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Authors
Wang, Michelle
Asanad, Samuel
Asanad, Kian
et al.

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Original research

Value of medical history in ophthalmology: A study of diagnostic accuracy

Michelle Y. Wang [a,b], Samuel Asanad [a,c,*], Kian Asanad [c], Rustum Karanjia [a,d,e], Alfredo A. Sadun [a,c]

[a] *Doheny Eye Institute, University of California Los Angeles, Los Angeles, CA, USA*
[b] *Department of Ophthalmology, Southern California Permanente Medical Group, Los Angeles, CA, USA*
[c] *David Geffen School of Medicine at University of California Los Angeles, Los Angeles, CA, USA*
[d] *Department of Ophthalmology, University of Ottawa, Ottawa, Ontario, Canada*
[e] *Ottawa Hospital Research Institute, Ottawa, Ontario, Canada*

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Abstract

Purpose: This study aimed to demonstrate the value of the chief compliant and patient history to accurately diagnose patient pathology without requiring ocular examination or imaging in an outpatient neuro-ophthalmology clinic.
Methods: We prospectively evaluated 115 consecutive patients at our institution from January to April 2009. The attending neuro-ophthalmologist committed to a single most likely diagnosis while solely being exposed to patient demographic information (age, gender, race) and chief complaint, but was otherwise blinded to ocular examination or imaging. The validity of the initial diagnosis was assessed by further acquiring subjective and objective findings and the percentage of correct diagnoses was determined.
Results: Patient cases were categorized based on the neuro-ophthalmologic localization of the final diagnoses: afferent nervous system, central nervous system (CNS), efferent nervous system, orbital system, and pupillary system. Correct diagnoses by chief complaint and patient history were 84%, 100%, 86%, 80%, 50% and 100% for afferent, central, efferent, orbit, pupil, and other neuro-ophthalmic diseases, respectively. Over half the cases were correctly diagnosed by chief complaint alone, which improved to 88% when combined with the patient history.
Conclusions: A simple combination of patient history and chief complaint predicts an overall diagnostic accuracy in approximately 90% of cases. Our study demonstrates the remarkable diagnostic value of patient history in neuro-ophthalmologic clinic practice.

Keywords: Diagnostic accuracy; Patient history; Neuro-ophthalmology

Introduction

It is known that achieving a medical diagnosis may involve the triad of patient history, physical examination, and laboratory investigation. Some have argued that not all three components of this triad are absolutely necessary. As early as 1947, the notion of achieving a correct diagnosis by history alone was considered.[1] Studies such as those conducted by Hampton et al. have further supported this notion, illustrating that 82.5% of patient diagnoses can be correctly achieved based on medical history alone.[1] However, patient history is not nearly as valued today as it was previously and is becoming more undervalued in common clinical practice.[2,3] This is especially evident as current medical education curricula and practices have become increasingly dependent on physical examination and objective laboratory investigations,[4] attenuating the importance and diagnostic value of acquiring critical historical patient information.[5] Various medical educators have also advocated for the incorporation of

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* Corresponding author. Doheny Eye Institute, University of California Los Angeles, 1355 San Pablo St., Los Angeles, CA, 90033 USA.
E-mail address: sasanad@mednet.ucla.edu (S. Asanad).

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contextualized patient history as observed in clinical practice as guidelines for constructing appropriate question stems in examination test items. These strategically designed test questions would serve as a useful measure of clinical competence among medical trainees in contrast to assessing the candidates' knowledge of trivial facts.[6,7]

Among the various fields in medicine, ophthalmology is often regarded as a pattern recognition science. However, even in this field, where technological advances often can objectively lead to clinical diagnoses, patient history in the context of a systematized approach towards collecting relevant medical history can serve as a critical component of the diagnostic process. Studies have shown that the most renowned clinicians place a high emphasis on patient history and spend the most time on gathering medical history when deriving patient diagnoses.[8] In addition, neuro-ophthalmology is a branch of ophthalmology particularly dependent on medical history among the various specialties within the field. Having a global perspective comprising the interaction and integration of complex and systemic conditions including rheumatologic, neurologic, and infectious insults on visual function, neuro-ophthalmology is the field commonly turned to when the etiology of patients' visual deficits remain unknown even after extensive consecutive workup by several ophthalmologists, neurologists, and neurosurgeons.[9] The eye is transparent and organized, but when the pathology is not evident, referral to neuro-ophthalmology is common. Given its comprehensive medical perspectives and clinical applications, neuro-ophthalmology relies heavily on the patients' history of present illness despite continued technological advancement of objective measurements.

