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CAN YOU CHANGE THE GAME IN...

Eye & Vision Care

How to mitigate, prevent and cure eye conditions and vision impairment?

EIT Health seeks to support and invest in teams with the most disruptive and cost effective, technology-driven solutions advancing eye and vision care.

1. Background information

The 2017 Global Burden of Disease (GBD) Study ranked vision impairment, including blindness, the third cause among all impairments for years lived with disability.[1] Globally, at least 2.2 billion people around the world have a vision impairment, from which, according to the WHO, 80% could be prevented or cured[2]. By 2050, over half of the world's population may be afflicted with myopia. Of these, one billion people will be highly myopic[3], with drastic long-term health implications, including sight-threatening eye diseases such as glaucoma, cataracts, retinal detachment and macular degeneration later in life.

Vision is the most dominant of our senses and plays a crucial role in all stages of our lives. We take vision for granted, but without it, we would be struggling to read, to work, to learn and even to walk.

Uncorrected poor vision, defined as uncorrected refractive error (URE), is the world's largest unaddressed disability[4] with 2.7 billion people concerned (among 4.7 billion people who need vision correction to live well) and costs the global economy $272B in lost productivity every year[5].

Fast evolving life habits such as intense digital display usage and new artificial light sources cause higher strain on our eyes and vision. Even well corrected individuals may still suffer from insufficient visual performance or comfort such as visual fatigue or glare.

Every individual adult at some point of their lives, will experience at least one eye condition that will require appropriate care. If not addressed properly, it could lead to a vision impairment or loss. Tens of millions of individuals have an untreated severe vision impairment and could benefit from rehabilitation.

1. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2019 Jun 22;393(10190)
2. https://www.who.int/blindness/world_sight_day/2017/en/#:~:text=The%20vast%20majority%20live%20in,can%20be%20prevented%20or%20cured.
3. The Economic and Societal Impact of Myopia and High Myopia, Sharon Yu Lin Chua and Paul J. Foster, Updates on Myopia, 2020. https://doi.org/10.1007/978-981-13-8491-2_3
4. https://visionimpactinstitute.org/wp-content/uploads/2019/11/EssilorSeeChange_Eliminating-Poor-Vision-in-a-Generation_2020-Update.pdf
5. [1] TST Smith et al., "Potential Lost Productivity Resulting from the Global Burden of Uncorrected Refractive Error," Bull World Health Organ. 87(6) (June 2009): 431–437, http://dx.doi.org/10.2471/BLT.08.055673. Updated for population and inflation, 2015.

The burden of eye conditions and vision impairment is not equally shared: it is often far greater in low- and middle-income countries, among older people and women, and in rural and disadvantaged communities.

Only in geographical Europe[6], it is estimated to be over 30 million blind and partially sighted people. On average, 1 in 30 Europeans experience sight loss. This problem aggravates in senior citizens where 1 in every 3 individuals over 65 faces sight loss. Moreover, direct healthcare costs of eye diseases in Europe are estimated to be greater than €18 billion per year, according to a study of 11 EU Member States.[7]

2. Opportunities

The global need for eye care is projected to increase dramatically in the coming decades posing a considerable challenge to health systems. Inequalities in coverage, ensuring services are planned and provided according to population needs, uneven quality of eye care services, workforce shortages, gaps in data and fragmented services poorly integrated into health systems are some of the most urgent challenges remaining.

Respective roles and education or training of eye care professionals (ophthalmologists, optometrists, orthoptists and opticians) are heterogeneous across European countries, raising interface frictions along the patient journey and quality of care issues. Moreover, this situation impedes a smooth adoption of innovative technologies.

There is an opportunity to address one of the world´s biggest problems by improving vision of billions of people. Scientific and technological advances have opened a wide range of clinical and research opportunities with the potential to accelerate future action.

Adoption of telehealth solutions has been efective in improving access to a range of eye care services, particularly for those living in rural and remote areas of many countries. Several emerging technologies in the field of eye care, including the use of mobile-based software applications for vision assessment and cataract surgery benchmarking, and artificial intelligence technologies for the detection of a range of eye conditions including diabetic retinopathy, offer further hope for enhancing access and quality of health care to the most neglected communities.

However, further research is required in real-world settings prior to widespread adoption of these technologies. The use of big data analytics also has the potential to improve knowledge of service use and the surveillance of eye conditions, and for monitoring surgery outcomes.

Better profiling and prediction tools could be developed by combining imaging with more sophisticated functional tests, leading to more effective screening and personalized prevention measures.

6. http://www.euroblind.org/about-blindness-and-partial-sight/facts-and-figures#details
7. https://www.medtecheurope.org/ophtalmology/

3. Challenges

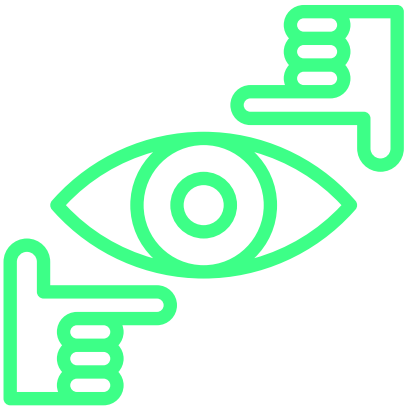
Despite advances made during the last 30 years, significant challenges remain. Still as of today, eye health is not a key priority in many countries and in light of the aging population there is a need to engage in preventive measures.

