

# Report of the 2030 targets on effective coverage of eye care



World Health  
Organization



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## **Abbreviations**

|       |                                                |
|-------|------------------------------------------------|
| BCVA  | best-corrected visual acuity                   |
| CI    | confidence interval                            |
| CSC   | cataract surgical coverage                     |
| DALYs | disability-adjusted life years                 |
| DHIS2 | District Health Information System 2           |
| ECIM  | Eye Care Indicator Menu                        |
| eCSC  | effective cataract surgery coverage            |
| eREC  | effective refractive error coverage            |
| ICD   | International Classification of Diseases       |
| IQR   | interquartile range                            |
| LICs  | low-income countries                           |
| LMICs | low- and middle-income countries               |
| PVA   | presenting visual acuity                       |
| RAAB  | rapid assessment of avoidable blindness        |
| RACSS | rapid assessment of cataract surgical services |
| REC   | refractive error coverage                      |
| SDGs  | Sustainable Development Goals                  |
| UCVA  | uncorrected visual acuity                      |
| UHC   | universal health coverage                      |
| UNGA  | United Nations General Assembly                |
| WHA   | World Health Assembly                          |
| WHO   | World Health Organization                      |

## Executive summary

Restoring a person's sight with cataract surgery or a pair of spectacles are among the most cost-effective of all health-care interventions to implement. In recognition of this, at the Seventy-Fourth World Health Assembly in May 2021, WHO Member States endorsed, in resolution WHA 74(12), two new ambitious global eye care targets for 2030: a 30 percentage point increase in effective cataract surgery coverage (eCSC), and a 40 percentage point increase in effective refractive error coverage (eREC) <sup>(1)</sup>. These indicators and related targets are intended to drive increases in eye care coverage while delivering high quality care.

This report provides the first estimates of both eCSC and eREC which serve as reference points to monitor progress towards the 2030 global targets. The report draws on the analysis of 175 population-based eye health surveys from 62 countries (undertaken during 2001–2021). The key results are summarized as follows:

Globally, the median eCSC values in the population aged  $\geq 50$  years were 17.2% (interquartile range (IQR): 11.5–25.4%) at the 6/12 visual acuity threshold for both the “need for intervention” and “good quality outcome”; and 24.8% (IQR: 15.5–38.1%) when adopting a 6/18 threshold.

Globally, the median eREC was 35.7% at the 6/12 visual acuity threshold for both the “need for intervention” and “good quality outcome”, and notably higher, at 65.4%, when applying a 6/18 threshold.<sup>i</sup>

Overall, eCSC was 3.5% higher in men than in women (29.6% for men [95% confidence interval (CI): 27.0–32.3] vs. 26.1% for women [95% CI: 23.4–28.9]). eREC was 10.4% higher in men than women (59.7% for men [95% CI: 37.3–66.0] vs. 49.3% for women [95% CI: 35.0–63.7]).

Estimates varied across WHO regions; the median eCSC was highest in the European Region (37.7%; IQR: 26.0–54.0%) and South-East Asia Region (40.4%; IQR: 20.2–52.6%). For eREC, estimates were highest in the Region of the Americas (80.2%; IQR: 65.6–87.9%) and the South-East Asia Region (75.8%; IQR: 64.0–81.9%).

Both median eCSC and eREC increased with increasing World Bank country income level (eCSC: high-income 60.5% (IQR: 55.6–65.4%) vs. low-income 14.8% (IQR: 8.3–20.7%); eREC: high-income 92.2% (IQR: 84.9–95.2%) vs low-income 14.5% (IQR: 12.0–26.6%)).

Distance eREC declined with increasing age  $\geq 50$  years, as demonstrated in the following age ranges and coverage rates: 50–59 years: 53.9% (95% CI: 47.1–60.4); 60–69 years: 47.8% (95% CI: 41.3–54.4); 70–79 years: 41.9% (95% CI: 35.4–48.4); 80–89 years: 33.8% (95% CI: 27.8–39.9), and  $\geq 90$  years: 31.0% (95% CI: 25.1–37.1).

The median global relative quality gap between “coverage” and “effective coverage” was 33.9% for cataract and 7.3% for refractive error.

<sup>i</sup> A 6/18 visual acuity threshold for both the “need for intervention” and “good quality outcome” was used for the remaining results included within the summary.

Interpretation of the results of this report should take into consideration certain limitations, especially in relation to gaps that exist in geographical and age-group data, and the use of data collected across a broad period of time (2001–2021). However, in highlighting existing sex, age, income-level and geographical variations, as well as service quality gaps, the report serves as a useful reference point for monitoring progress towards the 2030 global targets for eCSC and eREC. It further presents additional efforts to help improve monitoring, and the policies and programmes required for increasing the coverage of eye care interventions.

Significant opportunities exist to increase eCSC and eREC, as highlighted in the report. Efforts should focus on strategies to improve access and affordability in low- and middle-income countries (LMICs) and among underserved populations, including women and older people. In countries where the relative quality gap is high, enhancing service quality should be prioritized. In order to monitor progress effectively, Member States are encouraged to invest in robust national monitoring of eCSC and eREC as part of their endeavours towards achieving universal health coverage (UHC).



# Background

## Global 2030 eye care targets

In November 2020, at the Seventy-third World Health Assembly, Member States endorsed the recommendations of the World report on vision, with the adoption of the resolution WHA73.4, “Integrated people-centred eye care, including preventable vision impairment and blindness” (2, 3). This resolution requested WHO, in consultation with Member States, to prepare recommendations on global targets for 2030 focusing on two global tracer eye care indicators: effective cataract surgery coverage (eCSC) and effective refractive error coverage (eREC). To this end, WHO undertook a consultative process with Member States and experts from the field to develop global targets for eCSC and eREC that were endorsed in May 2021 at the Seventy-fourth World Health Assembly (1) (Box 1).

---

### Box 1. Global targets for eCSC and eREC for 2030\*

#### A 30-percentage point increase in eCSC by 2030:

Countries with a baseline effective coverage rate of 70.0% or higher should strive for universal coverage.

#### A 40-percentage point increase in eREC by 2030:

Countries with a baseline effective coverage rate of 60.0% or higher should strive for universal coverage.

*Note:* Given the well-established impact of near vision impairment on quality of life and productivity (4, 5), both spectacle coverage for distance refractive error and near vision impairment due to presbyopia will be considered in the global monitoring of eREC.

\* to reduce inequalities, countries should place a greater focus on increasing effective coverage in their traditionally underserved population subgroups.

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## Why these indicators?

### Huge unmet need for care

Unoperated cataract and uncorrected refractive error are the leading causes of vision impairment globally (6). Currently, an estimated 94 million people aged 50 years and over have moderate-to-severe distance vision impairment or blindness that could be corrected through access to cataract surgery (6), while at least 826 million people have distance- or near-vision impairment that could be addressed with an appropriate pair of spectacles (2). These figures are projected to increase, since presbyopia and cataract development are part of the ageing process, while growing evidence suggests that projected increases in myopia in the younger population will be driven largely by lifestyle-related risk factors (2).

## Health economic rationale

Interventions that address the needs associated with unoperated cataract and uncorrected refractive error are among the most cost-effective health-care interventions to implement (7, 8). Treatment for cataract is a surgical intervention involving the removal of the opaque lens in the eye and the implantation of an artificial intraocular lens. Reduced vision from refractive errors can be corrected with the use of spectacles or contact lenses or corrected by laser surgery in adulthood. Spectacles are non-invasive assistive products that are included in the WHO Priority Assistive Products List (9).

Cataract surgery has been identified as one of only a select few surgical interventions costing less than US\$200 per disability-adjusted life years (DALYs) averted (7); with cost-effectiveness comparing favourably to other surgical procedures in LMICs (10, 11). Uncorrected refractive error poses an enormous economic burden on society: annual global productivity losses associated with vision impairment from uncorrected myopia in adults and presbyopia alone are estimated to be US\$244 billion and US\$25.4 billion, respectively (12, 13). These figures far outweigh the estimated financial resource gap of addressing the unmet need of vision impairment due to unoperated cataract and uncorrected refractive error estimated at US\$24.8 billion (2), thus providing a strong health economic rationale for increasing coverage of these eye care interventions.

## Monitoring progress towards universal eye health coverage

Progress towards achieving UHC – ensuring all people can receive the quality health services they need, without experiencing financial hardship – is a WHO strategic priority (14). To understand how actions and investments in the field of eye care are delivering on the goal of improving eye health outcomes, and contributing to the advancement of UHC, it is essential to identify tracer indicators.<sup>ii</sup> Effective service coverage indicators are the WHO preferred indicators for countries to monitor progress towards UHC (15). Importantly, these indicators not only capture the extent of coverage, but also the concept of “effective” coverage, to ensure that people who need health services receive them with sufficient quality to produce the desired health outcome (16).