To demonstrate the diagnostic value of patient history, we report diagnostic data of a senior attending clinician (A.A.S.), in an outpatient neuro-ophthalmology clinic based on the patients' chief complaint, and assess associated changes in diagnostic accuracy when supplemented with patient history and objective data from ocular examination and imaging.

Methods

We performed a prospective assessment of 115 consecutive patients from January to April 2009 at the Doheny Eye Center, Department of Neuro-ophthalmology, University of California Los Angeles (UCLA). Inclusion criteria consisted of new patients being seen for the first time by the attending physician (A.A.S.), whether self-referred or referred by another practicing physician. Patients presenting to clinic for follow-up visits were excluded from the study. The study qualified as an exempted study per the Institutional Review Board at UCLA as the research and analysis of data did not contain any personally identifiable information. Patients were interviewed in separate, enclosed-door rooms by clinic staff, medical residents and clinical fellows. This ensured the privacy of patient interaction and history-taking, and masked the attending physician from potential premature exposures to patient presentation and preliminary physical examination findings that may influence or alter diagnostic performance. The attending physician (A.A.S.) assessed each case using a diagnostic paradigm resembling the scientific method (Fig. 1). Patient cases were presented to the attending physician in a predetermined step-wise approach based on chief complaint along with preliminary demographic information including: age, gender, and race. Technicians and staff members were advised to refrain from presenting information concerning objective data such as previous imaging findings and/or laboratory test results. The attending physician did not have access to referral notes nor were prior medical notes made available for review beforehand. Using solely this preliminary information, the attending physician was instructed to deduce and commit to the single most likely diagnosis or "hypothesis." Following this, the validity of the initial diagnosis was assessed with the attending physician asking the clinic staff specific follow-up questions to test the hypothesis. Based on the answers provided, the diagnosis was either sustained or revised by the attending physician and further questions were asked to derive the most likely diagnosis. After acquiring the patient history, the diagnosis was logged forced-choice and the attending physician was then able to see the patient in person for a physician examination. A diagnosis was logged again upon completion of this step. The final diagnosis was derived following objective data as needed including ocular examination, Humphrey visual field (HVF) testing, and spectral domain-optical coherence tomography (SD-OCT, Cirrus HD-OCT, software V.6.0; Carl Zeiss Meditec, Inc., Dublin, CA,

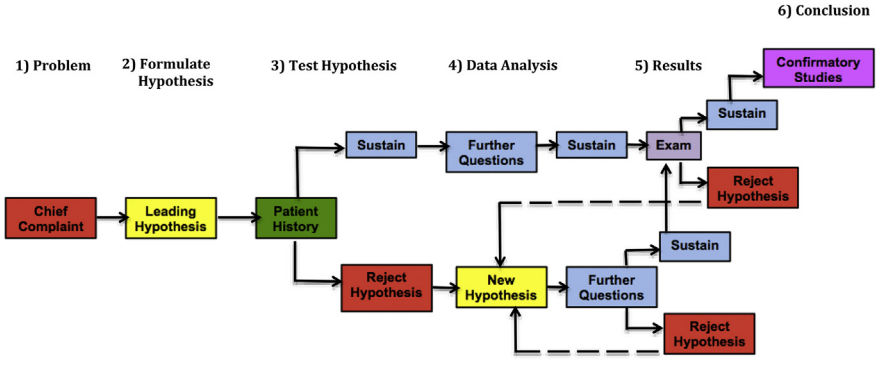


Fig. 1. Clinical integration of the scientific method.

USA). Neuro-imaging and follow-up examinations helped confirm the final diagnosis.

We assessed diagnostic accuracy by systematically classifying the diverse array of patient cases into a series of categories based on the nature and localization of the established final diagnoses. As illustrated in Table 1, these included afferent nervous system, central nervous system (CNS), efferent nervous system, orbit, and pupil. Diagnoses outside of these categories were classified as "other." Clinical performance was assessed based on recording specific ophthalmologic diagnoses accounting for the visual symptoms associated with the chief complaint and in the context of patient history. The primary outcome measure consisted of percentage of diagnoses made correctly from chief complaint in conjunction with patient history alone in addition to the percentage of diagnoses requiring physical examination and objective data for deriving at the final diagnosis.

