



IAPB EYE HEALTH

TECHNOLOGY GUIDE

Recommendations & tools to consider technology that enables access to and uptake of eye care services.

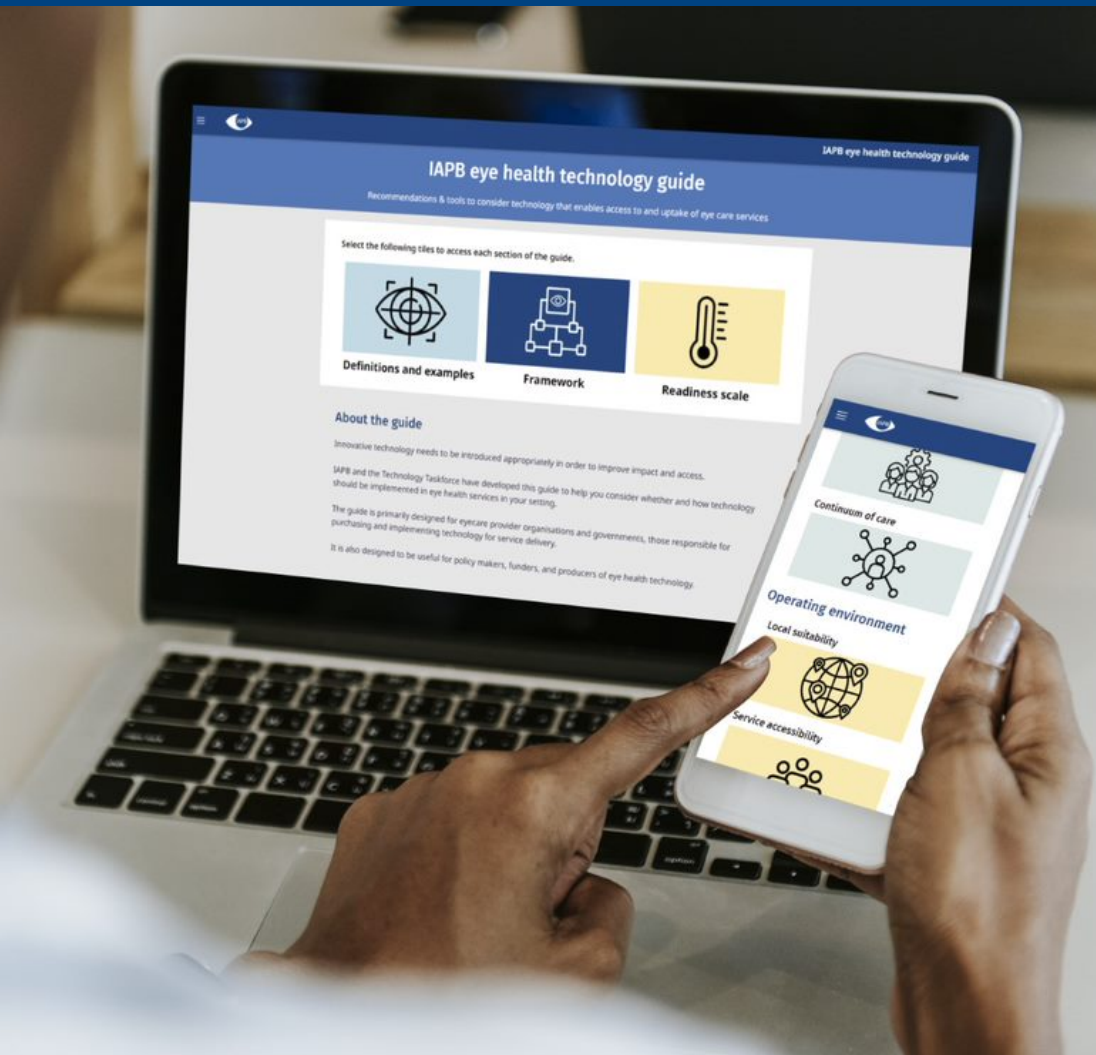


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Introduction

Background

There are 1.1 billion people around the world living with the consequences of sight loss because they do not have access to eye care services. These are some of the poorest and most marginalised in society.

Without change, 1.8 billion people will have sight loss by 2050. We are faced with the rising and complex impact of ageing populations, changing lifestyles and the sharp increase of conditions such as diabetes and myopia.

The rise of technology

Technology innovations have significant potential to address this growing burden of eye disease.

With access to existing and highly cost-effective interventions, we can help those 1.1 billion and many more. For example:

- Today, six billion people have mobile devices and by 2030, a range of vision tests will be available on mobile applications anywhere on the planet.
- High quality clinical images and data can be shared between eye health professionals on the other side of the world in real time.
- Artificial intelligence (AI) is already used in the screening and treatment of eye health conditions and will continue to evolve our sector in the coming years.
- The COVID-19 pandemic increased the uptake and acceptability of digital technologies in health and eye health.

The pace of change will not slow down. Nor will the complex factors influencing eye health or the inequalities that have only increased with time.

Implementing technology

Technology will be part of the future of eye health, so we need to ensure that it is developed and implemented in ways that give access to the underserved.

Thoughtful application is needed to maximise the potential of technology to improve coverage, accessibility, effectiveness, efficiency, and affordability of eye health services.

Importantly, technology should be used to unlock potential of eye health systems and workers – not replace them. Ultimately, providing access to eye health requires a multi-faceted approach that involves the use of technology as well as the efforts of people working together at all levels of the eye health system.

About this guide

IAPB members have recognised that although many eye health technologies exist and are emerging, technology is currently not reaching its potential to scale and increase access to eye care services.

IAPB and the Technology Taskforce have developed this guide that aims to help people better understand and critically analyse eye care technology and be comfortable engaging with and adopting technology in their work.

Technology for Access taskforce

The guide was developed by the Technology for Access Taskforce through a consultative process throughout 2022 and 2023.

The Taskforce brings together world leaders in technology development and implementation in eye care, a diverse group with a range of expertise in technology, eye care systems, people centred care and equity and affordability.



Photo credit: Azienyuiy Mbuhnyam

Aim

The key aim of the guide is to present a common language, understanding and framework to use when considering implementing eye health technology.

We aim to enable key stakeholders for eye health services to use the guide to work together to use technology appropriately to meet eye health challenges and achieve 2030 In Sight.

Specifically, this guide will help you to:

- learn more about established technologies for eye health and define which access factors a technology may address.
- understand and identify the stage of development of emerging technology.
- consider how to appropriately implement and sustain technology in eye health services, systems and programs.

This guide is not intended to replace structured frameworks, guidance or tools provided by WHO to member states, nor to be used as a planning tool for national level programming. The guide is intended to be used alongside a Health Technology Assessment (HTA) and relevant WHO tools, where available and appropriate. Read [more information from the WHO on HTA](#).

When implementing technology, it is also recommended that you make comparisons with similar products. However, the primary purpose of this guide is not to facilitate detailed comparisons of specific features and technical capabilities of technologies of the same type.