Given the large unmet need for care associated with unoperated cataract and uncorrected refractive error, coupled with the fact that highly cost-effective interventions already exist, eCSC and eREC serve as ideal tracer indicators to not only track changes in the uptake and quality of eye care services at the global level, but also contribute to monitoring progress towards UHC in general. Effective cataract surgery coverage is a time-contained, surgical intervention which provides a snapshot of the availability of high-level surgical services in Member States, while eREC is relevant across the life-course and involves ongoing access to, and uptake of, services. Thus, the two indicators complement each other in how they reflect overall health systems performance in providing access to quality eye care services.

As requested in the first United Nations General Assembly (UNGA) resolution on vision in 2021, the two indicators will be considered for inclusion in the global indicator framework for the Sustainable Development Goals (SDGs) at the fifty-sixth session of the United Nations Statistical Commission to be held in 2025 (17).

---

<sup>ii</sup> Tracer indicators cover essential health service domains to provide a signal of how health service coverage is improving or stalling throughout the world.

## **Scope of this report**

The primary purpose of this report is to present estimates of eCSC and eREC to serve as reference points to begin monitoring progress towards the 2030 global targets that were endorsed in May 2021 by Member States at the Seventy-fourth World Health Assembly. The report draws on key results from a comprehensive analysis of population-based eye health surveys and includes estimates of eCSC and eREC at the global level, by WHO region, sex and World Bank income level, and the relative quality gap (that is, the percentage difference between “effective coverage” and “coverage”). This report also serves to highlight key gaps in current data and presents suggestions for additional efforts required to advance the monitoring, policies and programmes for increasing the coverage of eye care interventions.

# **Methodology**

## **Data sources**

Data to estimate eCSC and eREC were collected using population-based surveys on eye care, including the standardized Rapid Assessment of Avoidable Blindness (RAAB) survey methodology, the Rapid Assessment of Cataract Surgical Services (RACSS) (18, 19), and other, more comprehensive, eye health surveys. Eligible studies were any of the aforementioned surveys conducted between 2000 and 2021 with a complete dataset available (that is, individual participant survey data and census population data showing age–sex group counts for people residing in the sampling area) and permission from the study’s principal investigator for use of data.

Ethical approval for analysis of RAAB data was obtained from the London School of Hygiene & Tropical Medicine Ethics Committee. Approval for analysis of data from comprehensive surveys was obtained from representative principal investigators. Ethical approval was obtained for each survey prior to implementation.

In total, 175 surveys from 62 countries, conducted between 2001 and 2021, were included in this analysis. Table 1 provides a summary of the available surveys by WHO region, decade the survey was undertaken, and survey representativeness. A complete list of all individual data sources, and their characteristics, that contributed to the analysis are available in the supplementary online annex.

Table 1. Summary of available surveys for analysis of eCSC and eREC\*

|                                  | eCSC       |              | eREC       |              |
|----------------------------------|------------|--------------|------------|--------------|
|                                  | N          | %            | N          | %            |
| <b>WHO Region</b>                |            |              |            |              |
| African                          | 27         | 18.2         | 29         | 16.6         |
| Americas                         | 20         | 13.5         | 23         | 13.1         |
| Eastern Mediterranean            | 10         | 6.8          | 15         | 8.6          |
| European                         | 4          | 2.7          | 4          | 2.3          |
| South-East Asia                  | 39         | 26.4         | 48         | 27.4         |
| Western Pacific                  | 48         | 32.4         | 56         | 32.0         |
| <b>World Bank income level#</b>  |            |              |            |              |
| High-income                      | 2          | 1.3          | 5          | 2.9          |
| Upper-middle-income              | 33         | 22.3         | 45         | 25.7         |
| Lower-middle-income              | 76         | 51.4         | 86         | 49.1         |
| Low-income                       | 37         | 25.0         | 39         | 22.3         |
| <b>Decade of survey</b>          |            |              |            |              |
| 2000–2009                        | 33         | 22.3         | 46         | 26.3         |
| 2010–2019                        | 110        | 74.3         | 124        | 70.8         |
| 2020–2021                        | 5          | 3.4          | 5          | 2.9          |
| <b>Survey representativeness</b> |            |              |            |              |
| National                         | 24         | 16.2         | 24         | 13.7         |
| Subnational                      | 124        | 83.8         | 151        | 86.3         |
| <b>Total</b>                     | <b>148</b> | <b>100.0</b> | <b>175</b> | <b>100.0</b> |

\* by WHO region, World Bank income level, decade the survey was undertaken, and survey representativeness.

# income level classification according to the World Bank in the year the survey was conducted.

## Indicators calculation methods

Building on previous work by researchers in the field (20), consultations were held in July 2020 with a WHO Expert Working Group, comprising of individuals from the field of eye care epidemiology and public health, to work with WHO to review the methods of calculating eCSC and eREC (21). The key proposals from these consultations were the subject of a broader web-based consultation (13 October to 3 November 2020), open to Member States, other intergovernmental organizations and non-State actors in the field of eye care. Based on the outcomes of these consultations, the indicator definitions and recommended calculation methods are presented in Table 2 (for eCSC) and Table 3 (for eREC) (22). Of note, due to limited data availability at this time of this report, estimates for near eREC are not included (see Annex 1 for the near eREC calculation method).

Table 2. eCSC: definition, calculation method and specifications

| eCSC                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition               | Proportion of people who have received cataract surgery and have a resultant good quality outcome (6/12 or better) relative to the number of people in need of cataract surgery.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Method of calculation*   | $\left( \frac{a+b}{c+d+e} \right) \times 100$ <p>a. Individuals with unilateral operated cataract attaining PVA equal to, or better than, 6/12 in the operated eye, who have BCVA worse than 6/12 in the other eye.</p> <p>b. Individuals with bilateral operated cataract attaining PVA equal to, or better than, 6/12 in at least one eye.</p> <p>c. Individuals with unilateral operated cataract (regardless of visual acuity in the operated eye), who have BCVA worse than 6/12 in the other eye.</p> <p>d. Individuals with bilateral operated cataract, regardless of visual acuity.</p> <p>e. Individuals with BCVA worse than 6/12 in both eyes with cataract as the main cause of vision impairment or blindness in one or both eyes.</p> |
| Data source              | Population-based surveys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Disaggregation           | Age, sex, geography (e.g. urban vs non-urban) and socioeconomic status.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Frequency of measurement | Every 5 years.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

\* all visual acuities are measured for distance.

PVA: presenting visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person wearing them.

BCVA: best-corrected visual acuity; visual acuity is assessed either by pinhole or refraction.

Table 3. eREC: definition, calculation method and specifications

| eREC                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition               | Proportion of people who have received refractive error services (that is, spectacles, contact lenses or refractive surgery) and have a resultant good quality outcome relative to the number of people in need of refractive error services.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Method of calculation*   | $\left( \frac{a+b}{a+b+c+d} \right) \times 100$ <p>a. Individuals with UCVA worse than 6/12 in the better eye who present with spectacles or contact lenses for distance vision and whose PVA is equal to, or better than, 6/12 in the better eye ("met need").</p> <p>b. Individuals with a history of refractive surgery whose UCVA is equal to, or better than, 6/12 in the better eye ("met need").</p> <p>c. Individuals with UCVA worse than 6/12 in the better eye who present with spectacles or contact lenses for distance vision and a PVA of worse than 6/12 in the better eye, but who improve to equal to, or better than, 6/12 on pinhole or BCVA ("undermet need").</p> <p>d. Individuals with UCVA worse than 6/12 in the better eye who do not have distance vision correction and who improve to equal to, or better than, 6/12 on pinhole or BCVA ("unmet need").</p> |
| Data source              | Population-based surveys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Disaggregation           | Age, sex, geography (e.g. urban vs non-urban) and socioeconomic status.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Frequency of measurement | Every 5 years.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

\* all visual acuities are measured for distance.

UCVA: uncorrected visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person not wearing them.

PVA: presenting visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person wearing them.

BCVA: best-corrected visual acuity; visual acuity is assessed either by pinhole or refraction.

## A note on the calculation of distance eREC

Justification for the use of uncorrected visual acuity (UCVA) to determine the “met” need of refractive error (that is, “met” need = individuals who present at the survey with spectacles or contact lenses for distance and whose PVA is  $\geq 6/12$  in the better eye) has been described in detail elsewhere (2, 23). Individuals with refractive errors have an ongoing need for eye care services; UCVA enables accurate information on both the unmet and met needs, which is important to plan services effectively. Nonetheless, a large proportion of previous population-based surveys in the field of eye care report solely on PVA (that is, vision as measured with spectacles or contact lenses if worn to the assessment). Based on the outcomes of a series of expert consultations (20), it was agreed that an alternative calculation method for distance eREC coverage using PVA would be used when UCVA measurements are not available (see Annex 2).