Results

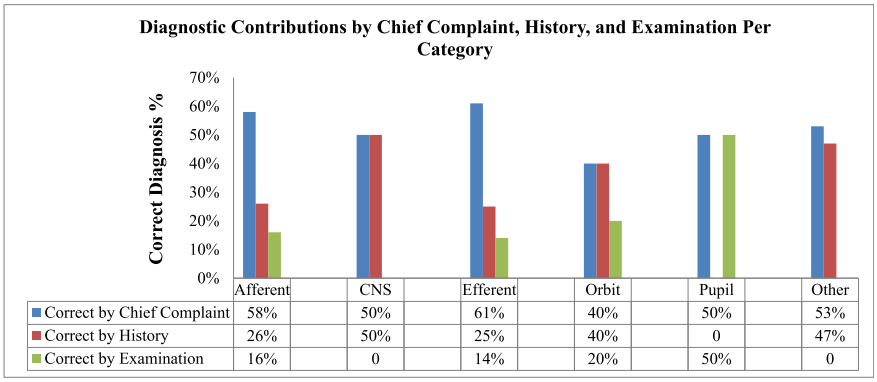
The data from all 115 patients is compiled in Fig. 2 based on final diagnosis along with the percentage of cases diagnosed correctly solely based on chief complaint followed by supplementation with patient history and objective data (i.e. physical examination, OCT, and HVF). The percentages of correct diagnoses by chief complaint together with history were 84, 100, 86, 80, 50 and 100 for afferent, CNS, efferent, orbit, pupil, and other neuro-ophthalmic diseases, respectively. The increase in percentage of correct diagnoses following objective measurements was 16, 14, 20, and 50 for afferent, efferent, orbit, and pupil cases, therefore representing the value added by examination signs, respectively. Physical examination provided no assistance (i.e. no change in the final diagnosis as initially established by chief complaint or history after inclusion of examination) in cases pertaining to "CNS" and "other" disease categories. Remarkably, 56% of correct diagnoses was made by chief complaint alone. The overall percentage of correct diagnoses increased to 88% when combined with history, leaving an additional 12% attained after examination or additional testing (Fig. 3).

With respect to the most frequently encountered patient cases, chief complaint in combination with history revealed diagnostic accuracies of 89% for ischemic optic neuropathy, 100% for optic neuritis, and 100% for CNS associated diseases (trigeminal neuralgia, vasculitic neuropathy, retinal migraine). However, physical examination was necessary for correctly diagnosing 25% of patient cases presenting with orbital conditions such as Graves' orbitopathy.

Of the 43 cases listed in the afferent group, 25 cases (58%) were diagnosed correctly based on chief complaint alone. With the addition of patient history, diagnostic accuracy in the afferent group increased by 11 cases (26%). The remaining 7 cases (16%) were diagnosed correctly after including physical examination. Of the 16 cases registered under the CNS group, 8 cases (50%) were diagnosed correctly solely based on chief complaint and the remaining 8 (50%) were diagnosed with the addition of history. Out of the 28 cases under the efferent group, 17 cases (61%) were diagnosed correctly by chief complaint alone, 7 more cases (25%) with the addition of history, and 4 additional cases (14%) following physical examination. Of the 5 orbital cases, 2 (40%) were diagnosed correctly by chief complaint alone, an additional 2 cases (40%) when history was added, and the remaining last case (20%) when examination was added. In the pupil category, 2 cases (50%) were correctly diagnosed by chief complaint and the other two cases (50%) following supplementation with physical examination. Lastly, there were 19 cases outside of the five listed categories, labeled as "other." Of these cases, 10

Table 1
Classification and distribution of conditions within each class based on the nature and localization of final patient diagnoses.

Afferent	# of Cases (N)
Anterior ischemic optic neuropathy	17
Posterior ischemic optic neuropathy	5
Optic neuritis	4
Optic nerve hypoplasia	2
Glaucoma	6
Toxic optic neuropathy	1
Neuromyelitis optica	1
Leber's hereditary optic neuropathy	2
Pseudotumor cerebri	5
Total	43
Central nervous system (CNS)	**# of Cases (N)**
Vertebrobasilar insufficiency	2
Pituitary adenoma	1
Cerebrovascular accident	2
Hemifacial spasm	2
Bell's palsy	2
Retinal migraine	2
Chiari malformation	1
Vasculitic neuralgia	2
Trigeminal neuralgia	2
Charle's Bonnet syndrome	1
Total	16
Efferent	**# of Cases (N)**
Cranial nerve palsy (total):	13
III	2
IV	7
VI	4
Ocular myasthenia gravis	15
Total	28
Orbit	**# of Cases (N)**
Grave's orbitopathy	4
Orbital blow-out fracture	1
Total	5
Pupil	**# of Cases (N)**
Horner's syndrome	2
Artie's pupil	2
Total	4
Other	**# of Cases (N)**
Dry Eye syndrome	7
Blepharospasm	3
Refractive error	4
Posterior vitreous detachment	3
Cystoid macular edema	2
Total	19



