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VISION FOR 2030: ADVANCING GLOBAL EYE HEALTH THROUGH WHO'S PEOPLE-CENTERED TARGETS

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Abstract

Eye health is an essential aspect of global public health, closely linked to individual well-being, productivity, and social inclusion. Cataract and uncorrected refractive errors remain the leading causes of vision impairment worldwide, contributing considerably to avoidable blindness and disability. Effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC) are emerging as critical indicators for assessing the quality and accessibility of eye care services. These indicators not only measure service delivery but also emphasize the importance of achieving good visual outcomes, reflecting both coverage and quality of care. This review synthesizes current evidence on the global burden of cataract and refractive errors, highlighting the significant variations in eCSC and eREC across countries and demographic groups. Data reveal persistent inequities, with rural populations, women, indigenous peoples, and ethnic minorities often experiencing lower coverage and poorer outcomes. Furthermore, projections suggest that the rising aging population will increase the absolute number of individuals requiring cataract surgery and refractive error correction, intensifying the need for scaled-up interventions. Cost-effectiveness analyses confirm that cataract surgery and refractive error correction are among the most feasible and economical health interventions, capable of reducing disability-adjusted life years (DALYs) and minimizing global productivity losses. Integrating eye care into Universal Health Coverage (UHC) frameworks and aligning efforts with Sustainable Development Goals (SDGs) are essential to ensuring equitable access and sustainable financing for eye health services. The Secretariat's forthcoming steps include finalizing baseline estimates for eCSC and eREC, developing practical monitoring frameworks, fostering funding dialogues, and supporting countries in implementation planning. These initiatives aim to enhance global eye care quality, coverage, and equity, ultimately reducing avoidable vision impairment and improving quality of life worldwide.

Keywords: *Effective cataract surgical coverage, effective refractive error coverage, eye health, vision impairment, universal health coverage, sustainable development goals, health equity, visual acuity, global eye care, cost-effectiveness.*

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1. Introduction

Eye health is a fundamental component of overall health and well-being, deeply influencing individuals' quality of life, productivity, and social inclusion. Globally, vision impairment affects hundreds of millions of people, with cataract and refractive errors representing the leading causes of avoidable blindness and vision impairment. Cataract, a clouding of the eye's natural lens, remains the most common cause of blindness worldwide, especially in low- and middle-income countries (LMICs), where access to surgical treatment is often limited. Uncorrected refractive errors—including myopia (near-sightedness), hypermetropia (farsightedness), astigmatism, and presbyopia—are the most prevalent causes of vision impairment globally, significantly affecting educational outcomes, employment opportunities, and productivity.

Addressing these conditions effectively is essential not only for improving eye health but also for advancing broader health and development goals. The World Health Organization (WHO), in collaboration with global partners, has introduced two critical indicators—effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC)—to measure the proportion of individuals in need of cataract surgery or refractive error services who receive them with good quality outcomes. These indicators move beyond mere coverage to incorporate the effectiveness of interventions, emphasizing the quality of care and visual outcomes achieved.

Effective Cataract Surgical Coverage (eCSC) is defined as the proportion of people who have undergone cataract surgery and attained a good quality visual outcome relative to those in need of such surgery. Similarly, **Effective Refractive Error Coverage (eREC)** refers to the proportion of individuals with refractive errors who have received corrective services (e.g., spectacles, contact lenses, surgery) and attained satisfactory vision correction relative to those requiring these services.

The importance of eCSC and eREC indicators lies in their ability to capture both access and quality of eye care services, providing robust data to inform policy, allocate resources, and monitor progress at national and global levels. Importantly, these indicators align with the vision of Universal Health Coverage (UHC), which seeks to ensure all individuals have access to essential health services without financial hardship. Eye health is explicitly recognized in the WHO's World Report on Vision (2019) and the World Health Assembly resolution WHA73.4, which advocate for the integration of comprehensive eye care into UHC frameworks.

Furthermore, improving eye health and reducing vision impairment contribute directly to achieving several Sustainable Development Goals (SDGs), including SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), and SDG 8 (Decent Work and Economic Growth). By targeting effective coverage of cataract surgery and refractive error correction, health systems can enhance not only the quality of life for millions but also societal productivity and economic development, fostering inclusive growth and reducing inequities.

This review explores the definitions, current global status, challenges, and strategic priorities associated with eCSC and eREC, highlighting the critical role of these indicators in advancing global eye health and universal health coverage by 2030.