Please use these frameworks to consider how you can use technology to provide [integrated people-centred eye care](#) and access to all people, in particular underserved populations.

Target audience

The guide is primarily designed for IAPB members and other eyecare provider organisations, those responsible for purchasing and implementing technology for service delivery, and advising government on eye health technology. It is also designed to be useful for policy makers, funders, and innovators and manufacturers of emerging eye health technology.

About the guide

There are three key sections to the guide:

1. Definitions and examples:

- a. Explanations and examples of key technologies that the Taskforce have emphasised that have the potential to improve access to eye health, particularly at the community and primary care levels.
- b. Key enablers of eye health that improve supply and demand, as well as examples of technologies that specifically aim to address each enabling factor.

2. Technology for access framework

- a. Key considerations for the successful introduction and ongoing management of technologies in eye health. For each criterion, the framework includes definitions, minimum and additional criteria and list of key questions to ask.

3. Technology readiness scale

A tool to help you quickly assess how likely it is that the technology can provide impact in a real-world setting in its current state of development. This can assist with timelines, risk assessment, and decision on technology purchase or funding.

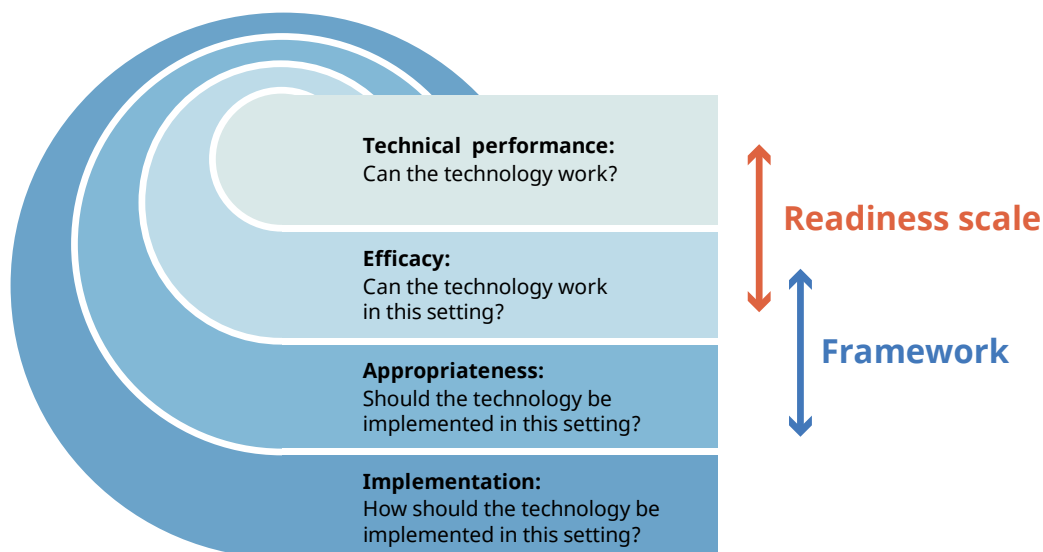


Figure 1: From performance to use in health care: layers of questions. Reference: Adapted from *Health technology assessment of medical devices*, WHO, 2011

Please note that this guide doesn't address *how* a certain technology should be implemented. More guidance on implementation considerations is available in this [WHO guideline: recommendations on digital interventions for health system strengthening](#).¹

We welcome your feedback, please contact knowledge@iapb.org with comments and suggestions.

¹ World Health Organization, 2019. WHO guideline: recommendations on digital interventions for health system strengthening.

Acknowledgements

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Section 1:

Definitions and examples



Many eye care clinics already have essential standard equipment, such as visual acuity charts, trial frames, phoropters and slit lamps, as listed in the WHO's [Package of eye care interventions](#). In addition, innovative solutions using commercially available eye health technology can also enable access to eye care.

The uptake of eye health technologies is increasing quickly. For example, many diagnostic, screening and portable devices can now be operated by personnel with minimal training, taking high quality screening and care closer to where people live and work.

In this guide, we focus on technology that can bring eye care services closer to where people are, particularly at the community and primary level (see [Appendix 1: Levels of eye care](#)).

The range of digital eye health technology is wide, dynamic and evolving. Please note:

- Examples are included in each category, though these aren't exhaustive lists.
- We don't address many technologies or devices used at the secondary and tertiary levels.
- Certain technologies may not yet be available in some low- and middle-income settings.

Devices

Diagnostic and screening devices



Photo credit: Martin Gamit

Definition

Diagnostic devices help establish the presence or absence of disease in symptomatic patients. Screening devices are used to detect potential eye diseases in people during routine tests that check for signs of problems, where there may be no symptoms.

Examples of diagnostic and screening devices include:

- **Autorefractor:** provides an objective measurement of a person's refractive error.
- **Corneal topographer:** creates high-resolution maps of the cornea.
- **Optical coherence tomographer (OCT):** create high-resolution 3D images of the retina.
- **Perimeter:** used to measure the eye's visual field.
- **Retinal camera:** takes high-resolution (2D) digital photographs of the retina.
- **Dry eye diagnostic devices:** that investigate the quality of the tear film.

Key factors being addressed

Availability, quality

Portable devices



Photo credit: Terry Cooper

Definition

Desktop diagnostic and screening devices are generally only available in well-equipped eye clinics. As a result, they can't be used in many community health settings around the world, such as health centres, nursing homes, workplaces, or schools, limiting their impact and usefulness.

Portable, easily carried devices can be used to help screen for and diagnose eye disease in these settings, as well as in the clinic.

Available handheld devices include:

- **Retinal cameras**
- **Autorefractors**
- **Retinopathy of Prematurity (ROP) screening devices:** captures images of the pre-term eye.
- **Slit lamp:** used to examine the anterior eye.
- **Pachymeter:** used to measure the thickness of the eye's cornea.
- **Tonometer:** used to measure the pressure inside the eye.

Key factors being addressed

Accessibility, quality

Digital technologies

Telehealth



Definition

Telehealth is where digital communication, information, and hardware are used to provide eye health care services when the practitioner isn't in the same room as the patient.

Telehealth services can be **synchronous**, as in live, real-time consultations, or **asynchronous**—where images are taken for later review (reference: Lancet).

- **Synchronous** telehealth consultations commonly involve reassurance, prescribing medications, or recommending an in-person appointment.
- In contrast, **asynchronous** telehealth often involves screening for diabetic retinopathy and retinopathy of prematurity, for example.²

² Massie, J., Block, S.S. and Morjaria, P., 2022. The Role of Optometry in the Delivery of Eye Care via Telehealth: A Systematic Literature Review. Telemedicine and e-Health.

Remote services

In certain settings around the world, fully integrated systems allow eye care providers to conduct parts of the comprehensive eye exam remotely, including refraction with automated phoropters.