	Afferent	CNS	Efferent	Orbit	Pupil	Other
Correct by Chief Complaint	58%	50%	61%	40%	50%	53%
Correct by History	26%	50%	25%	40%	0	47%
Correct by Examination	16%	0	14%	20%	50%	0

Fig. 2. The percentages of correct diagnoses* by chief complaint, history, and examination for afferent, central nervous system (CNS), efferent, orbit, pupil, and other neuro-ophthalmic diseases. *Correct by Chief Complaint represents % diagnoses that were the initial leading hypothesis based solely on chief complaint and was not rejected after inclusion of history and examination as outlined in Fig. 1. Correct by History represents % diagnoses whereby the initial leading hypothesis established by chief complaint was rejected after inclusion of history (Fig. 1; Step 3) with subsequent formulation of a new hypothesis, which was sustained even after examination. Correct by Examination represents % diagnoses whereby the initial leading hypothesis established by chief complaint was rejected after inclusion of history (Fig. 1; Step 3) and subsequent rejection of the newly formulated hypothesis after examination. The newly formulated hypothesis after inclusion of examination established the final diagnosis (Fig. 1; Step 5).

(53%) were correctly diagnosed by chief complaint along with the remaining 9 cases (47%) when combed with history.

Discussion

The value of the chief complaint and patient history as critical elements of the diagnostic process may be lost in current medical care. The continual redefining of medical practice in the context of technological advancement, especially in a field such as ophthalmology, makes it easy to lose sight of the fundamental role of history-taking in clinical practice.[8,10] Emphasis on the diagnostic value of patient history is especially important given the potential harm that comes with over-reliance on medical tests.[11]

In the present study, one experienced senior attending physician was able to correctly diagnose a problem 88% of the time based on chief complaint and history, demonstrating the remarkable diagnostic value of patient history in clinical practice. Physical examination and testing improved diagnostic accuracy only modestly as well as confirming and adding confidence to correct initial assumptions made by history taking. Yet, in the last few decades, physicians and physicians-in-training have become more reliant on objective and quantifiable measures including labs and imaging in achieving disease diagnoses.[12,13] Electronic medical records (EMRs) have encouraged this shift away from history and towards quantifiable testing readily offered and pursued via today's digitized health systems. Originally intended to improve medication safety and reduce health care costs, EMR implementation has been associated with several unpredictable adverse consequences, including overdependence on technology (Campbell 2006).[14] Studies have reported changes in power structure in association with EMR implementation as physicians lose their autonomy in clinical decision-making.[15] Menachemi et al. have supported this notion of an altered hierarchy as the Electronic Health System (EHS) inhibits physicians from ordering preferred tests and medications and provokes compliance with clinical guidelines not personal embraced. Physician independence is further limited as EHS restricts narrative flexibility in clinical documentation through

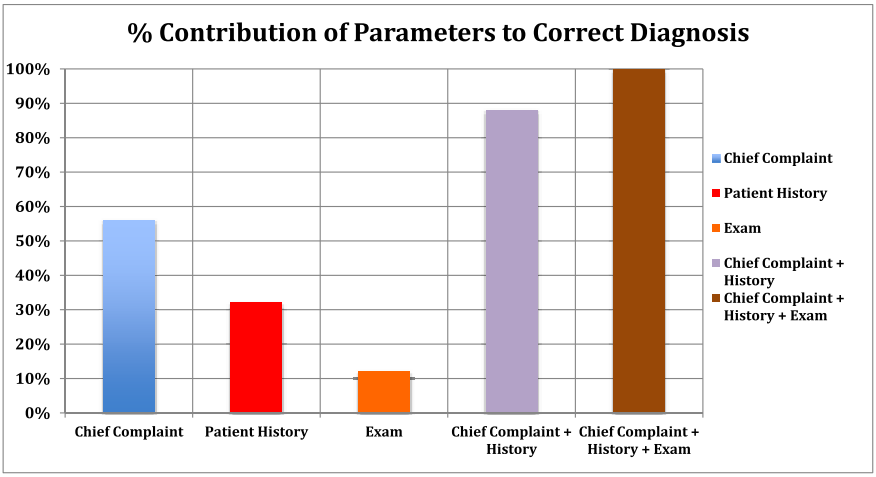


Fig. 3. The percentage of correct diagnoses by chief complaint alone, when combined with history, and when supplemented with objective examination.