2. Definitions and Measurement of Effective Coverage Indicators

2.1 Effective Cataract Surgical Coverage (eCSC)

Effective Cataract Surgical Coverage (eCSC) is an advanced metric that not only accounts for the proportion of individuals who have undergone cataract surgery but also evaluates the quality of the surgical outcome. Unlike traditional cataract surgical coverage, which focuses solely on the number of surgeries performed, eCSC incorporates visual acuity results post-surgery, thereby providing a more accurate reflection of the effectiveness of cataract interventions.

Definition:
eCSC is defined as the proportion of people who have received cataract surgery and achieved a "good" quality visual outcome (presenting visual acuity of ≥6/12 in the operated eye) relative to the total number of people who require cataract surgery. This measurement acknowledges that surgery alone is insufficient unless it results in meaningful improvement in vision.

Method of Calculation:

The calculation of eCSC involves several components, including individuals with unilateral or bilateral cataract surgery and their respective visual outcomes. The formula considers presenting visual acuity (PVA) and best-corrected visual acuity (BCVA) to ensure precision in defining surgical success.

Data Sources and Frequency:

Data to calculate eCSC typically come from population-based eye health surveys, conducted approximately every five years to monitor trends and disparities over time. Disaggregation by age, gender, socioeconomic status, and geographic location allows for detailed equity analyses.

2.2 Effective Refractive Error Coverage (eREC)

Effective Refractive Error Coverage (eREC) is a complementary indicator focused on the correction of refractive errors, such as myopia, hypermetropia, astigmatism, and presbyopia. Like eCSC, it emphasizes not just the provision of refractive services but also the quality of visual correction achieved.

Definition:
eREC measures the proportion of individuals who have received refractive error services (spectacles, contact lenses, or refractive surgery) and attained a good visual outcome (e.g., presenting visual acuity ≥6/12 for distance vision or ≥N6 for near vision) relative to those in need of such services.

Distance and Near Vision:

eREC is subdivided into two components:

- **Distance eREC:** For individuals with distance vision impairment due to refractive error.
- **Near eREC:** Specifically for near vision impairment caused by presbyopia, which significantly affects daily functioning and quality of life, particularly in older adults.

Method of Calculation:

The formula for eREC accounts for individuals with unmet, undermet, and met needs for refractive error correction, considering presenting, uncorrected, and best-corrected visual acuity to estimate effective coverage accurately.

Data Sources and Frequency:

Similar to eCSC, eREC estimates derive from population-based surveys, with data collected approximately every five years. Stratification by demographics supports targeted interventions to address inequities.

2.3 Significance of Measuring Effective Coverage

Measuring effective coverage through eCSC and eREC is crucial for several reasons:

- **Quality Emphasis:** These indicators reflect not just service delivery but also the success and quality of interventions, encouraging health systems to prioritize outcomes.
- **Policy and Planning:** Reliable data on effective coverage inform policy decisions, resource allocation, and program design, helping countries identify gaps and prioritize eye health services.
- **Equity Monitoring:** Disaggregated data highlight disparities among population groups (e.g., rural vs. urban, gender, socioeconomic status), promoting equity-focused strategies.
- **Global Monitoring:** As part of the WHO global eye health monitoring framework, these indicators support tracking progress towards UHC and SDG targets.

3. Current Coverage, Trends, and Inequities in Eye Care

3.1 Overview of Effective Cataract Surgical Coverage (eCSC)

Recent analyses of population-based surveys across various countries reveal significant disparities in eCSC, reflecting inequities in access to quality cataract surgery globally. Preliminary data from 47 surveys conducted in 11 countries, including low-income (LIC), lower-middle-income (LMIC), upper-middle-income (UMIC), and high-income countries (HIC), show a wide range of eCSC coverage—from as low as 2.8% in some regions to as

high as 88.5% in others. This variation underscores the persistent challenges in delivering cataract services effectively across different contexts.

Countries with repeated surveys have demonstrated an encouraging trend with an average annual increase in eCSC of 1.1 percentage points, indicating gradual progress in cataract surgical service delivery. However, this progress remains uneven and is often hindered by socioeconomic and geographic barriers.

3.2 Geographic and Socio-Demographic Disparities

Significant disparities in eCSC exist, particularly between urban and rural populations. Rural areas typically report lower coverage due to factors such as limited health infrastructure, scarcity of trained ophthalmic personnel, and logistical challenges in accessing surgical services.

Gender inequities are also notable. Globally, women are approximately 21% more likely to experience cataract-related vision impairment than men. This gender gap in eCSC highlights systemic barriers such as cultural norms, financial constraints, and lower health-seeking behavior among women. For example, in Australia, data from 2015 illustrate a stark contrast with non-Indigenous Australians achieving an eCSC of 88.5%, compared to only 51.6% among Indigenous Australians—an alarming indicator of ethnic disparities.