Key factors being addressed

Accessibility

Mobile health

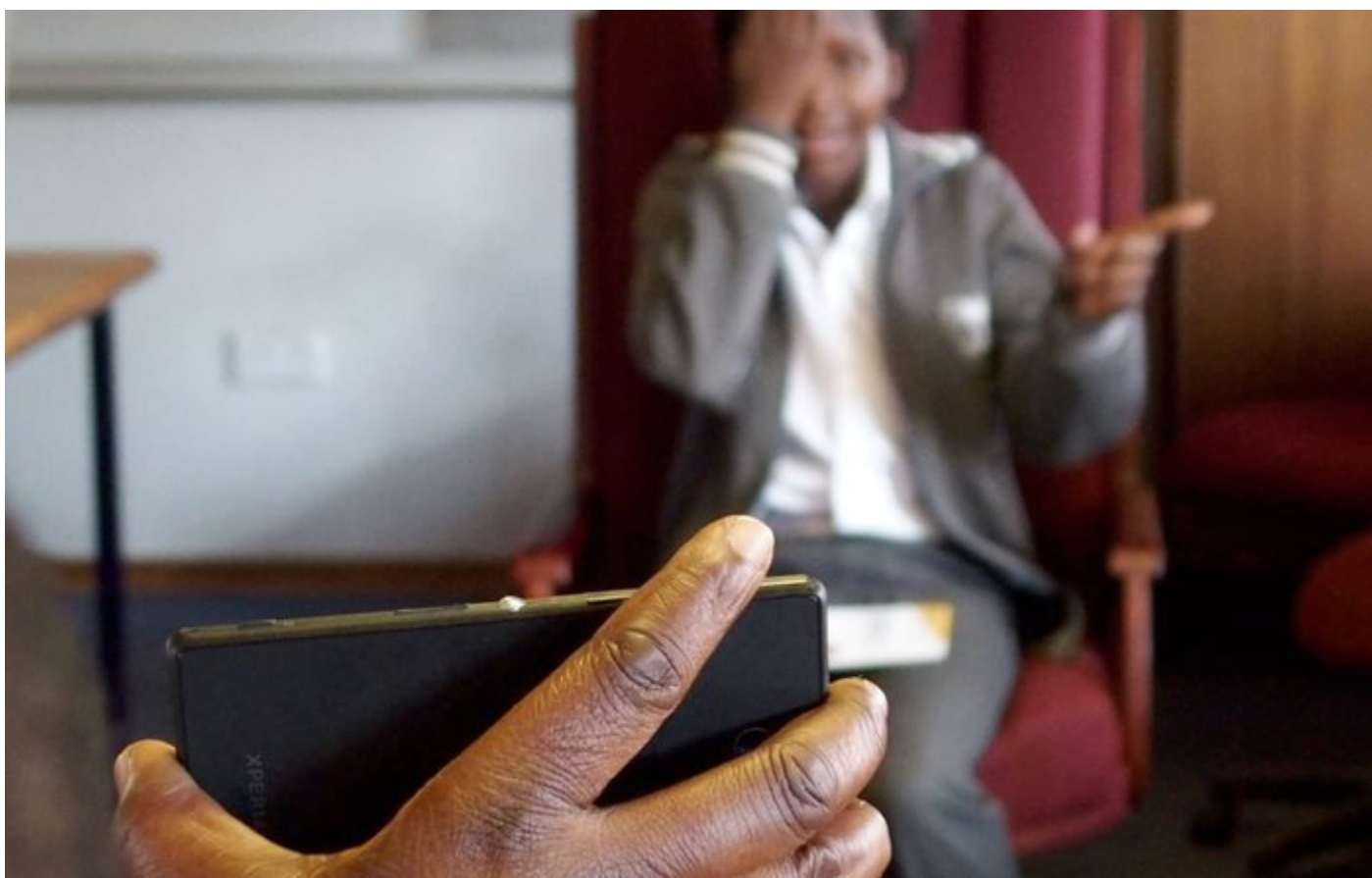


Photo credit: Peek Vision

Mobile health (mHealth) refers to the use of any mobile device, but particularly mobile phones, to support the achievement of health objectives.³

³ Morjaria, P. and Massie, J., 2022. mHealth for eye care: what is possible?. *Community Eye Health*, 35(114), p.16.

Screening

Smartphone-based visual acuity apps can help identify people who need to see an eye care provider or specialist during vision screenings.

Self-screening visual acuity tests and portable visual field tests are also available. However, most self-screening apps are untested or unvalidated. This means they may have variable accuracy and should be used with caution.⁴ These tests also don't replace a comprehensive eye examination or assess eye health.

Key factors being addressed:

Availability, accessibility

Referrals and follow-up

mHealth applications can facilitate the patient journey by:

- referring patients who have an eye condition to another eye care provider, specialist and/or hospital.
- tracking who has attended referral and follow-up appointments and send reminders and promote attendance.
- helping to provide the referring clinician with feedback about the patients they refer.
- promoting adherence to medication.
- analysing data and assess overall service delivery performance in real-time.

Key factors being addressed:

Integration, awareness

Eye health education

mHealth applications can provide evidence-based targeted health information messages to patients at high-risk, parents and carers, health workers and/or educators. These can provide evidence-based motivation, support, information, and/or reminders.

Key factors being addressed:

Awareness

⁴ Yeung, W.K., Dawes, P., Pye, A., Charalambous, A.P., Neil, M., Aslam, T., Dickinson, C. and Leroi, I., 2019. eHealth tools for the self-testing of visual acuity: a scoping review. *NPJ digital medicine*, 2(1), pp.1-7.