As an example, the costs of the coverage gap for UREs and cataract globally are estimated to be $14.3 billion[8]. These are the additional costs our health system would have to absorb. This financial investment is needed immediately; it requires appropriate planning and relies on additional investment to strengthen existing health systems. Besides keeping up with citizens eye care needs, progress in this area will face major challenges that lie ahead:

- globally eye care needs will rise sharply due to changes in demographics and lifestyle (ageing population, unhealthy eating habits, sedentarism, overexposure to screens and artificial lights, etc.)
- patient data are often lacking, and health information systems are weak in most countries
- eye care is frequently poorly integrated into health systems, for example, in national health strategic plans and health information systems. In addition, the eye care workforce is poorly coordinated

4. Possible areas of intervention

The list of challenges is long, as well as the list of possible areas of intervention in the Eye & Vision space. Among others, we would like to see solutions addressing the following topics:



4.1. Eye care: accessible and massive

Vision impairment has serious consequences, however many of them can be mitigated by timely access to quality eye care and rehabilitation. This is fundamental: quality treatment should reach all citizens regardless of their geographical location, socio-economic status or age.

The most critical factor is to raise public awareness and understanding of the importance of maintaining eye health through regular eye and sight examinations.

8. World report on vision. Geneva: World Health Organization; 2019.

Diagnostic & mass screening	Tools to image, monitor, and track the eyes for a wide range of diseases. Better assessment of visual functions with psychological tests. Instruments for measurement of eye defects. Access to the right care and early detection of eye conditions.
Monitoring	Detection and characterization of a disease progression, to understand its evolution and treat it on time.
Treatments	Scalability and democratization of the solutions available and new approaches to non-pharmaceutical treatments.
Surgery in non-surgical settings	Surgical procedures often imply high costs and instruments not accessible for all. There is a need to bring surgery out of the operating room.

4.2. Visual performance and comfort

Several visual functions (acuity, accommodation, fixation, contrast, visual field, dynamic vision, colour vision, etc.) interact to provide an efficient functional vision in all daily life situations at any age (reading, working, spatial navigation etc), and hence constitute a major pillar of everybody's quality of life and autonomy.

Our fast evolving life habits and environments often put us in situations where our quality and comfort of vision are degraded even for healthy individuals: screen usage triggers visual fatigue, ageing alters visuo-postural balance and increases risks of falls, artificial lighting and light transitions enhance photosensitivity and glare. Today, our visual tests are often limited to acuity and do not predict how we perform in more demanding visual tasks.

Therefore, there is a need to better assess complex visual functions and develop customized visual solutions for citizens in order to enhance visual performance and comfort, wellbeing, and prevent loss of autonomy or accidents and therefore master health costs.

Presbyopia & Ageing	Difficulty seeing objects at near distance with increasing age (i.e. after 40 years of age). There is a clear need to compensate accommodation in Presbyopic patients not affected by cataract. Ageing in healthy or pre-pathological conditions can lead to overall sensory and cognitive deficits that affect visual performance.
Visual Fatigue	Characterization and solutions to relieve eye strain, eye ache, tearing, blur, headache after long and demanding visual tasks (on screens particularly) or in harsh light environments.
Photosensitivity & Glare	Prevent discomfort glare (photosensitivity threshold) and disability glare (loss of visual acuity and contrast in glary environment).

Multi-sensory deficits	Enhance effective multi-sensory interaction between vision, hearing, proprioception for proper vision and body functioning and decision making.
Specific situations	Improve visual performance and comfort in specific situations such as: driving, working, sports activity, etc.

4.3. Eye conditions

Eye conditions that can cause vision impairment and blindness – such as cataract, glaucoma and age-related macular degeneration (AMD) – are, for good reasons, the main focus of prevention and other eye care strategies.

However, the importance of eye conditions that do not typically cause vision impairment, such as myopia, dry eye and conjunctivitis must not be overlooked. These conditions are frequently among the leading reasons to seek eye care in all countries.

Amblyopia (Lazy eye)

Amblyopia treatment is usually less effective in adults than in children. There is a need to treat moderate and severe amblyopia to provide improved visual acuity in patients who are refractory to traditional therapy.