## Data analysis

All data management and analyses were conducted using R software (24). Initially, estimates of “coverage” and “effective coverage” for both cataract and refractive error were calculated for total populations and men and women separately (age-adjusted only for sex-disaggregated estimates) for all available surveys. Following this, country estimates were used to generate the median, interquartile range (IQR) and range at the global level and by WHO region and income level (using World Bank country income level (25) high, upper-middle, lower-middle and low). Median and IQR values were applied given that these effective coverage estimates were non-normally distributed. Pooled survey estimates for males and females were used to generate absolute sex differences in eCSC and eREC. Due to having the most data, the main analysis for eCSC and eREC used 6/18 for both the thresholds for the ‘need for intervention’ and ‘good quality outcome’ unless stated otherwise.

The gap between “coverage” and “effective coverage” can be considered a “quality gap”. In this analysis, the “relative quality gap” was calculated as:

$$\left( \frac{\text{coverage} - \text{effective coverage}}{\text{coverage}} \right) \times 100$$

Where two or more surveys were available from a given country, only one estimate was used according to a pre-determined decision tree based on the time in years since the studies were completed and the sampling frame representativeness (national or subnational) (see Annex 3). In brief, more recent studies and studies with nationally-representative sampling frames (either a single survey or a pooled series of subnational surveys) were prioritized. An inverse variance weighted average (calculated using the metagen command from the meta package in R) was used to combine subnational estimates from the same country.

## **Strengths and limitations**

The strengths of this analysis include the use of individual participant level data from many population-based studies that applied largely standardized sampling and examination protocols. Equally important was the ability to highlight inequities by presenting results in age-, sex- and income level-stratified form. An additional key strength of eCSC and eREC is the use of a clinical measure of quality (that is, visual acuity) (26).

Several limitations should be considered when interpreting the findings presented in this report. Firstly, the analysis included population-based surveys undertaken between 2001 and 2021 and, as such, estimates are not directly comparable across regions. Despite this, many more studies were available from 2010 onwards (eCSC: n = 115; eREC: n = 129) compared to 2000–2009 (eCSC: n = 33; eREC: n = 46). Secondly, there was a scarcity of data in some regions, particularly the region of the Americas, the Eastern Mediterranean Region and the European Region. Similarly, given the historic emphasis on implementation of RAAB surveys in LMICs, a scarcity of data also exists for these indicators in high-income countries. Thirdly, the age inclusion criteria in most datasets was  $\geq 50$  years. Given that refractive error is common among children and working age populations, there may be an overestimation or underestimation of the true eREC among all age groups in the population. In addition, after applying the pre-determined decision tree based on sampling frame representativeness (see Annex 3), fewer than half of the country estimates (24/62; 38.7%) were nationally representative; the remainder of the results from subnational areas may underestimate or overestimate effective coverage at the national level.

In 2021, after consultation with Member States and eye care stakeholders (23), WHO recommended that the population in “need for intervention” (that is, cataract surgery or use of spectacles) is defined as having a visual acuity worse than 6/12 (consistent with the International Classification of Diseases (ICD) 11 definition of vision impairment). Likewise, the recommendation also included defining a “good quality visual outcome” as 6/12 or better. However, the main analysis in this report used a 6/18 visual acuity threshold for both the “need for intervention” and “good quality outcome” given that there was far greater availability of data at this threshold. As data become more widely available in the future, the global reporting framework will monitor progress towards the achievement of the 2030 targets based on the 6/12 visual acuity threshold for both the “need for intervention” and a “good quality visual outcome”.

## Findings

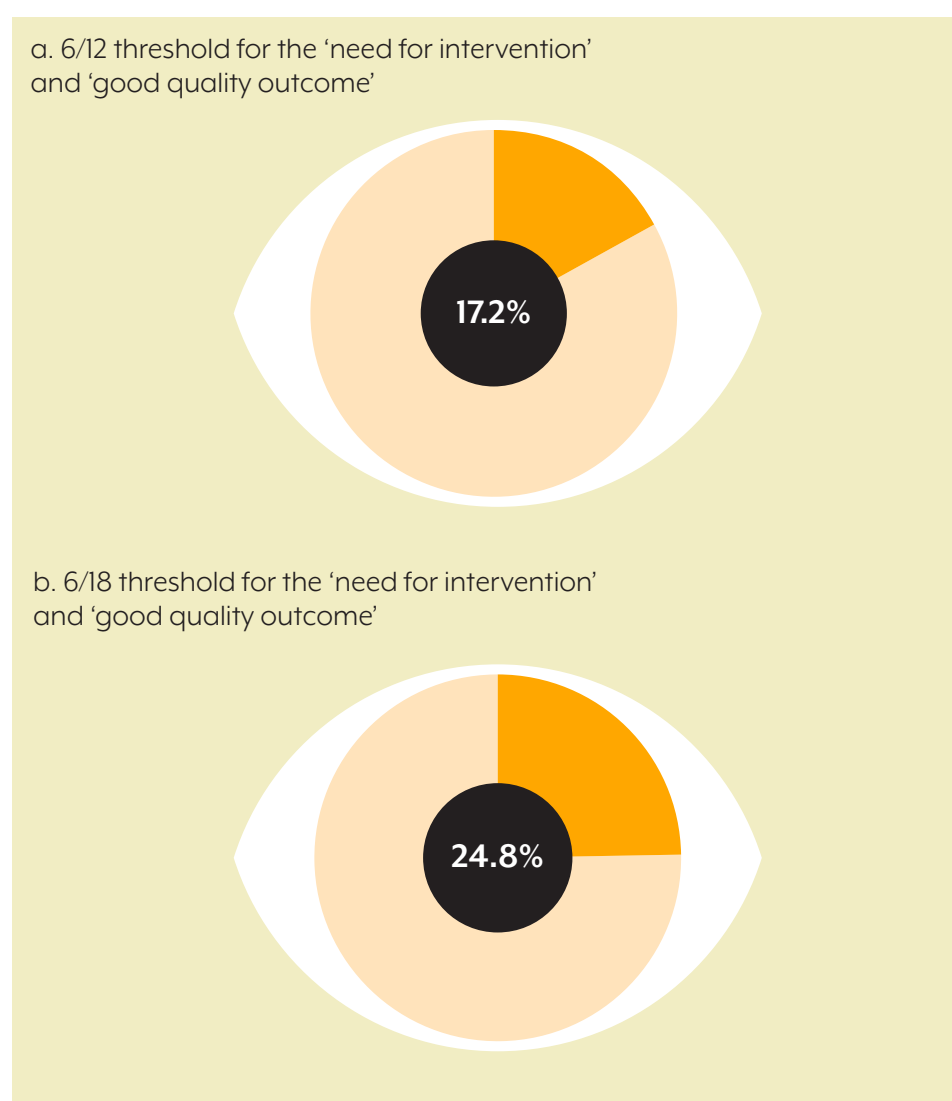
### Effective cataract surgery coverage (eCSC)



## **Global estimates**

Adopting a 6/12 visual acuity threshold for both the “need for intervention” and “good quality outcome”, the median eCSC estimate in the population aged  $\geq 50$  years (63 surveys from 19 countries) was 17.2% (IQR: 11.5–25.4%; range 4.1% to 48.7%). At the 6/18 threshold for the ‘need for intervention’ and ‘good quality outcome’, the median eCSC estimate was 24.8% (IQR: 15.5–38.1%; range: 3.8% to 70.3%) in the population aged  $\geq 50$  years (105 surveys from 55 countries) (Figure 1). On average, eCSC was 3.5% higher in men than women in absolute terms (men: 29.7% [95% CI: 27.0–32.3] vs. women: 26.1% [95% CI: 23.4–28.9]).

Figure 1. Median eCSC\* in the population aged  $\geq 50$  years

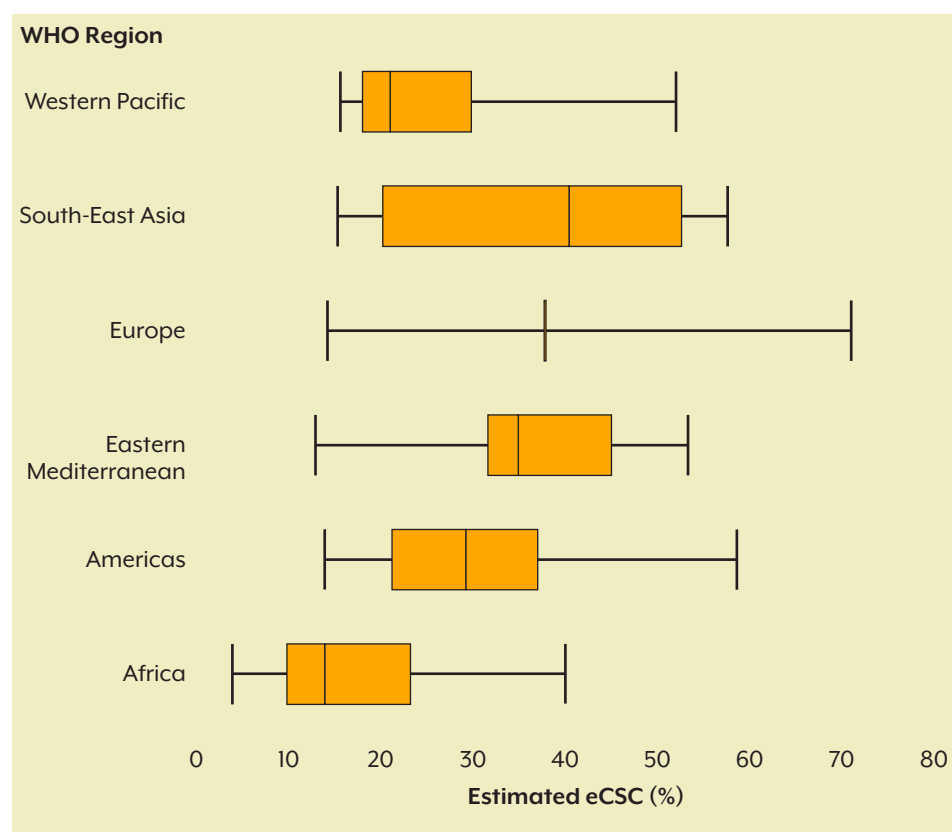


\* at both 6/18 and 6/12 thresholds for the “need for intervention” and “good quality outcome”.