Artificial intelligence

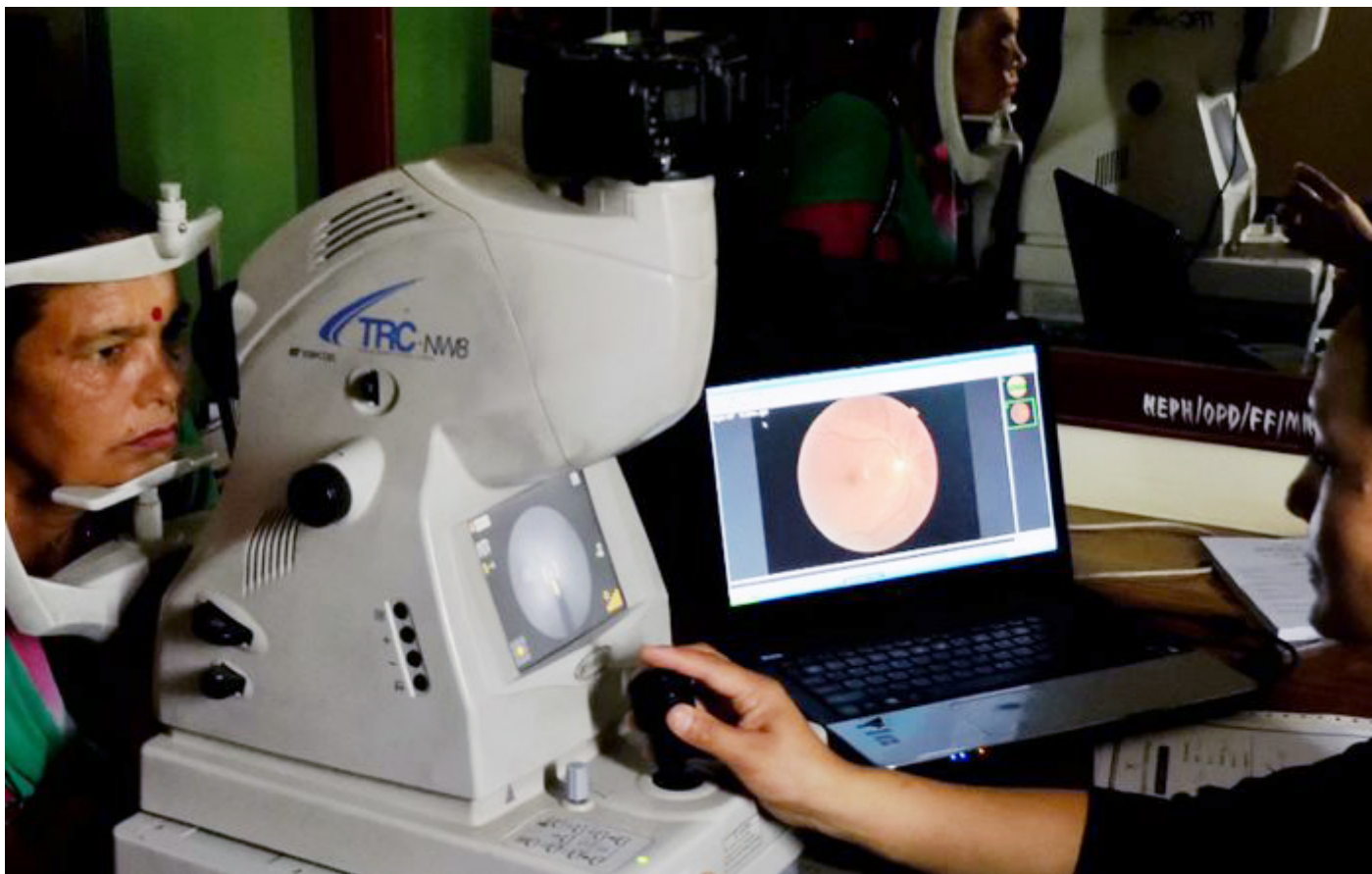


Photo credit: Shyam

Definition

Artificial intelligence (AI) is when computer systems can complete tasks including diagnosis, prediction or decision making that normally require human intelligence.

In eye health, modern imaging devices combined with AI and machine and deep learning are enhancing our ability to screen and manage eye disease.

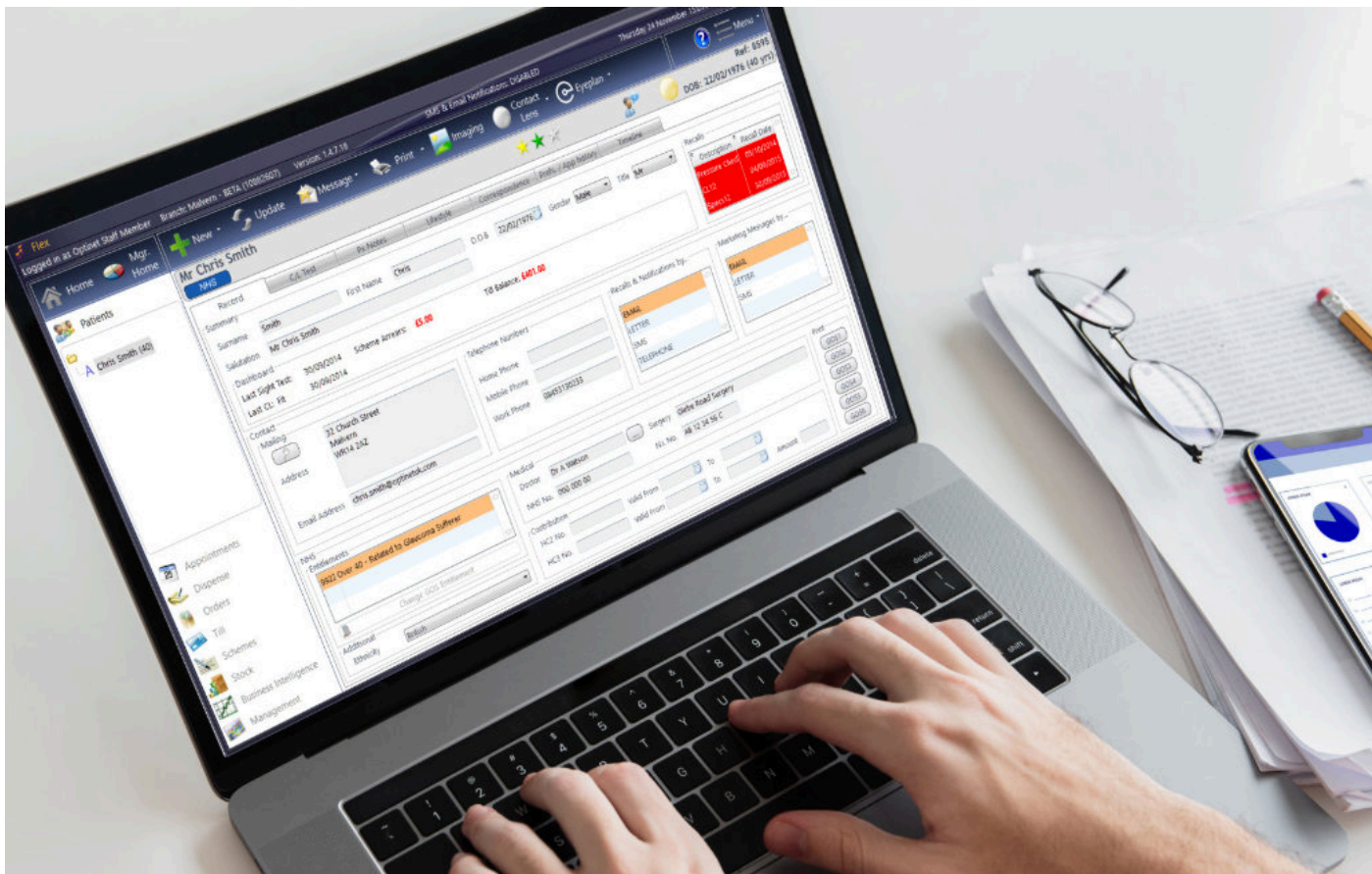
Early application for AI in public health programmes is in screening and diagnosis of high-volume chronic conditions such as diabetic retinopathy, age-related macular degeneration, and glaucoma. The system should be able to grade disease stage and progression when clinically appropriate, even when image is imperfect under real-world conditions.

