Oculomics: Opportunities and Challenges for Optometry

Dear Editor,

Optometrists have long played an important role in the detection of non-ocular conditions, identifying warning signs and manifestations of more than 270 systemic and chronic diseases through comprehensive eye exams.[1] However, the rapid advancement of oculomics—the study of ocular biomarkers for the detection and monitoring of systemic diseases— has the potential to greatly expand this capability, unlocking unprecedented insights into cardiovascular, neurological, and overall systemic health.[2-6]

The eye is often called a window to health because it is the only part of the human body where blood vessels and nerve tissue can be directly observed in their natural state. Alterations in retinal blood vessels allow the clinician to draw conclusions about the status of vasculatures in the entire body.[7] Similarly, given that in many ways the retina is a direct extension of the brain, it allows non-invasive and real-time characterization of structures and functions associated with the central nervous system.[8] Moreover, changes in the eye often precede or manifest concurrently with various non-ocular conditions, providing a unique opportunity to use them as crucial prognosticators of disease progression.[9]

The rise of technologies enabling oculomics will help eye care professionals not only assess ocular health or detect subtle indicators of non-ocular conditions in the eye but also uncover a patient's unique risk factors. This knowledge will facilitate personalized patient care, allowing eye care professionals to offer tailored advice aimed at preventing the onset or altering the progression of various non-ocular conditions. Much like the well-established role of eye exams in detecting diabetic changes, this holistic approach will not only elevate the overall healthcare experience for patients but also reinforce the critical link between eye health and systemic well-being.

As an early example of the broad relationship between ocular and systemic factors, recent articles have revealed that hyperspectral imaging may serve as valuable markers for diseases such as Parkinson's and Alzheimer's.[10,11] Electroretinography also shows promise as an indicator of vulnerability to mental health conditions, including depression and schizophrenia,[12,13] and tear fluid analysis is emerging as a potential source of biomarkers for cancers.[14,15]

Due to the accessibility and frequency of routine eye exams, eye care clinics are emerging as ideal settings for screening for a wide array of conditions, which can lead to initiating timely therapeutic management, improving prognosis and quality of life, and reducing costs for the healthcare system. Considering this, it becomes clear that eye care professionals will not only play an increasingly important role in the early assessment of diseases, but that they will also face new ethical and technological challenges and responsibilities. It is thus critical for optometrists to understand not only how the upcoming innovative technologies work, but also their own clinical and ethical obligations towards their use in the clinic.

Optometrists should always prioritize patients' well-being by adopting a structured approach to detecting non-ocular conditions, including, when necessary, referring patients to the appropriate healthcare provider. As new technology arises and new features are developed, optometrists must stay aware and informed of the evolving context to ensure patients receive the best, most up-to-date, and comprehensive care. Key principles should guide the resulting interactions, including obtaining informed patient consent, which involves explaining the purpose, potential findings, implications of new technologies, the data that will be collected, and how that data will be used. Clinicians must be adequately trained to understand both the capabilities and limitations of emerging tools to ensure safe and accurate interpretation of results. Technologies should be used within their intended regulatory scope, with clear and transparent communication to patients—especially when distinguishing between risk assessments, suspicions, diagnoses, and prognoses. Findings should be documented and, when necessary, shared with the appropriate healthcare professional (e.g., primary care physician, cardiologist, neurologist) based on the nature and severity of the condition. Interdisciplinary collaboration is essential to integrating these advancements effectively, fostering a coordinated approach to patient care that enhances early detection and intervention. Additionally, optometrists must stay informed about technical updates, potential biases, and evolving clinical standards, ensuring they integrate innovations in their practice responsibly while maintaining patient care of the highest quality.

While the integration of new technology in eye care, including oculomics, can enhance diagnostic capabilities and improve patient outcomes, the indispensable elements of human judgment and patient communication remain critical components of the healthcare process. We must ensure that new information gathered via the eye, its biology, and its functions is interpreted by a professional capable of discerning critical insights. Ultimately, the objective is to harness new technology as invaluable tools in the diagnostic and disease management processes while maintaining a patient-centered approach that guarantees the best care possible.

The eye is a window to an individual's health that, when coupled with oculomics, presents optometrists with an extraordinary opportunity to increase their contribution to the overall health of their patients. ●

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