## Regional and income-level estimates

The median eCSC in each WHO region was: 40.4% (IQR: 20.2–52.6%; n = 7) in the South-East Asia Region; 37.7% (range: 14.2% to 70.3%; n = 3) in the European Region; 34.9% (IQR: 31.7–45.0%; n = 7) in the Eastern Mediterranean Region; 29.2% in the Region of the Americas (IQR: 21.2–37.0%; n = 15); 21.0% (IQR: 17.9–29.8%; n = 7) in the Western Pacific Region; and 13.9% in the African Region (IQR: 9.8–23.2%; n = 16) (Figure 2). Considerable variation in eCSC also exists within WHO regions (as evident by the wide IQR values), being particularly marked in the South-East Asia Region. There have been encouraging examples of improvements in eCSC over time where comparable sampling frames had been used in repeated surveys (see Box 2).

Figure 2. Estimated eCSC\* by WHO region



\* at the 6/18 threshold for the “need for intervention” and “good quality outcome”.

## **Box 2. Improvements in effective cataract surgery coverage: a case example from the State of Nuevo León, Mexico**

In the State of Nuevo León, Mexico, population-based eye health surveys were conducted in the years 2005 and 2014. During this period, eCSC increased by an estimated 28.1 percentage points, from 31.2% to 59.3%, and there was a corresponding drop from 48.0% to 32.6% in the proportion of blindness caused by unoperated cataract. The improvement in eCSC during this period can be attributed to at least two drivers.

### *Dedicated funding*

Recognizing that cataract was the leading cause of blindness in Mexico, the Mexican Government allocated a dedicated budget (*Gastos Catastróficos para Catarata*), whereby cataract surgery was covered by a fund against Catastrophic Expenditures in Health between 2005 and 2013. Both government and private hospitals were able to receive this funding. Additional funding support from nongovernmental organizations enabled the construction of additional cataract surgical facilities.

### *Increased outreach to detect cases and provide awareness*

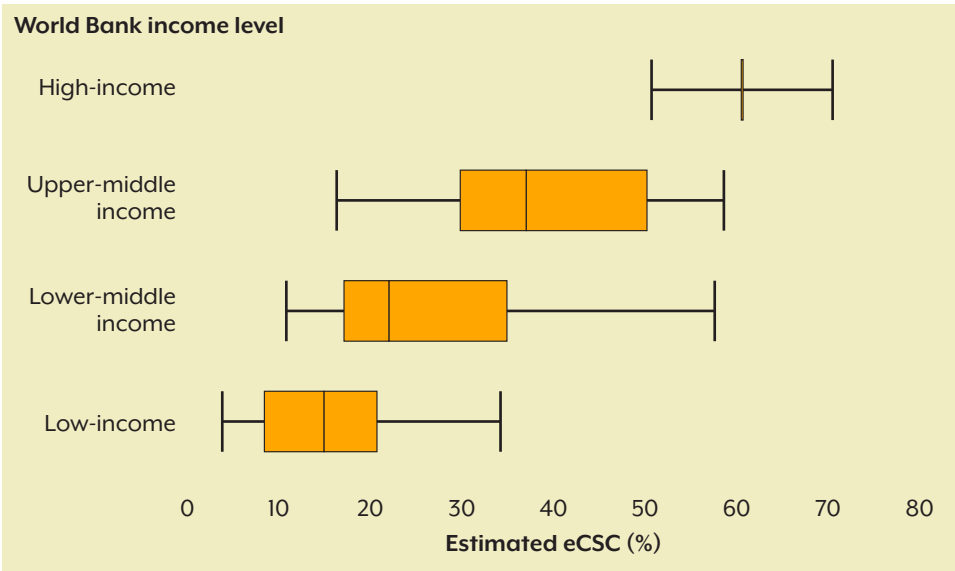
In Nuevo León, additional efforts were made to increase access to eye disease screening services through community outreach eye services in both urban and rural areas. Screening targeted people aged  $\geq 50$  years, as well as people with diabetes. Health technicians were trained to carry out specific eye examinations while resident ophthalmologists examined patients for eye conditions, with a focus on cataract and diabetic retinopathy. Individuals with reduced vision or suspected eye disease were referred to the Instituto de la Visión Hospital La Carlota in the city of Monterrey or other facilities for comprehensive ophthalmology assessment and treatment.

Dedicated quality committees generally oversaw the monitoring of cataract surgical outcomes in hospitals. Local partners, either governmental or nongovernmental service organizations, provided transport support to patients and outreach teams. In addition, outreach teams were joined by nutritionists to provide education and awareness around healthy diet, lifestyle changes and the importance of regular eye checks.

This case example suggests that strengthening community awareness and screening services with effective referral pathways, coupled with reducing out-of-pocket expenditures through public–private partnerships, can improve effective cataract surgery coverage and substantially reduce blindness caused by cataract.

The median eCSC became progressively lower with lower World Bank income level: 60.5% (range: 50.7% to 70.3%;  $n = 2$ ) in high-income groups; 37.0% (IQR: 29.8–50.2%;  $n = 14$ ) in upper-middle-income groups; 22.0% (IQR: 17.0–34.9%;  $n = 25$ ) in lower-middle-income groups; and 14.8% (IQR: 8.3–20.7%;  $n = 14$ ) in low-income groups (Figure 3).

Figure 3. Estimated eCSC\* by World Bank income level



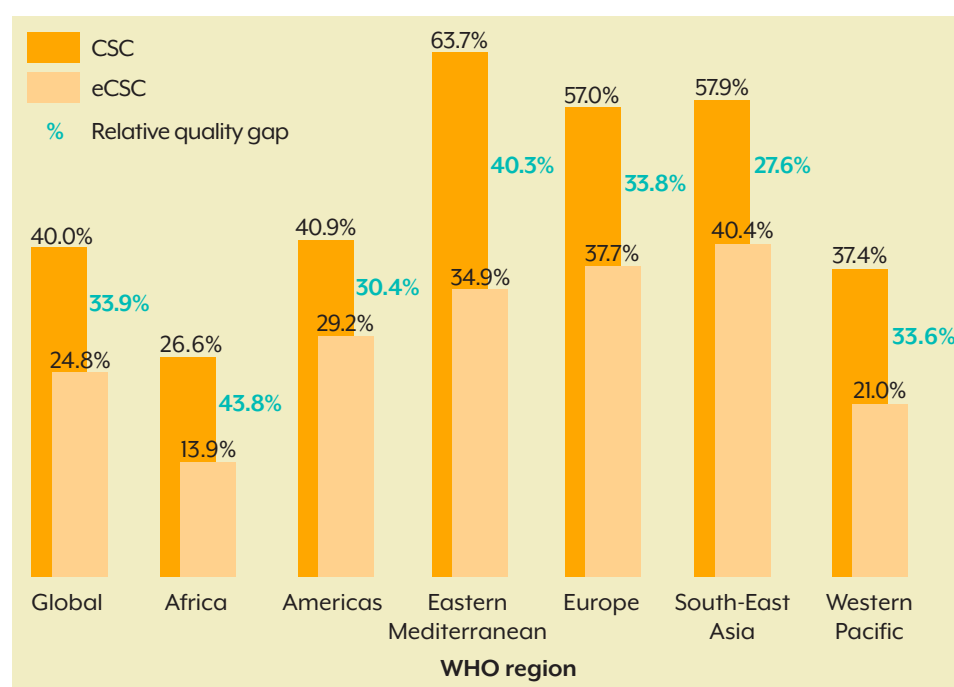
\* at the 6/18 threshold for the “need for intervention” and “good quality outcome”.

## Relative quality gap between CSC and eCSC

The median global relative quality gap between CSC and eCSC was 33.9% (IQR: 27.4–43.2%), thus 33.9% of people who received cataract surgery did not achieve a presenting visual acuity outcome of  $\geq 6/18$ .