Other possible applications of artificial intelligence include supporting point-of-care diagnostics, surgical decision making, patient management and treatment as well as integration with electronic medical records, telehealth and mobile health.

Key factors being addressed

Availability, quality, accessibility

Clinic management software



Definition

Clinic management software may include the following features:

- Clinical records
- Image management
- Online appointments
- Patient recalls
- Patient communication (email / SMS)
- Billing and accounting
- Inventory management
- Telehealth
- Electronic prescriptions

Clinic management software may include electronic medical records (EMRs), a digital record of the patient's examination treatment history at one location.

Link between EHR and national health information systems

Some clinic management software includes integration with electronic health records (EHR), which are digital records of health information designed to be shared between other health professionals at multiple sites.

Data from both individual and service records can also be used to help define sector targets and outcomes, clinical decision-making, estimates of service utilization, and quality management.⁵

For example, in the United States and England, clinical data from clinical management systems and electronic health records are collected and used to estimate the prevalence of various eye diseases, to survey the outcomes of health care, and to improve the quality of eye care services nationwide.⁶

Key factors being addressed

Integration

Online training



⁵ Routine health information systems rehabilitation toolkit (no date) World Health Organization. World Health Organization. Available at: <https://www.who.int/activities/integrating-rehabilitation-into-health-systems/routine-health-information-systems---rehabilitation-toolkit> (Accessed: November 25, 2022).

⁶ Hashemi, N., Moghaddasi, H., Rabiei, R., Asadi, F. and Farahi, A., 2018. Eye health information systems in selected countries. *Journal of Ophthalmic & Vision Research*, 13(3), p.333.

Online training is accessed via computers or mobile devices, and includes self-paced activities such as elearning courses, job aids, simulations and videos. It can also include instructor-led webinars, presentations, mentoring and communities of practice.

Online training can provide eye health professionals with continuing education opportunities on a wide range of topics, such as the latest management, technologies, and best practices in eye care.

Online training can have several advantages:

- Online training is often more **cost effective** and **scalable** than traditional in-person training, allowing health care providers in remote or underserved areas to access training and increase their expertise more easily.
- Elearning can be self-paced and customized to the learners need, pace and schedule, increasing **convenience**.

However, in-person sessions can often increase social interaction, discipline and self-motivation compared to online training. A blended approach, where online training supplements in-person sessions, can often maximize results.

Key factors being addressed

Quality, accessibility

Emerging technologies

There are other emerging technologies which are not yet widely available and/or not used at the community and primary levels of care. These include:

- **2D / 3D display systems:** Allow surgeons to perform surgery by viewing a 2D or 3D microscopic image on a screen.
- **Robotics:** Robotic surgery is where surgeon operates smart instruments that have a superior level of functions.
- **3D printing:** Possible uses in eye health include in anatomical education, surgical planning, research models, implants, lenses, diagnostics, therapeutic applicators, and eye protection.
- **Wearable devices / monitoring devices:** Small electronic devices worn on the body by patients to collect data about eye disease or service delivery.
- **Drug delivery devices:** Specialised tools for the delivery of a drug or therapeutic agent via a specific route.
- **Conversational AI / chat bots:** Conversational AI and chat bots enables consumers to interact with computer applications the way they would with other humans.
- **Blockchain:** a system in which a record of transactions is maintained across computers linked in a peer-to-peer network. In eye health, blockchain technology can help to monitor data and results integrity.

Eye health enabling factors

High quality health care is critical for achieving universal health coverage.⁷ However, many patients can't access quality eye health care. For example, appropriate services may be unavailable, too expensive, take too long, or be ineffective.⁸

Many factors can enable a person's access to eye health services, such as availability, accessibility, acceptability and quality of services (AAAQ)⁹ as well as integration and awareness.¹⁰

Some of these factors relate to the supply of services, others the demand for services, and some factors relate to both supply and demand. **Technology can help support these factors when implemented thoughtfully.**¹¹

Below we list examples of technologies that specifically aim to address each enabling factor.

Supply-side factors

Availability

Efficient care that is available in sufficient quantity and type, minimising delays after a need is recognised and waste of resources and repetition. Examples of technologies that aim to address availability include:

- **Diagnostic and screening devices:** by helping to detect and diagnose eye disease.
- **Artificial intelligence (AI):** by helping to screen and diagnose high-volume chronic conditions.

⁷ World Health Organization. 2022. Quality of care. [online] Available at: <<https://www.who.int/health-topics/quality-of-care>> [Accessed 4 October 2022].

⁸ Australian Institute of Health and Welfare. 2022. Coordination of health care: experiences of barriers to accessing health services among patients aged 45 and over, Summary - Australian Institute of Health and Welfare. [online] Available at: <<https://www.aihw.gov.au/reports/primary-health-care/coordination-of-health-care-experiences-barriers/summary>> [Accessed 4 October 2022].

⁹ UN Committee on Economic Social and Cultural Rights. CESCR General Comment No. 14: The Right to the Highest Attainable Standard of Health (Art. 12). 2000 [cited 2014 21 January]; Available from: <http://www.refworld.org/docid/4538838d0.html>.

¹⁰ World Health Organization, 2019. World report on vision.

¹¹ Burton, M.J., Ramke, J., Marques, A.P., Bourne, R.R., Congdon, N., Jones, I., Tong, B.A.A., Arunga, S., Bachani, D., Bascaran, C. and Bastawrous, A., 2021. The Lancet global health Commission on global eye health: vision beyond 2020. *The Lancet Global Health*, 9(4), pp.e489-e551.

Quality

Evidence-based care that achieves the desired outcomes, minimising complications, errors and harm. Examples of technologies that aim to address quality include:

- **Diagnostic and screening devices:** by more accurately establish the presence or absence of disease in symptomatic patients.
- **Portable devices:** by more accurately screening and diagnosing eye disease outside of the clinic.
- **Artificial intelligence (AI):** by reducing issues with interobserver reliability.

Integration

Services that are coordinated and continuous across health services and providers. Examples of technologies that aim to address integration include:

- **Mobile health - referrals and follow up:** by facilitating the patient journey to another eye care provider, specialist and/or hospital.
- **Clinical management software:** by facilitating referrals and sharing data to improve the overall quality of eye care services.

Demand-side factors

These factors can reduce gaps between the total availability of eye health services and the actual contact that people have with them.

Accessibility

Eye health services must be within safe physical reach of all parts of the population, and affordable for all. Examples of technologies that aim to address accessibility include:

- **Portable devices:** by helping to screen for and diagnose eye disease outside of the clinic.
- **Telehealth:** by allowing practitioners to serve patients in other locations.
- **Mobile health - screening:** by helping to identify people in remote locations who need referrals.
- **Artificial intelligence (AI):** by helping to screen and diagnose high-volume chronic conditions remotely.