3.3 Effective Refractive Error Coverage (eREC) Trends

Similar disparities are observed in the effective coverage of refractive error services. Analysis from 25 countries post-2010 shows that distance eREC varies dramatically, with averages around 55% but ranges spanning from a mere 1.7% to nearly 94%. Low- and middle-income countries often report significantly lower coverage rates.

Near vision impairment, mainly due to presbyopia, remains highly underserved in LICs and LMICs. Regions such as western, eastern, and central sub-Saharan Africa exhibit eREC for near vision of less than 20%, whereas high-income regions like North America, Australasia, and Western Europe report coverage exceeding 90%. This discrepancy highlights the urgent need for accessible and affordable near vision correction services in resource-limited settings.

3.4 Challenges Contributing to Inequities

Multiple factors contribute to these inequities, including:

- **Health System Limitations:** Inadequate infrastructure, shortages of trained eye care professionals, and insufficient integration of eye care services into primary health care systems.
- **Financial Barriers:** High out-of-pocket costs for surgery, spectacles, and other refractive services disproportionately affect disadvantaged populations.

- **Awareness and Health-Seeking Behaviour:** Lack of awareness about eye health, cultural beliefs, and low prioritization of eye care contribute to delayed or absent treatment.
- **Geographical Barriers:** Remote and rural populations face difficulties in reaching eye care facilities due to distance, transportation issues, and limited availability of services.

3.5 Implications for Universal Health Coverage and Equity

Achieving equitable increases in eCSC and eREC is essential for the realization of Universal Health Coverage (UHC). Eye health services that are accessible, affordable, and of high quality must be integrated within national health systems to reduce the burden of avoidable vision impairment. Addressing the root causes of inequities through targeted policies and investments will ensure no population is left behind.

4. Health Economic Rationale for Scaling Up eCSC and eREC

Investing in eye care, particularly interventions addressing cataract and refractive errors, offers one of the most cost-effective opportunities to improve population health and economic productivity. Understanding the economic benefits of scaling up effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC) provides a compelling rationale for prioritizing these services within health systems.

4.1 Cost-Effectiveness of Cataract Surgery

Cataract surgery is recognized globally as one of the most cost-effective health interventions available. Studies have consistently shown that cataract surgery costs less than $200 per disability-adjusted life year (DALY) averted, placing it among the most economically efficient surgical procedures worldwide. This high cost-effectiveness is attributed to the significant improvement in quality of life and productivity that cataract surgery offers to individuals who regain vision.

Analyses indicate that achieving 95% coverage of cataract surgery globally could avert over 3.5 million DALYs annually, emphasizing the profound impact of expanding surgical services. Investing in cataract surgery not only improves individual well-being but also reduces the overall societal burden of visual impairment.

4.2 Economic Burden of Uncorrected Refractive Errors

Uncorrected refractive errors (URE), including myopia, hypermetropia, astigmatism, and presbyopia, contribute substantially to global productivity losses. The economic impact is staggering, with annual global productivity losses estimated at approximately US$244 billion for uncorrected myopia and US$25.4 billion for presbyopia.

These losses far exceed the relatively low costs of providing corrective spectacles, contact lenses, or surgical interventions. For instance, both custom-made and ready-made spectacles are inexpensive yet highly effective means to restore vision. This stark contrast highlights an

underutilized opportunity to reduce economic losses through improved refractive error correction.

4.3 Return on Investment

Investing in eye care services, particularly cataract surgery and refractive error correction, yields high returns both in health outcomes and economic gains. Improved vision enables individuals to participate more fully in education, employment, and community life, enhancing overall productivity and economic development.

By reducing vision impairment, countries can alleviate healthcare costs related to complications from blindness and visual disability, such as falls and injuries. Moreover, addressing vision impairment aligns with broader development goals, including poverty reduction and improved educational outcomes.

4.4 Integration with Universal Health Coverage (UHC)

The cost-effectiveness and economic benefits of scaling up eCSC and eREC make eye health an essential component of Universal Health Coverage. Embedding eye care services within UHC frameworks ensures that populations can access necessary interventions without financial hardship.

Strategic funding, policy support, and resource allocation will enable countries to implement sustainable eye care programs that address both cataract and refractive error needs, ultimately reducing avoidable blindness and vision impairment.