The median relative quality gap between CSC and eCSC across WHO regions was: 43.8% (IQR: 31.4–52.0%) in the African Region; 30.4% (IQR: 27.7–38.3%) in the Region of the Americas; 40.3% (IQR: 34.1–47.6%) in the Eastern Mediterranean Region; 33.8% (IQR: 25.1–42.2%) in the European Region; 27.6% (IQR: 26.2–30.4%) in the South-East Asia Region; and 33.6% (IQR: 27.2–37.3%) in the Western Pacific Region. The median CSC, eCSC and relative quality gap globally and by WHO region is shown in Figure 4.

Figure 4. Median CSC, eCSC and relative quality gap globally and by WHO region



# Findings

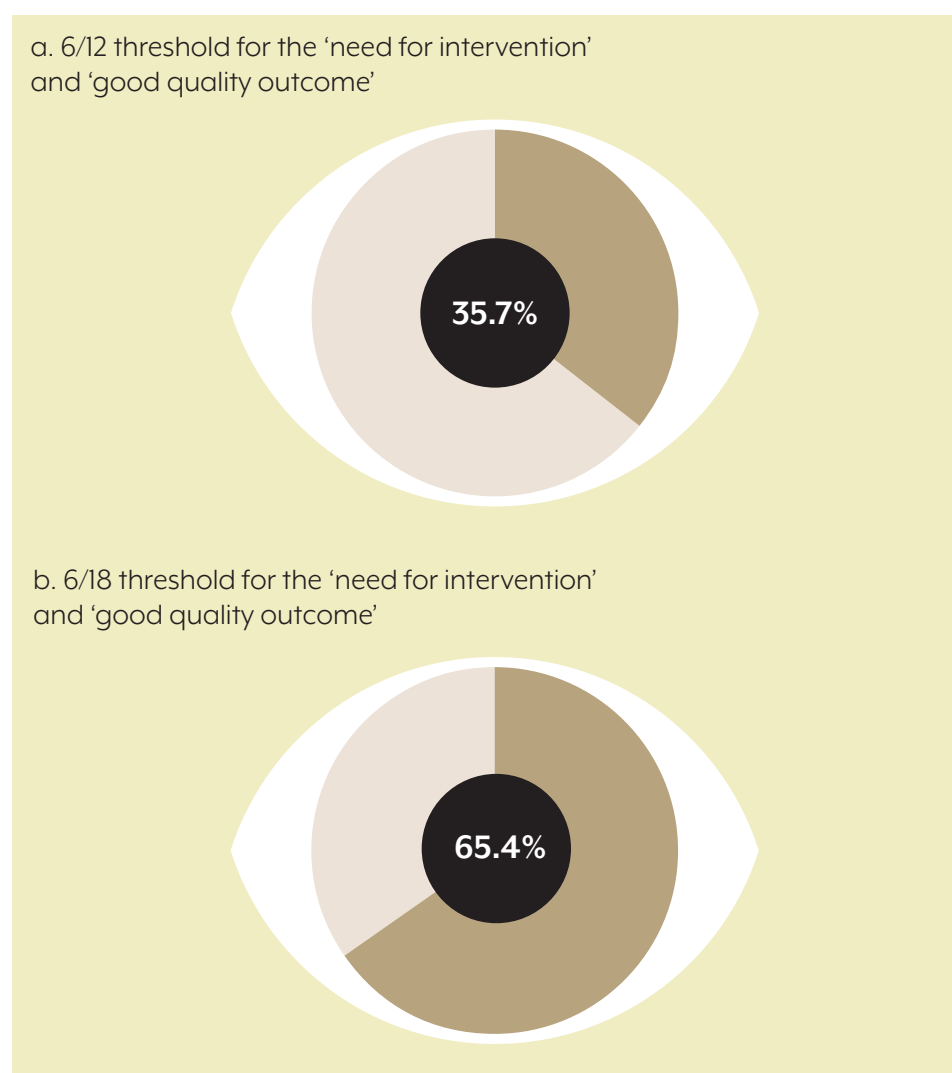
## Effective refractive error coverage (eREC)



## **Global estimates**

Using the 6/12 visual acuity threshold for both the “need for intervention” and “good quality outcome” (86 surveys from 26 countries), the median eREC was 35.7% (IQR: 17.8–77.3%; range: 3.5% to 89.9%). Adopting a 6/18 threshold for the “need for intervention” and “good quality outcome” (175 surveys from 62 countries), the median eREC was notably higher at 65.4% (IQR: 25.1–83.6%; range 2.9% to 96.7%) (Figure 5).

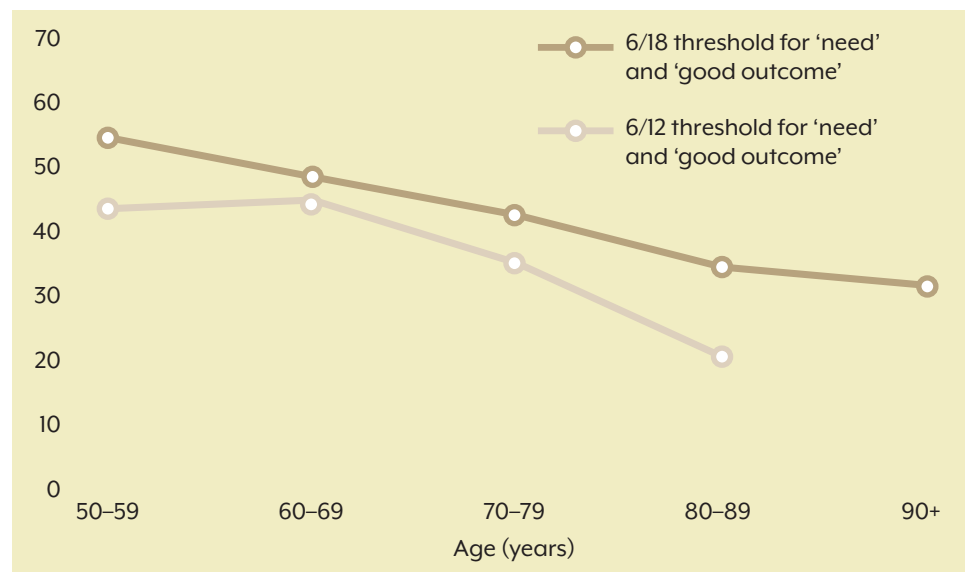
**Figure 5. Median eREC\* in the population aged  $\geq 50$  years**



\* at both 6/18 and 6/12 thresholds for the “need for intervention” and “good quality outcome”.

Effective refractive error coverage was, on average, 10.4% higher in men than in women in absolute terms (men: 59.7% [95% CI: 37.3–66.0] vs. women: 49.3% [95% CI: 35.0–63.7]). A reduction in eREC with increasing age  $\geq 50$  years was observed, with the following age ranges and effective coverage rates: 50–59 years: 53.9% (95% CI: 47.1–60.4%); 60–69 years: 47.8% (95% CI: 47.3–54.4%); 70–79 years: 41.9% (95% CI: 35.4–48.4%); 80–89 years: 33.8% (95% CI: 27.8–39.9%); and  $\geq 90$  years: 31.0% (95% CI: 25.1–37.1%). At the 6/12 threshold for the “need for intervention” and “good quality outcome”, eREC was similar for the age groups 50–59 years (42.9% [95% CI: 37.0–48.4%]) and 60–69 years (44.2% [95% CI: 38.4–50.0%]), but declined thereafter (70–79 years: 34.4% [95% CI: 28.3–40.8%]; and 80–89 years: 19.9% [95% CI: 15.0–25.3%]). For individuals aged  $\geq 90$  years, data were not available due to limited availability (Figure 6).

Figure 6. Estimated eREC (%)\* by age group (years), in the population aged  $\geq 50$  years

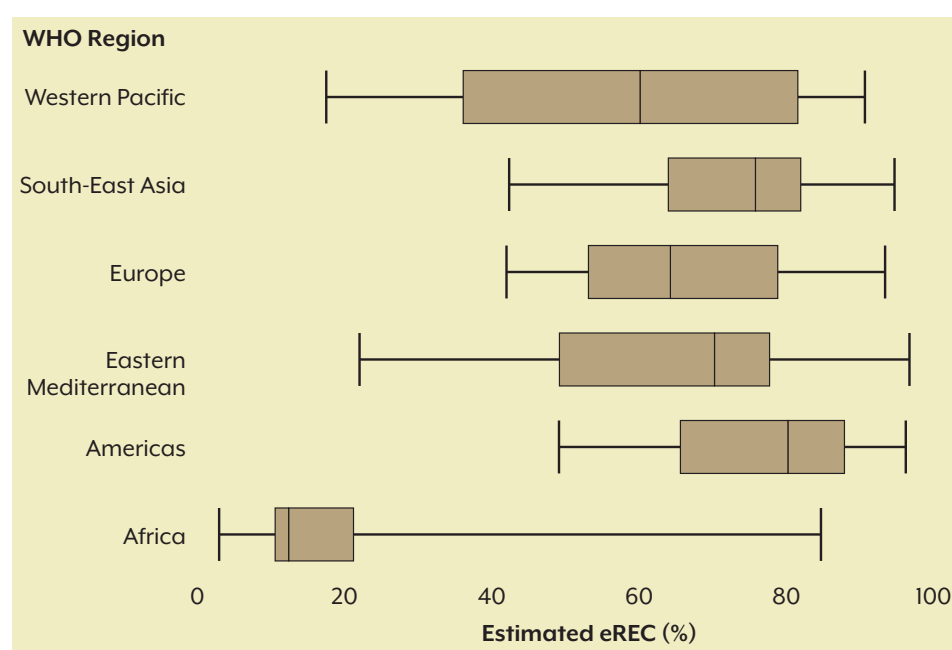


\* at both 6/18 and 6/12 thresholds for the “need for intervention” and “good quality outcome”.