Awareness

When people have an understanding and knowledge about eye health diseases, services, and preventative measures. Examples of technologies that aim to address awareness include:

- **Mobile health - referrals and follow up:** by tracking who has attended referrals, sending reminders and promoting adherence to medication.

- **Mobile health - eye health education:** by providing targeted health information messages to patients at high-risk, parents and carers, health workers and/or educators.

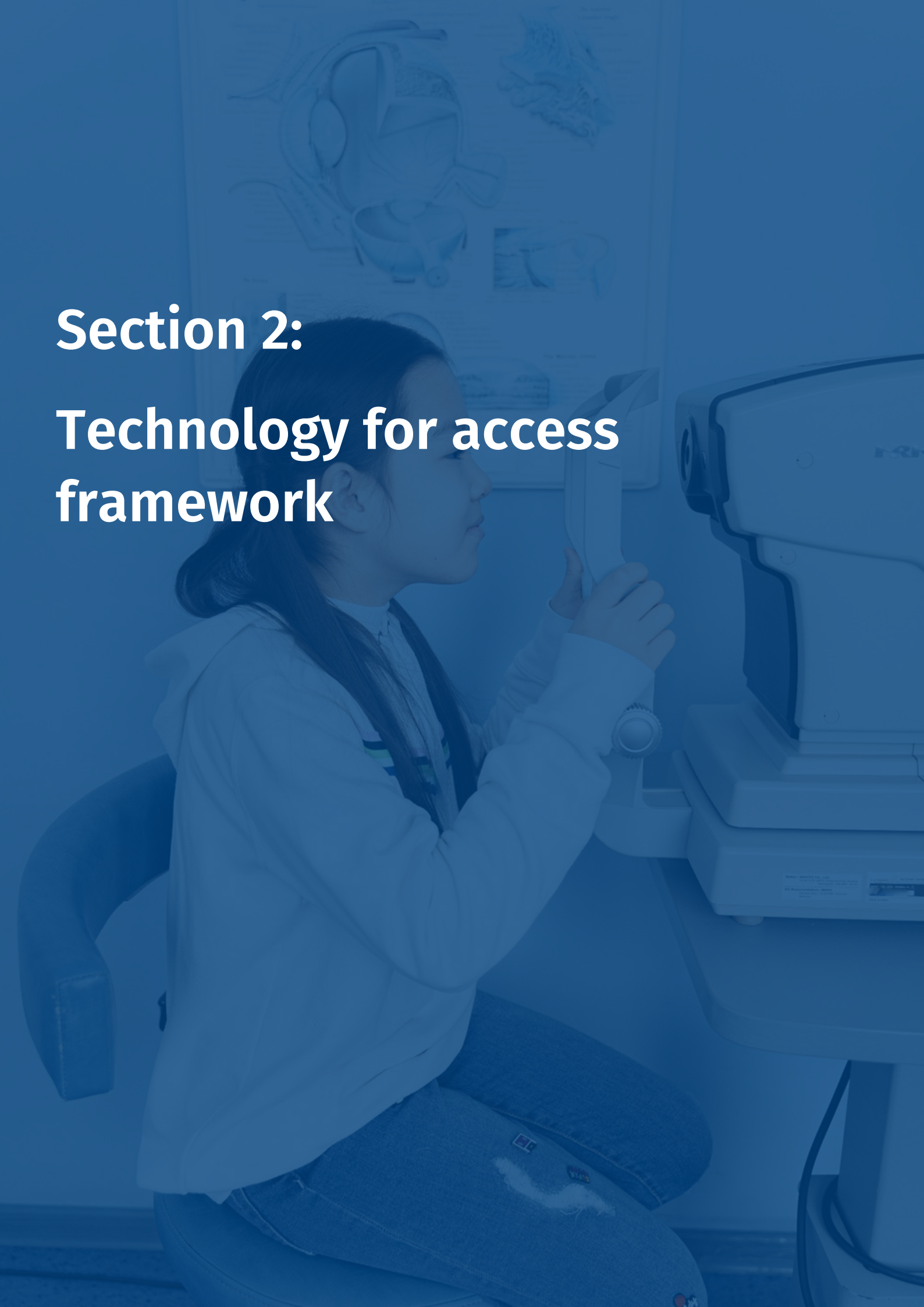
People-centredness

Services must be acceptable to all - respecting people's preferences, needs and values.

- Most technologies don't aim to specifically address the people-centredness factor, but this is a key consideration during implementation. See the **Technology for access framework** on the following pages for more details on how to assess whether a technology is likely to be people-centred.

Section 2:









Technology for access framework



Framework overview

This framework is designed to help you consider whether a new technology will be appropriate in eye health services in a specific setting.

Under each of the following areas, you will find a definition, essential and additional criteria for introduction and questions to ask stakeholders such as vendors, manufacturers, colleagues or partners. Additional criteria should be met where possible.

Technology readiness		
Efficacy	Safety	
 <p>How likely the technology is to improve eye health outcomes, including whether the technology is based on the latest scientific knowledge and evidence-based guidelines.</p>	 <p>Patient safety is a key consideration in the delivery of any health services. It aims to prevent and reduce risks, errors and harm that occur to patients during provision of health care.</p>	
Systems integration		
Policy and regulation	Human resources	Continuum of care
 <p>The introduction and scale-up of technology needs to be within the context of government policies, legal and regulatory frameworks.</p>	 <p>Personnel need to be trained to competently use the technology.</p>	 <p>Technology exists within a broader eye health and health context, so well-defined referral criteria and pathways are critical.</p>
Operating Environment		
Local suitability	Service accessibility	Economic sustainability
 <p>The technology needs to function correctly specifically in the country of introduction or a similar country context or population.</p>	 <p>Health care is considered 'accessible' when it is available at the right place and time, taking population needs and the affordability of care into account.</p>	 <p>A technology needs to be worth introducing. Consider direct and indirect costs involved in the assessment, implementation, and ongoing use of the technology.</p>

Technology readiness



Efficacy

How likely the technology is to improve eye health outcomes, including whether the technology is based on the latest scientific knowledge and evidence-based guidelines.

Essential criteria

1. The technology consistently achieves or surpasses minimum accepted standards, validated against currently available methods.

Additional criteria

2. Published evidence on the efficacy of the technology available in the scientific literature and/or from results of other local evaluations/pilots/trials of the intervention.
3. Efficacy of the technology can be measured and monitored.

Questions to ask

- What evidence or research is available that shows the product does it what it claims?
- How does the efficacy of the technology compare to the current standard of care or to other competitive products?



Safety

Patient safety is a key consideration in the delivery of any health services. It aims to prevent and reduce risks, errors and harm that occur to patients during provision of health care.

Essential criteria

1. The technology and services enabled by the device meet local regulatory standards.
2. Personnel to use the technology are trained and assessed as competent.
3. Risk assessments and management protocols for patient safety are in place to reduce, eliminate and manage any adverse outcomes.
4. Obtain informed consent from patients before using the technology on them.
5. Regularly monitor and document the technology's safety and efficacy once it's in use.
6. Any service involving children must have safeguarding protocols in place and activated.