5. Disease Projections and Future Trends

5.1 Increasing Prevalence of Cataract and Refractive Errors

The global population is aging rapidly, with the number of people aged 65 years and older projected to increase from 703 million in 2019 to 998 million by 2030—a 42% increase over just a decade. Given that cataract prevalence increases with age, this demographic shift will likely lead to a significant rise in the number of individuals requiring cataract surgery worldwide.

Similarly, presbyopia—a near vision impairment common in aging populations—is expected to affect approximately 2.1 billion people by 2030, up from 1.9 billion in 2020. Although the rate of increase in presbyopia is slightly lower than in previous decades, the absolute number of affected individuals will continue to grow, reinforcing the need for accessible eye care services.

5.2 The Myopia Epidemic

Beyond age-related conditions, lifestyle and environmental factors are driving a global surge in myopia (near-sightedness). Factors such as reduced outdoor activity, increased near work, and urbanization contribute to this trend. The prevalence of myopia is projected to rise by approximately 28% between 2020 and 2030, slightly less than the 34% increase recorded in the previous decade, but nonetheless substantial.

This rapid increase poses a major public health challenge, as myopia—if left uncorrected or progressing to high degrees—can lead to severe vision impairment and increased risk of complications such as retinal detachment and glaucoma.

5.3 Implications for Eye Care Services

The growing burden of cataract and refractive errors necessitates strategic planning and scaling up of eye care services globally. Countries must anticipate increased demand for cataract surgeries and refractive error correction and ensure that health systems are equipped to deliver effective, accessible, and affordable interventions.

5.4 Addressing Inequities in Eye Care Coverage

Current data indicate significant disparities in effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC) across regions, socioeconomic groups, and genders. Rural populations, indigenous communities, and women often experience lower coverage and poorer outcomes.

Future efforts must prioritize equitable service delivery, targeting underserved populations to reduce these disparities. Strengthening data collection and monitoring mechanisms will be crucial to identify gaps and guide interventions.

6. Current Coverage and Trends

6.1 Effective Cataract Surgical Coverage (eCSC)

Effective cataract surgical coverage (eCSC) is a critical indicator of both access to cataract surgery and the quality of surgical outcomes. A preliminary analysis of 47 population-based surveys across 11 countries (including low-, middle-, and high-income settings) reveals a striking disparity in eCSC, ranging from as low as 2.8% to as high as 88.5%. This wide range underscores significant inequities in cataract surgical services worldwide.

Data from repeated surveys in four low- or middle-income countries suggest that eCSC is improving at an average annual increase of approximately 1.1 percentage points. However, this progress remains insufficient to meet the growing need for cataract surgery driven by demographic changes.

Geographic disparities are notable; rural populations often experience lower cataract surgical coverage and higher prevalence of untreated cataract. Gender inequities also persist, with women being 1.21 times more likely than men to suffer from cataract-related visual impairment. Indigenous peoples and ethnic minorities similarly experience disproportionately lower eCSC, exemplified by the 2015 data from Australia showing eCSC rates of 88.5% in non-Indigenous Australians compared to just 51.6% among Indigenous Australians.

6.2 Effective Refractive Error Coverage (eREC)

Effective refractive error coverage (eREC) measures access to and outcomes of refractive error services, including spectacles, contact lenses, and refractive surgery. Population-based

data from 25 countries highlight wide variability in eREC for distance refractive errors, with averages around 55% but ranging from 1.7% to 93.5%.

The burden of uncorrected near vision impairment due to presbyopia is particularly severe in low- and middle-income regions, where effective coverage rates are often below 20%, especially in sub-Saharan Africa. In contrast, high-income regions such as North America and Western Europe report eREC rates exceeding 90%.

6.3 Key Inequities and Challenges

Both eCSC and eREC exhibit marked disparities based on age, gender, socioeconomic status, and geography. Rural and marginalized populations consistently face barriers to accessing eye care services, including cost, availability of trained personnel, and cultural factors.

These inequities emphasize the need for targeted strategies to improve equitable access to high-quality eye care services, aligning with global commitments to Universal Health Coverage (UHC) and the Sustainable Development Goals (SDGs).

Goals related to health, education, and economic growth.

7. Disease Projections

Understanding future trends in eye health conditions such as cataract and refractive errors is crucial for planning effective interventions and resource allocation. Demographic shifts and lifestyle changes are expected to drive increases in the prevalence of vision impairment globally.

7.1 Aging Population and Cataract Prevalence

The global population aged 65 years and over is projected to rise significantly from 703 million in 2019 to 998 million by 2030—a 42% increase. Since cataract prevalence increases with age, this demographic trend suggests a substantial rise in the number of people requiring cataract surgery.