## Regional and income-level estimates

The median eREC varied across WHO regions; 12.4% in the African Region (IQR: 10.6–21.2%; n = 17); 80.2% (IQR: 65.6–87.9%; n = 17) in the Region of the Americas; 70.2% (IQR: 49.2–77.7%; n = 9) in the Eastern Mediterranean Region; 64.2% (range 42.0% to 93.4%; n = 3) in the European Region; 75.8% (IQR: 64.0–81.9%; n = 8); in the South-East Asia Region; and 60.1% (IQR: 36.1–81.5%; n = 8) in the Western Pacific Region (Figure 7). As evident in the wide IQR values, notable variation also exists within WHO regions, particularly the Western Pacific and Eastern Mediterranean regions. A case example demonstrating improvement in spectacle coverage is provided in Box 3.

Figure 7. Estimated eREC\* by WHO region



\* at the 6/18 threshold for the “need for intervention” and “good quality outcome”.

### **Box 3. Changing the trend of spectacle coverage: a case example from Pakistan**

In Pakistan, population-based eye health surveys were conducted in 1990, 2004 (comprehensive national survey) and again in 2021 (series of rapid assessment of avoidable blindness surveys conducted in 16 districts from all four provinces in the country). Although the findings of the 2004 and 2021 surveys cannot be directly compared due to the employment of different age inclusion criterion, the results indicate several notable improvements in eye health outcomes, including:

- i. a three-fold reduction in the estimated prevalence of blindness among people aged 50 and over, from 6% in 2004 to 2% in 2021;
- ii. a reduction in the proportion of vision impairment caused by uncorrected refractive error; 73% in people 30-69 years in 2004 vs 12% in people 50 and over in 2021;
- iii. an increase in spectacle coverage; 15% coverage in people 30 and over in 2004 vs 80% coverage in people 50 and over in 2021.

Over this period, successive, evidence-based five-year national plans for prevention and control of blindness have provided strategic direction for eye care programmes in Pakistan. Implementation of the national plans was governed by the National Committee for Eye Health. At sub-national level, subsequent provincial committees were established to oversee implementation of the eye care plans. The following four specific factors have contributed to the improvements in eye care in Pakistan since the early 2000's:

#### *Strengthening eye care at primary and secondary care levels*

Bringing services closer to communities, including integrating cataract and refractive error services at secondary and primary level health facilities with referral pathways in place; and deploying the appropriate eye health workforce to provide these services, has significantly contributed to increasing access while ensuring sustainability.

#### *Strong stakeholder engagement and commitment*

Robust partnerships between public, national and international NGOs, donors, and private actors facilitated the provision of scalable service delivery models to accelerate a reduction in the burden of vision impairment caused by refractive error.

#### *Coordinating services within and across sectors*

Active coordination and continued engagement within health and other sectors maximized the impact of refractive error programmes. Working in partnership with education, finance, general development actors, corporate and the private sectors supported the development of longer-term scalable refractive error interventions and allocation of corresponding investments.

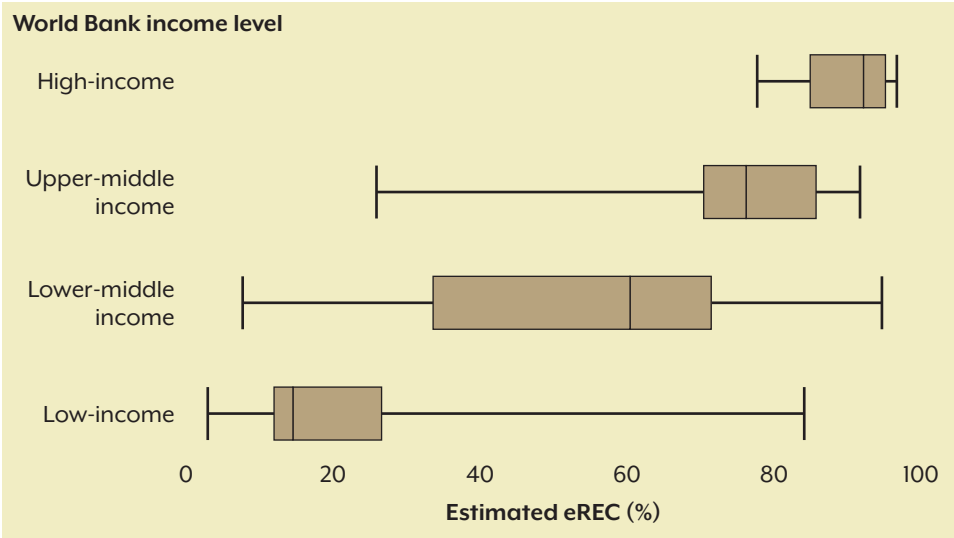
#### *Strengthening governance and accountability*

A focus on building the capacity of government and other stakeholders to ensure that better governance and robust accountability mechanisms were in place proved to be instrumental in effective and efficient utilisation of resources and monitoring of progress.

This case example suggests that integrated planning for eye care across all levels of the health system, combined with strong partnerships and cross-sectoral collaboration, have substantially improved the delivery of eye care in Pakistan over the past 20 years.

As with eCSC, the median eREC was lower with lower World Bank income level: 92.2% (IQR: 84.9–95.2%; n = 4) in high-income countries; 76.2% (IQR: 70.4–85.8%; n = 17) in upper-middle-income countries; 60.4% (IQR: 33.6–71.4%; n = 25) in lower-middle-income countries; and 14.5% (IQR: 12.0–26.6%; n = 16) in low-income countries (Figure 8).

Figure 8. Estimated eREC\* by World Bank income level



\* at the 6/18 threshold for the “need for intervention” and “good quality outcome”.

## **Relative quality gap between REC and eREC**

The median global relative quality gap between REC and eREC was 7.3% (IQR: 2.3–9.0%), thus over 90.0% of people who received refractive error services had a resultant good quality outcome which, in this case, referred to a PVA  $\geq$  6/18 in the better eye. The median relative quality gap between REC and eREC varied by WHO region: 5.1% (IQR: 0.0–14.8%) in the African Region; 3.7% (IQR: 2.3–5.9%) in the Region of the Americas; 7.2% (IQR: 5.9–11.7%) in the Eastern Mediterranean Region; 9.0% (IQR: 5.6–11.4%) in the European Region; 3.2% (IQR: 2.0–4.2%) in the South-East Asia Region; and 13.5% (IQR: 6.8–15.3%) in the Western Pacific Region.

## **Conclusions**

This report involved the analysis of 175 population-based eye health surveys undertaken in 62 countries between 2001 and 2021 to generate estimates of eCSC and eREC. The results serve as reference points to commence monitoring progress towards the global 2030 targets endorsed at the Seventy-fourth World Health Assembly in 2021.

Globally, the median eCSC values in the population aged  $\geq 50$  years were 17.2% when adopting a 6/12 threshold for the “need for intervention” and “good quality outcome”; and 24.8% at the 6/18 threshold for the “need for intervention” and “good quality outcome”. The median eREC was 35.7%, and was notably higher, at 65.4%, when applying a 6/18 threshold for both the “need for intervention” and “good quality outcome”. This finding is largely in line with a recent report estimating that 1.84 billion people globally have moderate to severe vision impairment or blindness (that is visual acuity  $< 6/18$ ) that is due to myopia alone, and, of these, an estimated 484 million have uncorrected myopia (13).

Overall, from the available data, more men than women have accessed good quality cataract surgery and refractive error services (3.5% and 10.4% more men than women, respectively). These findings are consistent with previous reports that women with vision impairment outnumber men by approximately 7.0% and that women in LMICs are less likely than men to undergo cataract surgery (20, 27).

Effective refractive error coverage declined with increasing age  $\geq 50$  years. Possible explanations for this include reduced access to eye care, high costs of optical services and a perception that vision impairment is part of the normal ageing process and therefore does not warrant intervention.