Myopia

Difficulty seeing distant objects affects 30% of the actual population, while estimates set the incidence in 50% in 2050. If 50% of the population become myopic, the incidence of eye diseases will rise. 10% of people suffering from myopia will develop high myopia (5-6 dioptres). Potential needs in this area include:

- Control of the myopic growth
- Screen time and myopia epidemic among children
- Prevention

Cataracts

Most common cause of vision loss in people over age 40, and the leading cause of blindness in the world. For a patient with cataracts, vision can become cloudy and ultimately become obstructed. The main treatment for cataracts is surgery, where the ophthalmologist removes the clouded lens and replaces it with a plastic intraocular lens (IOL). Potential actions in this area include:

- Prevention
- Non-surgical interventions
- Surgery: reducing pre- and post-operative times, optimizing procedures

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AMD (Age-related Macular Degeneration)	Macular degeneration is a disease in which the macula begins to deteriorate. There are two forms of AMD: dry and wet. Macular degeneration causes damage to the central part of the retina responsible for detailed vision, leading to dark patches, shadows or distortion of the central vision. The risk of developing macular degeneration increases with age. There is still no good approach to stop the progression and cure this disease.
Diabetic Retinopathy	Most common cause of vision loss among people with diabetes and the leading cause of vision impairment and blindness for working-age adults. This diabetes complication is caused by sugar in the blood blocking the blood vessels that feed the retina. Detection is difficult, as the patient can be asymptomatic until it is too late.
Dry eye	Chronic condition where tears do not provide enough lubrication for the eyes. This can occur due to insufficient tear production (often caused by aging and laser eye surgery), increased tear evaporation (perhaps due to environmental factors or infrequent blinking), or an imbalance in tear composition. From the diagnostic perspective, there is a need to treat dry eye that provides sustained symptomatic relief for patients who do not produce adequate tears.
Glaucoma	Glaucoma is a condition in which the optic nerve is damaged. It is one of the leading causes of blindness. As the disease progresses, the patient loses peripheral vision and develops tunnel vision, and ultimately might even lose central vision. The most common treatments for glaucoma come in the form of eye drops or pills that halt further vision deterioration. Previously lost vision cannot be restored. There is a need to improve the patient journey by granting access to care, enhancing early detection of the disease and optimizing medication and drug administration.

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4.4 Vision: the eye as a gateway to the full-body health

The eyes do more than they allow us to see, they can be also considered literally as a window to our health. Many signs and symptoms are reflected by various parts of the eye, offering a range of biophysical, biological and biomolecular signals that can be detected from the anterior or the posterior segment (e.g. from the eyelid, tears, iris, pupil, sclera, eyeball, or retina) or from the eye movements. Proper measurement and analysis of those signals would allow to detect or predict many ocular or non-ocular diseases, or even reveal various wellbeing disturbances, whether related to psychological, mental, physical, emotional or nutritional state. Available or new technologies could be leveraged to develop efficient tools for the early diagnosis and prevention of many health problems, whether in real life conditions or in clinical observations.

For instance, retina vasculature can indicate underlying health problems. Some health conditions may lead to a range of ocular manifestations; such as diabetes, heart disease, stroke or multiple sclerosis.

The arrangement of blood vessels at the back of the eye is closely connected to the health of the body. Hypertension and blocked arteries can be easily diagnosed in the eye. High blood sugar can bring problems in the small blood vessels, potentially leading to a diabetic retinopathy, which can lead to blindness and other kidney and heart-related problems. Systemic inflammatory diseases that cause arthritis and inflammation in other parts of the body can also be detected.

The list of conditions below provides significative examples in this area but is not limitative.

Diabetes	Detection of diabetic retinopathy symptoms could lead to a diabetes diagnosis for diabetic patients who are not aware of their condition.
CVDs (Cardiovascular Diseases)	The retina offers several clues into cardiovascular health. For example, high blood pressure can be determined by noting the relative sizes of the retinal veins and arteries.
Eye and neurological diseases	Neurological disease can involve the eye in many ways. In many cases, ocular involvement is the first manifestation of an underlying neurological disease. Thus, the ability to recognise the nature of ocular abnormalities can lead to early diagnosis and successful treatment of the underlying condition.

5. Why is EIT Health addessing this problem?

Eye health is still not a key priority in many countries in Europe. As the European population grows older and the prevalence of non-communicable diseases rises, the pressures on social care and health budgets is increasing. Addressing this topic with the Wild Card challenge holds the promise of finding ways to identify and treat these diseases, support people who have them and enable them to continue to live full and productive lives as they age.

6. Why is Essilor addessing this problem?

As an industry leader in vision care, Essilor has made it its responsibility to help drive in research on vision and eye care solutions.

Poor vision is in fact one of the world's largest disabilities: out of the 4.7 billion people in the world who need vision correction, 2.7 billion still do not have the vision correction they need. 6 billion people still do not protect their eyes from harmful light, and 5 billion people are at risk of being myopic by 2050. And with changing life habits, millions of people are suffering from visual fatigue or light sensitivity.

All of this makes eye health a public health issue that only a strong commitment by leaders and coalitions can help put on the global agenda.

With a mission of "improving lives by improving sight", Essilor is firmly committed to doing its part through innovative partnerships which complement the work of its R&D experts who every day are pushing the boundaries of what is possible to address all vision needs, enhance the ophthalmic products performances as well as improve instruments for testing and diagnosing visual health, for the benefit of every patient, everywhere in the world.

The Wild Card programme provides a perfect platform for continuing Essilor's mission to promote and foster visual health innovation.