Additional criteria

7. Review the technology's safety record, including any reported adverse events or complications, including in clinical trials.

Questions to ask

- How can we be sure the technology is safe?
- Does the technology meet all local regulatory standards?
- How are any risks to patient safety managed?
- Is the device disposable or reusable? Are there any infection-related risks?
- How can we be sure services enabled by the technology are child safe?

Systems integration



Policy and regulation

The introduction and scale-up of technology needs to be within the context of relevant policies, legal and regulatory frameworks.

Essential criteria

1. The technology and services enabled by the device meet local regulatory standards.
2. Government and regulatory bodies, professional bodies and/or civil society have been consulted around the introduction of the technology.
3. Proposed solution aligns with existing in-country digital strategies and platforms and data standards.
4. Patient information, data and associated financial systems are secure and aligned with national regulations.

Additional criteria

5. Technology will be introduced by a well-led organization open to change and with good managerial relations where risks are managed and supported.
6. Government and regulatory bodies, professional bodies and/or civil society are supportive of the introduction of the technology.
7. The technology meets any existing regulatory, security or policy framework, or this is planned.
8. Technology and/or digital platform is compatible with existing health systems or data can be regularly shared with government in a format easily integrated into their system.

Questions to ask

- Does the technology meet local regulatory standards?
- Do other stakeholders support the introduction of this technology?
- Does the solution align with existing digital strategies and platforms?
- How can we be sure that patient information is secure?



Human resources

Personnel need to be trained to competently use the technology.

Essential criteria

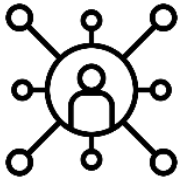
1. The technology is being distributed under the guidance of a suitably trained health worker who has met recognised competencies (WHO) and who fits within existing public or private sector HR systems.
2. The technology is user-friendly and acceptable for health workers.
3. Personnel to use the technology can be trained and assessed as competent.
4. The device operator can use the technology to identify patients that need to be referred for further treatment.

Additional criteria

5. Mechanisms are in place to regularly assess the competency and effectiveness of the device operators and provide refresher training.
6. A plan is in place to address any change to professional identity, values, or scope of practice produced by the technology.

Questions to ask

- What type of health worker should use this technology in our context?
- How is this technology more user friendly than current or similar options?
- How are personnel trained to use the technology?
- How can the device operator use the technology to identify patients that need to be referred for further treatment?



Continuum of care & referrals

Technology exists within a broader eye health and health context, so well-defined referral criteria and pathways are critical.

Essential criteria

1. There are clearly defined accessible, permanent and verified referral pathways for patients targeted by the technology.
2. The device operator conveys basic eye health information to the patients and encourages appropriate use of referral pathways.
3. For digital referral and tracking systems, patient data is protected.

Additional criteria

4. Referral pathways are aligned to the public health referral system.

Questions to ask

- If a patient needs referral, what is the pathway and process?
- How and when should device operators convey eye health information to patients?
- How is referred patient data protected?

Operating environment



Local suitability

The technology needs to function correctly specifically in the country of introduction or a similar country context or population.

Essential criteria

1. The outcomes delivered by the technology address user needs.
2. The technology has been tested and validated in country of introduction or a similar country context.
3. The technology is robust enough to be used in rural and remote locations.

4. Existing internet and mobile infrastructure support consistent access to the technology.
5. Device maintenance, repair and replacement options are available locally or regionally.

Additional criteria

6. Data from in-country trial is published in a peer reviewed journal.
7. Acceptability of services provided by the technology is measured.
8. The technology improves upon the balance between cost-effectiveness, patient safety and environmental impacts of current service provision.

Questions to ask

- How does the technology improve the user experience compared to current or similar technologies?
- Has the technology has been tested, validated and used in this country or a similar country?
- Can you give examples of where the technology has been used in demanding conditions or rural and remote locations?
- What internet or mobile infrastructure is required to run the technology?
- Will the technology be consistently available?
- If the technology requires maintenance, repair or replacement, how would this be handled? What is the turn-around time?



Service accessibility

Health care is considered 'accessible' when it is available at the right place and time, taking population needs and the affordability of care into account.

Essential criteria

1. The technology leads to improved availability, affordability and/or reach of services and products.

Additional criteria

2. Services enabled by the technology are affordable to most groups or individuals.
3. Groups or individuals who may not be able to access the service benefit from an equity plan.
4. There is a data-driven understanding of how the technology will bring down the cost of eye care services over time, with metrics that track progress towards this goal.
5. Relevant disaggregated monitoring indicators are in place to determine level and type of coverage.

Questions to ask

- How will the technology improve availability, affordability and/or reach of eye care services?
- How will the technology affect the overall burden of care for each patient?



Economic sustainability

A technology needs to be worth introducing. Consider direct and indirect costs involved in the assessment, implementation, and ongoing use of the technology.

Essential criteria

1. Cost-benefit balance of the technology being considered is favourable for service providers.
2. Budget is available for direct and indirect costs involved in assessment, implementation, ongoing service delivery and maintenance.

Additional criteria

3. Cost-benefit balance of the technology being considered is favourable compared to alternate options.

Questions to ask

- What are the costs and work involved in implementation of this technology?
- What are the costs and work involved in ongoing service delivery and maintenance?
- How might the technology affect costs for the patient?

Section 3:

Technology readiness scale



We often hear about new innovations in eye health through the media or through reports of early research. However, sometimes it’s difficult to separate hype from reality, especially if you don’t have experience evaluating new technology.

The technology readiness scale can help you quickly assess how likely it is that the technology can provide impact in a real-world setting in its current state of development.

This can assist with timelines, risk assessment, and decision on technology development, investment, purchase, and/or policy.