structured rather than free-text formatting.[14] Overall, these constraints in clinical practice may impede necessary creative approaches in medicine, especially when working up unique, non-standardized patient cases.

The chief complaint and patient history provided an overall diagnostic accuracy of 88%. These findings are in agreement with studies conducted in general medicine clinics, which reported a diagnostic accuracy of 83% achieved by chief complaint in combination with patient history.[12] Similarly, additional studies have demonstrated that history led to the final diagnosis 76% of the time in a medicine outpatient clinic, whereas the physical examination and laboratory testing only contributed an additional 12% and 11% to diagnostic accuracy, respectively for general medical diagnosis.[8]

A survey conducted by the department of medicine from three different institutions found that among the 239 faculty members and residents included in the study, history was valued the most at nearly 60% towards achieving disease diagnoses, whereas physical examination and laboratory investigation were valued at 20% each.[14] However, it is important to note that faculty members valued history higher relative to residents, whereas residents rated laboratory tests more highly.[8] This suggests that the diagnostic value of patient history rises as a function of clinical experience. Experienced clinicians likely have great competency with respect to patient interviewing skills. In line with this, the residents' perceptions of the diagnostic value of history increased significantly over the course of training.[8] There may also have been the effect of overconfidence by inexperienced clinicians in laboratory results. The diagnostic accuracy observed in our report was derived from a senior clinician with decades of experience.

It is important to note that some elements of the history may be more important than others and the diagnostic importance of history may vary from specialty to specialty. In a study assessing the values of history, examination, and laboratory investigation across various specialties, Sandler and associates reported that history was particularly important for diseases concerning the cardiovascular, neurological, and respiratory systems.[16] Similar to neurology, neuro-ophthalmology may also represent a subspecialty more highly dependent on history.

Furthermore, our report illustrates that history can be more helpful for diagnosing some neuro-ophthalmic conditions relative to others. Chief complaint and history led to the correct diagnosis in 89% of ischemic optic neuropathy cases (Fig. 4A) and 100% for optic neuritis cases (Fig. 4B). On the other hand, physical examination served useful in diagnosing orbital diseases such as Graves' orbitopathy, contributing to a 25% increase in correctly deducing the final diagnosis (Fig. 4D). This may also relate to the diverse array of non-specific presenting symptoms associated with Grave's orbitopathy including double vision, blurry vision, and eye pain.

The value of patient history is recognized when considering each patient case individually in order to acquire the most pertinent historical points. In turn, a good history cannot be obtained by merely "checking the boxes" as promoted by today's electronic approach to health care. Hence, EMR discourages the fundamental applications of the scientific method as a reiteration approach to history taking. Ideally this would also entail thinking critically about the patient problem, gathering relevant historical information, and "testing" the validity of the most likely diagnosis with another question. In this report, the chief complaint was used as a platform to formulate a preliminary diagnosis, serving as the "leading hypothesis," which was then tested and qualified in a step-wise fashion with follow-up questions pertaining to the history of the presenting disease and associated symptoms. For example, in cases of increased intracranial pressure, the key question is not to scale the pain from 1 to 10 (as required by EMR), but to assess the positional nature of the pain, one that is particularly exacerbated when lying recumbent and relieved when standing upright. Inquiry of the "right" three questions cannot be fulfilled by a menu of 1000 non-specific questions. While not