Based on the available data, considerable variation in eCSC and eREC was observed both within and across WHO regions. The European and South-East Asia regions were found to have the highest eCSC; however, variation in effective coverage within these regions was also marked. eREC was higher in the Region of the Americas and South-East Asia Region. There was also a clear trend for increasing eCSC and eREC with increasing World Bank country income level, reflecting the tendency for greater resource allocation and subsequent cataract service output and provision of spectacles in countries of higher income.

Consistent with previous reports (20), a noteworthy relative quality gap (of 33.9%) between “coverage” and “effective coverage” exists for eCSC highlighting the need for countries to consider both components of access and quality in their efforts to achieve the 2030 targets. In countries where the relative quality gap is high, there is a significant opportunity to improve eCSC in a cost-effective manner. For example, enhancing service quality through the better training of eye care personnel, protocols that reflect best practices, and a process of continuous improvement, may not require significant additional expenditure.

In the future, the ability to periodically collect a representative volume of standardized data (both within and across countries) from population-based surveys will be critical to ensure robust reporting and monitoring of

progress towards achieving the global targets for eCSC and eREC. In order to strengthen the monitoring of eCSC and eREC through to 2030, emphasis should be placed on:

- i. addressing geographical data gaps that are particularly notable in the Region of the Americas, the Eastern Mediterranean Region, and the European Region;
- ii. strengthening data within high-income countries;
- iii. enhancing data on eREC in younger populations, given that refractive error is common among the children and working age populations; and
- iv. generating more estimates of near eREC.

For most countries, there is lack of comprehensive national data for these global tracer indicators and Member States are encouraged to invest in robust national monitoring of eCSC and eREC as part of their endeavours towards achieving UHC. To facilitate the collection of data on eCSC and eREC, WHO has integrated a vision module within existing WHO surveys, including the STEPS surveys (28) and the World Health Survey plus (29); a sensory functions survey protocol is also under development. Stand-alone eye health survey methodologies also exist for measuring these indicators in older populations (18, 19). In order to strengthen data among younger populations, further opportunities should also be taken to incorporate eye care modules within childhood and general health surveys.

Estimates of eCSC and eREC will be generated again in 2025 and 2030, drawing on newly collected data that will also include near eREC. WHO defines mild vision impairment as being at the 6/12 threshold; therefore, for the global reporting framework, progress towards the achieving of the 2030 targets will be based on the 6/12 threshold for defining the “need for intervention” and a “good quality visual outcome”.

Restoring a person’s sight with cataract surgery or a pair of spectacles are among the most cost-effective health interventions. Significant opportunities exist to improve eCSC and eREC; efforts should focus on strategies to improve access and affordability for populations that are traditionally disadvantaged and underserved, including people living in lower-income countries, women, and older people.

# **Key challenges and strategies for improving coverage of eye care services**

## **Key challenges**

While increases in rates of cataract surgery have been seen in many LMICs during the past two decades (39, 31), these endeavours have resulted in only modest reductions in the global proportion of cases of vision impairment and blindness attributable to cataract due to concurrent demographic changes (32). At the same time, vision impairment due to uncorrected refractive error is predicted to rise even further due to lifestyle-related factors, including intensive near-vision activity and less time spent outdoors. These challenges are not specific to cataract and refractive error: substantial increases are also anticipated in the number of people with other noncommunicable eye conditions, such as diabetic retinopathy, glaucoma and age-related macular degeneration (6, 33–35).

The burden of vision impairment from preventable or addressable causes also tends to be greater in underserved populations, such as people living in rural areas, those with low incomes, women, older people, people with disability, indigenous populations, and ethnic minorities (2).

In response, the following system-related challenges need to be addressed:

### **Availability**

A shortage of trained human resources is a key challenge to increasing the availability of eye care services and reducing the prevalence of vision impairment and blindness that could be prevented or has yet to be addressed. Several factors accentuate the problems associated with the shortage of health workers, including suboptimal distribution (both geographically and across income levels), issues with retention, and poor supervision and coordination. Even where health workers are available, essential ophthalmic equipment and consumables to manage ocular conditions are frequently unavailable, particularly in the public sector of some low- and middle-income settings (36). Many governments perceive spectacles as cosmetic products rather than health or medical items, thus availability of optical services is limited to the private sector.

### **Accessibility**

Barriers related to, for example, sex or socioeconomic status, can prevent patients from accessing services. The reality that most eye care services in LMICs are provided in secondary or tertiary hospitals (or the private sector in the context of spectacles), which are principally located in urban areas, adds to the inequity in access (37).

### **Affordability**

The costs associated with accessing eye care services are often reported as a major barrier to the access to, and provision of, eye care services (38). Eye care interventions, including cataract surgery and spectacle provision, are rarely included in national health insurance schemes, resulting in high out-of-pocket expenditures by patients (2).

### **Acceptability**

The acceptability of eye care is seldom considered but has substantial consequences on the use of services and subsequent eye health outcomes.

Adherence to spectacle-wear among children and adolescents is often suboptimal, and commonly attributable to stigma and misconceptions, particularly with parents, that using spectacles worsens a child's vision (39, 40). Fear of ocular surgery, including cataract surgery, has also been cited as a barrier to the uptake of eye care services (41, 42).

### **Quality of services**

Highlighting the importance of quality care is not new in the field of eye care; the quality of cataract surgery, for example, has at times been a concern (20). By emphasizing the “effective” aspect of cataract surgery and refractive error correction, the global targets are expected to be a catalyst for increased efforts to monitor outcomes of cataract surgery and refractive correction. Improved quality of services depends on systematic monitoring of outcomes. Of importance, other significant components of quality care, such as safety, efficiency and timeliness, should also be considered in quality improvement efforts.

### **The need for better eye care data and monitoring systems**

Comprehensive national data systems for eye care are lacking globally, thereby limiting the ability to monitor progress. Robust national monitoring and evaluation frameworks are required to ensure informed decision-making on the implementation of actions towards improving coverage of quality eye care interventions.

## **Key strategies**

### **Integrated people-centred eye care**

To address many of the challenges faced in the field of eye care – including inequities in access and lack of integration within the health system – eye care needs to be an integral part of UHC. This message was endorsed by the Seventy-third World Health Assembly (3) in resolution WHA73.4 which urges Member States to make eye care an integral part of UHC and to implement integrated people-centred eye care (IPEC) in health systems.

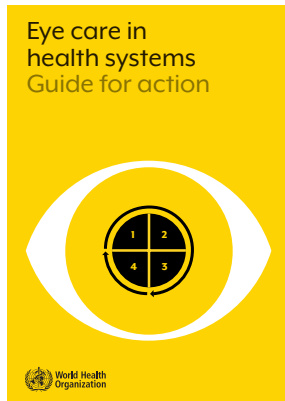
WHO defines IPEC as services that are managed and delivered so that people receive a continuum of health interventions covering promotion, prevention, treatment and rehabilitation, to address the full spectrum of eye conditions according to their needs, coordinated across the different levels and sites of care within and beyond the health sector, and that recognizes people as participants and beneficiaries of these services, throughout their life course. Through IPEC, WHO envisions all people having equitable access to health services which include quality eye care.

The four key strategic recommendations towards IPEC are:

1. Engaging and empowering people and communities.
2. Reorienting the model of care based on a strong primary care.
3. Coordinating services within and across sectors.
4. Creating an enabling environment for integration of eye care in national plans and health systems, where the workforce meets population needs.

## Key WHO tools to support IPEC implementation

To support countries with the implementation of IPEC, WHO has developed a number of frameworks and tools to support planning, implementation and monitoring of eye care services, including cataract surgical services and refractive and optical services.<sup>iii</sup>

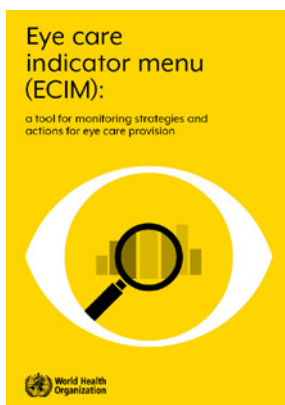


**Eye care in health systems: guide for action (the Guide)** was developed as a manual for health planners. The Guide outlines strategies and approaches proposed by WHO that provide practical, step-by-step support to Member States in the planning and implementation of integrated people-centred eye care (43). The guide links four resources, or tools, to support countries in their development of eye care plans and frameworks:



### 1. Eye care situation analysis tool (ECSAT)

A questionnaire-based survey tool to comprehensively assess eye care in a country. The tool provides a snapshot of the current situation in a country, identifying priority areas that need to be addressed in eye care strategic planning (44).