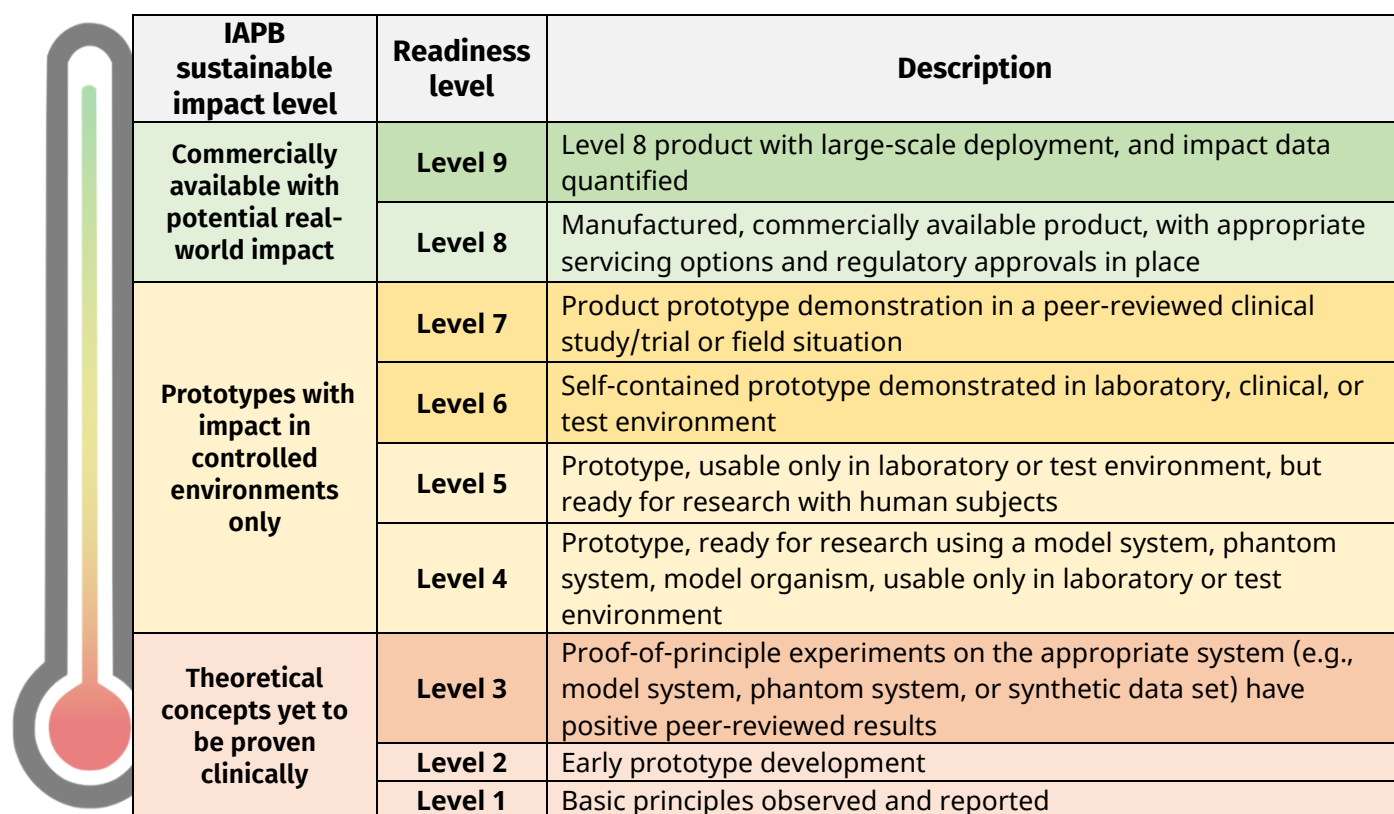


Figure 2: Technology readiness scale

This scale is based on NASA Technology Readiness Levels (TRL)¹² and Biomedical DoD Technology Readiness Levels (TRLs): Medical Devices.¹³

¹² NASA (2015), Technology readiness level. Available at: https://www.nasa.gov/directorates/heo/scan/engineering/technology/technology_readiness_level (Accessed: January 24, 2023).

¹³ Biomedical DOD Technology Readiness Levels (trls): Medical Devices, Tier Seven. Available at: <https://tier7.us/biomedical-dod-trls-medical-devices/> (Accessed: January 24, 2023).

How to use the Technology readiness scale

Questions to ask from the [Technology for Access Framework](#) that can help you evaluate the readiness level of an innovation include:

- **Efficacy**
 - What evidence or research is available that shows the product does it what it claims?
This could include published evidence in the scientific literature and/or from results of other local evaluations/pilots/trials.

- **Local suitability**
 - Has the technology has been tested, validated and used in this country or a similar country?
Can you give examples of where the technology has been used in demanding conditions or rural and remote locations?

- **Policy and regulation**
 - Does the technology meet local regulatory standards?

Once you find technologies at level 8 or 9, the [Technology for Access Framework](#) can help you to evaluate whether the innovation is likely to create sustainable impact and increased access in a specific setting.

For more information, please view

- [Appendix 2: IAPB sustainable impact level](#)
- [Appendix 3: Technology readiness scale glossary.](#)

Appendix 1: Levels of eye care

Community level eye care

A tier between primary eye care and communities, services provided by people who spend a substantial part of their working time outside a health facility. Services include vision screening and referral, and education and promotion.

Primary care

Eye care that is delivered by health care professionals working in health facilities in the community, who act as the first contact with a patient. What eye care is delivered at primary level varies from country to country, and even within countries, depending on the resources available.¹⁴ However, primary eye care services often include:

- Vision screening and referral
- Diagnosis and treatment of simple conditions
- Education and promotion
- Refractive error services
- Support and supervision of community activities.

Secondary care

Secondary eye care services include diagnosis, management and treatment of leading causes of vision impairment. For example, surgery for cataract and glaucoma or laser and injection therapies (for diabetic retinopathy and age-related macular degeneration).

Tertiary care

The tertiary care level is specialised care in a facility with complex and advanced equipment, treatment or procedures. Patients are often referred from a primary or secondary clinic.

¹⁴ Gilbert, C., Faal, H., Allen, L. and Burton, M., 2021. What is primary eye health care?. Community eye health, 34(113), p.70.

Appendix 2: IAPB sustainable impact level

Theoretical

Innovations at these levels are at the theoretical stage only, being prepared for further research and testing.

Prototypes

Innovations at this stage are prototypes ready for research with human subjects in clinical studies with ethics committee approval, and the results should be published in reputable, peer-reviewed journals.

These innovations are most commonly used in clinical studies or controlled test environments. They aren't yet commercially available and don't yet have real world impact at scale.

Commercial

Innovations are commercially available at these stages, and usable in relevant clinical or field settings. Innovations at level 8 can have early impact and at level 9 can show large-scale impact.

Appendix 3: Technology readiness scale glossary

- **Clinical trials / studies:** Research investigations in which people volunteer to test new interventions or tests designed to help prevent, detect, treat or manage various diseases or medical conditions.
- **Ethics committee:** Also known as an institutional review board (IRB), this a group formed to review the methods proposed for research to ensure that they are ethical.
- **Field situation:** Working in a real-world environment, rather than in a laboratory or other place of testing.
- **Model system / phantom system:** A setup that allows the instrument/technology under evaluation to be tested.
- **Proof of concept:** Results from experiments or clinical work that establish that the underlying idea, technique or theory are valid and have potential for real-world impact.
- **Peer review:** Evaluation of scientific/clinical research by others working in the same field to verify its validity.
- **Prototype:** Preliminary version of a device or technology from which other forms are developed.
- **Regulatory approval:** Approvals, licenses, registrations or authorizations from any governmental authority required to commercialize a product in that region.
- **Synthetic data set:** Data that's artificially generated rather than generated by real-world measurements.
- **Digital data set:** Data, such as an image database, that can be used to evaluate image processing or other ML/AI algorithms.

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