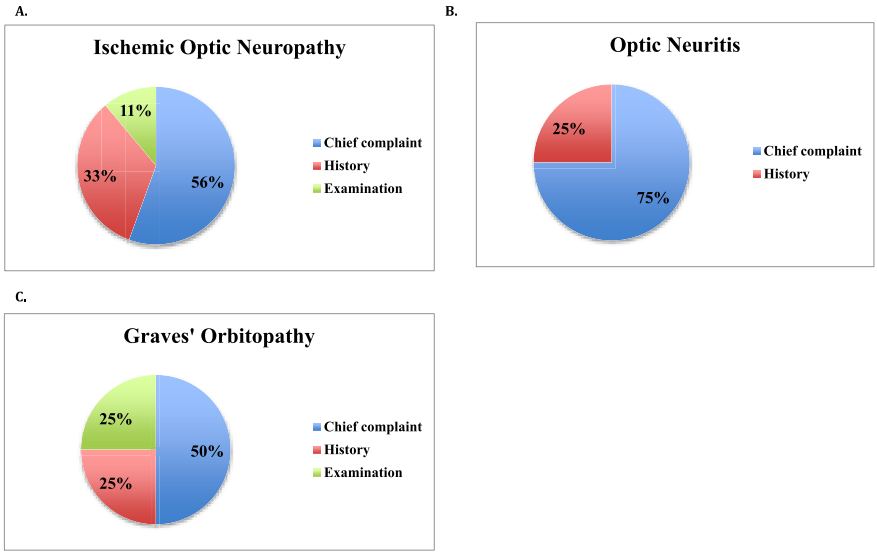


Fig. 4. Individual contributions of chief complaint, patient history, and examination to disease diagnosis in (A) Ischemic optic neuropathy, (B) Optic neuritis, (C) Graves' orbitopathy.

conducted under rigorous methodology, the present report illustrates the powerful diagnostic value of intelligently accrued patient history. Objective data such as physical examination and imaging were less critical for employed less for diagnostic purposes, and more as confirmatory testing.

Potential limitations of our study should be mentioned. First, this report assessed a single attending physician and did not compare diagnostic performance among multiple physicians. Yet this report gives good reasons for allocating more time and space for interviewing patients to effectively acquire the patient history, especially in the context of medical trainees and as counterweight to the pressures from EMR. Second, one may argue that a senior, highly trained sub-specialty ophthalmologist's personal dependence on using the patient history in deriving diagnoses may influence the recorded diagnostic performance as a tautology, and this partly true. Third, we did not measure the diagnostic contributions of each objective examination individually as derived from physical patient signs on presentation, ocular examination, HVF, and OCT. Nevertheless, the major point is that the diagnostic value of the chief complaint and patient history largely outweighed the contributions from physical examination as a whole. Fourth, our assessment was conducted in a university-based outpatient clinic setting usually without urgency. Emergent patient presentations might naturally rely more on physical examination signs and laboratory findings in the diagnostic process. In addition, patient history may hold different value within the private practice setting, where patient cases are frequently less diverse and neuro-ophthalmologic cases are often referred to a university-based setting. Also, referral by an optometrist or ophthalmologist may preliminarily screen for more common ophthalmic diseases when presenting to a neuro-ophthalmology clinic. Intriguingly, our study revealed that a significant number of referred patient cases were ultimately diagnosed with non-neuro-ophthalmologic conditions (dry eye syndrome, cataract, posterior vitreous detachment) based on chief complaint and patient history alone. These findings suggest that increased application of patient history may be warranted even for the general ophthalmologist. Additional studies may be worthwhile to similarly assess the diagnostic value of patient history within general and alternative sub-specialty ophthalmology settings. Lastly, we would like to remind the reader that while patient history can be exploited to correctly diagnose the majority of patient cases, confirmatory and ancillary testing with objective examination are still necessary, especially when ruling out potential life threatening conditions. Nevertheless, the present report shows that despite continued technological advancements, the contributions of fundamental history taking should not be undervalued in clinical medicine.

In conclusion, the present article serves to reinforce the value of fundamental history-taking in a generation faced with increasing technological advancement, which may lead to over-reliance on objective testing. Qualitative studies on the importance of history-taking within the field of medicine have been reported. However, an ophthalmologic perspective on the diagnostic value of patient history and its implications within the field of medicine as a whole is lacking. Therefore, our findings offer several unique and noteworthy contributions to the scientific literature with this purpose in mind. One, the study demonstrates the diagnostic value of the chief complaint and patient history in ophthalmology, a field especially at risk of losing sight of fundamental history taking given its stereotypical reputation as a pattern-recognition science. Second, we specifically illustrate the value of skilled history-taking by clinically integrating the scientific method when deriving disease diagnoses. This has important implications for future medical curricula by serving as a useful model for developing clinically competent medical trainees. Third, the results of our study were in close agreement with similar studies conducted within the general medical setting, suggesting the practical applications of our study to the field of medicine as whole.

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