### 2. Eye care indicator menu (ECIM)

A comprehensive set of indicators, including for cataract services and optical services, to facilitate the monitoring of strategies and actions for eye care provision (22). To support wider integration of eye care data monitoring, selected ECIM indicators – whose preferred data source is routine data from health facilities – are currently being integrated into the District Health Information System 2 (DHIS2) platform, within a Sensory Functions Package.<sup>iv</sup>

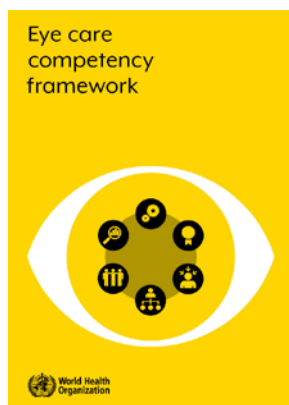


### 3. Package of eye care interventions (PECI)

A set of recommended, evidenced-based eye care interventions across the continuum of care, including cataract services and optical services, and the material resources required for implementation. The PECI serves to facilitate policy-makers and technical decision-makers in low- and middle-income countries to integrate eye care into the packages and policies of their health services (37).

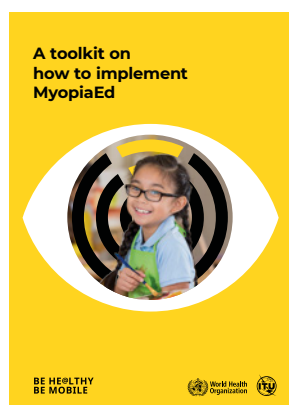
<sup>iii</sup> The WHO tools described can be accessed at: <https://www.who.int/health-topics/blindness-and-vision-loss>.

<sup>iv</sup> See: <https://dhis2.org>



#### 4. Eye care competency framework (ECCF)

A tool that conveys the expected performance of an eye care worker (including providers of refractive and optical services at the primary, secondary and tertiary levels of the health system) for the purpose of workforce planning and development, and that aligns to standards of competencies (45).



#### MyopiaEd toolkit

The MyopiaEd toolkit was developed to support countries and other stakeholders to develop, implement and monitor large scale digital health programmes aimed at: i) improving awareness of the importance of regular eye examinations and spectacle adherence; and ii) supporting behaviour change that may delay the age of onset, and slow the progression of myopia. This toolkit includes evidence-based message libraries for key population groups, along with operational guidance and resources for adapting, implementing and monitoring the MyopiaEd programme (46).

#### WHO SPECS

Expanding the coverage of spectacles is essential and requires a multisectoral approach that includes focusing on the increasing demand for spectacles, raising the number of access points for screening and provision, and accelerating the availability of affordable products (47). In 2022, the WHO Vision and Eye Care Programme will launch SPECS to support countries to increase to increase spectacle coverage while delivering quality care. Specifically, this initiative aims to: i) develop innovative models of screening and delivery of Spectacles; ii) support the training of Professionals; iii) improve public Education targeting the prevention and management of refractive error; iv) reduce the Costs of optical services; and v) ensure robust Surveillance and monitoring of effective coverage of refractive error.

Achieving the proposed actions and targets will require the combined and proactive efforts of all stakeholders, including governments, WHO, multi-lateral institutions, nongovernmental partners, the private sector and the community, to provide the long-term investment and management capacity needed to ensure that all people can receive quality eye care services without risking financial hardship.

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## Annexes

### Annex 1. Definition, calculation method and specifications for near eREC

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Definition            | Proportion of people who have received refractive error services (that is, spectacles or contact lenses or refractive surgery) at near vision and have a resultant good quality outcome relative to the number of people in need of refractive error services – near vision.                                                                                                                                                                                                                                                                                                                                                                                          |
| Method of calculation | $\left( \frac{a}{a+b+c} \right) \times 100$ <p>a. Individuals with UCVA worse than N6 at 40cm in the better eye who present with spectacles for near vision and whose PVA is equal to, or better than, N6 in the better eye (“met need”).</p> <p>b. Individuals with distance BCVA of equal to or better than 6/12 in at least one eye who present with spectacles for near vision and whose PVA is worse than N6 in the better eye (“undermet need”).</p> <p>c. Individuals with distance BCVA of equal to or better than 6/12 in at least one eye, who do not have correction for near vision and whose UCVA is worse than N6 in the better eye (“unmet need”).</p> |
| Data source           | Population-based surveys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Disaggregation        | Age, sex, geography (e.g. urban vs non-urban) and socioeconomic status.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

UCVA: uncorrected visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person not wearing them.

PVA: presenting visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person wearing them.

BCVA: best-corrected visual acuity; visual acuity is assessed either by pinhole or refraction.

## Annex 2. Alternative calculation method for eREC\*

$$\left( \frac{a}{a+b+c} \right) \times 100$$

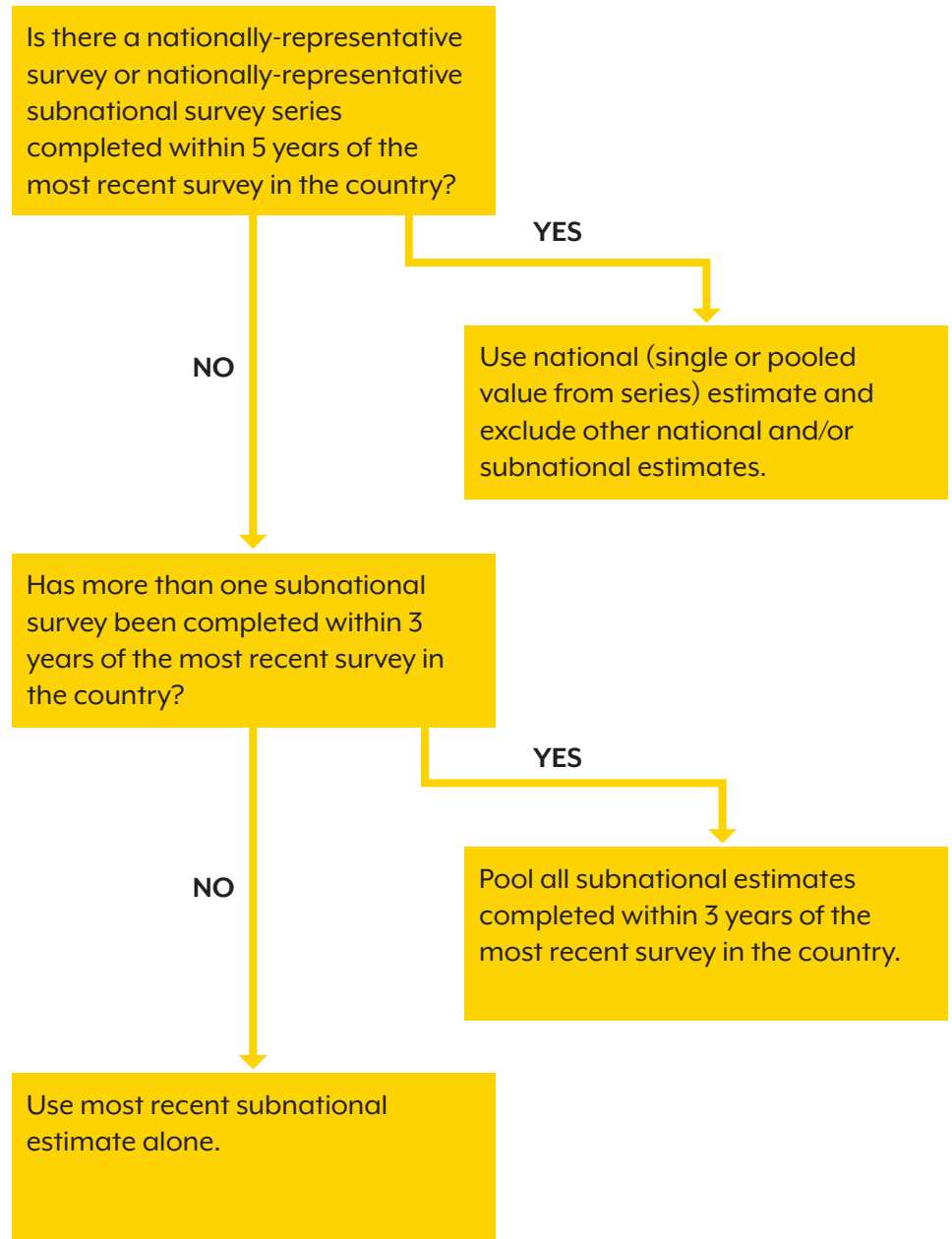
- a. individuals who present with spectacles or contact lenses for distance (or have a history of refractive surgery) and whose PVA is equal to, or better than, 6/12 in the better eye (“met need”).
- b. individuals who present with spectacles or contact lenses for distance (or have a history of refractive surgery) and whose PVA was worse than 6/12 in the better eye, but improves to be equal to, or better than, 6/12 on pinhole or refraction (“undermet need”).
- c. individuals with PVA worse than 6/12 in the better eye, who do not have correction and whose visual acuity improves to be equal to, or better than, 6/12 on pinhole or refraction (“unmet need”).

\*All visual acuities are measured for distance.

PVA: presenting visual acuity; if spectacles or contact lenses are worn to the assessment, visual acuity is measured with the person wearing them.

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### Annex 3. Decision tree for inclusion of survey data presented per country





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Switzerland  
<https://www.who.int/health-topics/blindness-and-vision-loss>

