COMMUNITY VISION SCREENING

A closer look at the potential impact and ideal framework.

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An estimated 253 million people worldwide are visually impaired, 36 million of whom are blind and 217 million of whom have moderate to severe visual impairment. More than 80% of visual impairment is considered to be either preventable or reversible, suggesting a global population of more than 200 million people with avoidable significant visual impairment or blindness. The burden of visual impairment is disproportionately borne by developing countries and other disenfranchised populations.

The leading causes of blindness worldwide include cataract, refractive error, and glaucoma. Glaucoma will affect the vision of nearly 80 million people by 2020, and more than 8.4 million of these people may ultimately become blind bilaterally. Many patients diagnosed with glaucoma experience painless, progressive, permanent visual impairment due to a lack of health care access, nonadherence to prescribed therapy, and inadequate treatment. As the early stages of glaucoma are typically asymptomatic, comprehensive vision screening is essential to prevent progression to irreversible blindness and to avoid the health care costs and morbidity associated with late-stage glaucoma treatment.

Unfortunately, current guidelines for vision screening from the United States Preventive Services Task Force state that there is insufficient evidence to assess the benefits and harms of screening for visual impairment in adults aged 65 years and older. In contrast, the AAO’s guidelines recommend comprehensive medical eye examinations for asymptomatic patients without risk factors under 40 years old every 5 to 10 years; 40 to 54 years old every 2 to 4 years; 55 to 64 years old every 1 to 3 years; and 65 years and older every 1 to 2 years.

Although glaucoma management can prevent irreversible vision loss, it also represents a significant economic burden that increases with disease severity. The direct cost burden of glaucoma—accounting only for expenses directly related to its treatment—is estimated to be more than $2.9 billion in the United States. The average direct costs per patient per year are estimated to be $623 for early glaucoma, $1,915 for advanced glaucoma, and $2,511 for end-stage glaucoma. The true economic impact is likely higher, as these estimates do not take into account expenses related to the care of patients with significant glaucomatous morbidity, visual morbidity in undiagnosed patients, or lost productivity on the part of patients and caregivers.

The prolonged asymptomatic period, the irreversible nature of the vision loss, and the substantial economic impact of glaucoma suggest that screening, early detection, and early treatment have great potential value. The ideal screening system should be optimized to a streamlined, cost-sensitive, and portable process, which is especially important to increase accessibility in regions with impaired health care access and lower socioeconomic status.

SCREENING HIGH-RISK POPULATIONS

The value of vision screening increases when high-risk, underserved populations—especially neighborhoods with high poverty rates and lack of access to eye care—are targeted. Underserved populations are more likely to have cultural and linguistic disparities, which are additional barriers to accessing health care. By carefully choosing vision screening sites within communities with high-risk populations, health care providers can minimize barriers to access. Typical sites used for local vision screenings include community centers, health fairs, conventions, churches, senior centers, and schools.
housing, and primary care and eye care provider offices. Examples of targeted high-risk community vision screening projects include the Los Angeles Latino Eye Study (LALES); the Haitian Afro-Caribbean population study in South Florida; the Chinese American Eye Study in Monterey Park, California; and the Hoffberger Project in Baltimore.

In addition to detecting eye disease early, screening high-risk populations provides a wealth of epidemiologic data and an improved understanding of the burden of ocular disease in specific cohorts. For example, the LALES focused on Latinos of Mexican ancestry living in Los Angeles and identified a higher prevalence of open-angle glaucoma and diabetic retinopathy in this group compared with the general population. Similarly, the Haitian Afro-Caribbean community in South Florida revealed a higher prevalence of severe glaucoma. Similarly, the Chinese American Eye Study showed that Chinese Americans have longer axial lengths and a greater contribution of axial length to refractive error than other populations, resulting in a higher burden of myopia-related disease. These types of population-based findings help to direct specific, high-yield interventions where they are needed most.

**SCREENING FRAMEWORK**

Creating a vision screening system that can be effectively utilized in a community setting (eg, health fair, international mission, etc.) requires the screenings to be efficient, cost-effective, and mobile, while maintaining reproducible measurements for ocular disease risk factors. The screening framework outlined below offers a fairly comprehensive but brief assessment of an individual’s overall glaucoma risk.

A proper screening examination should assess (1) visual acuity, (2) visual field (VF), (3) central corneal thickness (CCT), (4) IOP, and (5) the optic disc and macula. Nonphysician volunteers can be trained to collect the first four data points. We then recommend that the patient be seen or the case be reviewed by an ophthalmologist who can synthesize these data in conjunction with an optic disc and retinal examination. Taken together, the ophthalmologist is able to assess the individual’s risk for glaucoma and other ocular disorders, such as refractive error, cataracts, and common retinal diseases. The patient can then be referred for further testing, diagnosis, and treatment at a health care center if necessary.

**Visual acuity.** A Snellen eye chart with pinhole occluder can be used to assess visual acuity, which may be associated with refractive error, cataract, advanced glaucoma, and macular disease. The Snellen eye chart is preferred in a community setting because it does not require a projector or a dark room and is inexpensive and portable. Portable frequency doubling technology (FDT) perimetry can be used to assess VF. FDT perimetry is preferred to formal threshold VF testing because it can be performed quickly with minimal training, is relatively inexpensive, and is portable. The sensitivity and specificity for detecting glaucoma increase when combined with additional examination data obtained during screening. Investigators are currently evaluating a smartphone-based, virtual reality model of FDT perimetry, which has the potential to further minimize cost and improve the accessibility.

**CCT and IOP.** CCT and IOP measurements are important components of the screening examination. Although the role of CCT in glaucoma-screening models has yet to be determined, properties such as corneal hysteresis and corneal resistance factor are known to affect the accuracy of IOP measurements.

The availability of portable and relatively inexpensive pachymeters has enabled CCT measurement to be incorporated into vision screening protocols. The Tono-Pen (Reichert Technologies) is suitable for community vision screenings because it is portable, user-friendly, and relatively accurate. A nonanesthetic alternative is the Icare rebound tonometer (Icare USA). It has been suggested that this device is comparable to the clinical standard of Goldmann applanation tonometry; however, the
CONCLUSION

Although the vision screening protocol discussed in this article emphasizes glaucoma detection, the general eye examination performed in a community setting measures many parameters that screen for other ocular problems, such as cataract and macular degeneration. The value of community vision screenings is increased by maintaining cost-effectiveness, focusing on high-risk populations, and ensuring an avenue for referral and ongoing treatment if disease is identified. As the leading causes of blindness can be detected by a comprehensive vision screening process, it is imperative to use a systematic screening protocol to prevent blindness through early diagnosis and treatment.