As the number of older adults grows, health systems will face increased demand for cataract surgery services. This necessitates scaling up surgical capacity and ensuring equitable access to prevent avoidable blindness in aging populations.

7.2 Increasing Burden of Presbyopia

Near vision impairment due to presbyopia is also expected to increase, with affected individuals rising from 1.9 billion in 2020 to an estimated 2.1 billion in 2030. Although this 10% increase is slightly lower than the previous decade's growth rate, it still represents a significant public health challenge, especially in low- and middle-income countries where coverage remains low.

7.3 Rising Prevalence of Myopia and Other Refractive Errors

Lifestyle factors such as reduced time outdoors, increased near work, and urbanization contribute to a growing global burden of myopia. The number of people affected by myopia is expected to increase by approximately 28% between 2020 and 2030.

This trend underscores the urgent need for effective refractive error correction services to mitigate long-term vision impairment and its associated social and economic impacts.

7.4 Implications for Health Systems

These projections highlight the pressing need for health systems to adapt by integrating eye care services into universal health coverage frameworks. Early planning and investment in cataract surgical capacity, refractive error correction programs, and workforce training will be vital to meet rising demand and reduce avoidable vision impairment.

8. Next Steps by the Secretariat

To effectively address the growing global burden of cataract and refractive errors, the Secretariat has outlined a strategic plan with concrete next steps to support countries in improving eye care outcomes.

8.1 Finalizing Baseline Estimates

The Secretariat will complete the analysis of existing evidence to establish baseline estimates for effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC). This will be done in collaboration with academic partners and is expected to be finalized by the first quarter of 2021. Establishing these baselines is critical for tracking progress and informing policy decisions.

8.2 Developing a Monitoring Framework

A practical, financially viable, and robust monitoring framework will be developed across the first and second quarters of 2021. This framework aims to systematically track progress toward achieving the indicator targets and ensure that data collection is both sustainable and actionable for stakeholders at all levels.

8.3 Funding Dialogue for Data Collection

Recognizing the need for improved data, the Secretariat will lead funding dialogues to support additional country-level data collection efforts starting in the first quarter of 2021. Enhanced data quality and coverage will enable more accurate measurement of eCSC and eREC and facilitate targeted interventions.

8.4 Developing an Implementation Strategy

The Secretariat will collaborate with relevant stakeholders to formulate an implementation strategy that provides a clear pathway for Member States to achieve the proposed objectives and targets. This strategy will emphasize the integration of eye care within the broader Universal Health Coverage (UHC) agenda.

8.5 Creating a Planning and Costing Tool

To assist countries in planning and budgeting efforts to increase eCSC and eREC, the Secretariat plans to develop a tool linked to the WHO Package of Eye Care Interventions and the OneHealth tool. This tool, to be developed in the first two quarters of 2021, will facilitate evidence-based decision-making and resource allocation to maximize impact.

9. Summary and Conclusions

Effective cataract surgical coverage (eCSC) and effective refractive error coverage (eREC) are essential indicators for measuring the quality and accessibility of eye care services globally. Cataract and uncorrected refractive errors remain leading causes of vision impairment, disproportionately affecting vulnerable populations, including women, rural residents, indigenous peoples, and low- and middle-income countries. Improving eCSC and eREC not only enhances individual quality of life but also supports broader economic productivity and social inclusion.

The available evidence highlights significant disparities in coverage rates, with eCSC ranging from as low as 2.8% to nearly 90% across countries, and eREC varying widely depending on geographic and socioeconomic factors. Despite progress in some regions, large gaps remain in access to quality eye care, underscoring the urgent need for targeted strategies that address inequities.

From an economic perspective, interventions like cataract surgery and refractive error correction are among the most cost-effective health measures, capable of averting millions of disability-adjusted life years (DALYs) annually and preventing substantial productivity losses worldwide. As the global population ages, the burden of eye conditions like cataract and presbyopia is expected to rise, making the scaling-up of effective interventions critical.

The Secretariat's planned next steps, including establishing baseline data, developing monitoring frameworks, fostering funding dialogues, and creating planning tools, provide a comprehensive approach to accelerate progress. Integration of eye care within Universal Health Coverage frameworks will ensure that eye health is prioritized within broader health systems, contributing to the achievement of Sustainable Development Goals related to health, equity, and well-being.

In conclusion, prioritizing the improvement of eCSC and eREC through evidence-based policies, equitable service delivery, and sustained investment will be pivotal in reducing avoidable vision impairment globally. A collaborative, multisectoral effort involving governments, academia, donors, and communities is essential to ensure that no one is left behind in the journey toward universal eye health coverage.

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