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Approaches for delivery of refractive and optical care services in community and primary care settings (Review)

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[Prototype Review]

Approaches for delivery of refractive and optical care services in community and primary care settings

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ABSTRACT

Background

Uncorrected refractive error is a leading cause of vision impairment which, in most cases, can be managed with the appropriate spectacle correction. In 2021, the World Health Assembly endorsed a global target of a 40-percentage-point increase in effective coverage of refractive error by 2030. To achieve this global target, equitable access to refractive and optical services within community and primary care settings needs to be strengthened. This review will inform the development of technical guidance to support improvements in the testing and correction of refractive error among World Health Organization (WHO) member states.

Objectives

To determine the range of approaches for delivery of refractive and optical care services in community and primary care settings, and the methods employed for their evaluation.

Search methods

We searched CENTRAL, MEDLINE, Embase and Global Health databases, grey literature, and annual reports and websites of relevant organizations involved in eye-care delivery from January 2002 to November 2022 to identify approaches for refractive and optical service delivery.

Selection criteria

We included observational and interventional studies, reviews, and reports from relevant organizations related to delivering refractive services and optical services for preschool and school-aged children and adults in community and primary care settings published between January 2002 and November 2022. We searched for studies and reports published within the last 20 years because vision impairment due

to uncorrected refractive error has only recently become a public health and eye health priority, therefore we did not expect to find much relevant literature until after 2002.

Data collection and analysis

Two review authors screened titles, abstracts and full texts, and extracted data. We resolved any discrepancies through discussion. We synthesized data, and presented results as tables, figures, and case studies. This project was led by the World Health Organization (WHO) Vision and Eye Care Programme.

Main results

We identified 175 studies from searches of databases and grey literature, 146 records from company reports, and 81 records from website searches of relevant organizations that matched our inclusion criteria. Delivery approaches for refractive and optical services in community care included school-based, pharmacy, and outreach models, whereas primary care approaches comprised vision centre, health centre, and a combination of vision or health centre and door-to-door delivery. In community care, school-based and outreach approaches were predominant, while in primary care, a vision-centre approach was mainly used. In the WHO African region, the school-based and outreach approaches were mainly reported while, in the Americas, the outreach approach was mostly used. Very few approaches for service delivery were reported in the WHO Eastern Mediterranean region. Prominent gaps exist in the evaluation of the approaches, and few studies attempted to evaluate the approaches for delivery of refractive and optical care services.

Authors' conclusions

We comprehensively describe a range of approaches for delivery of refractive and optical services in community and primary care. Further evaluation of their effectiveness will better inform the application of these service-delivery approaches. The study outcomes will help guide WHO member states in strengthening refractive and optical services at community and primary care levels.

Funding

This scoping review was supported by the Vision and Eye care Programme, World Health Organization and ATscale Global Partnership.

Registration

The protocol of this scoping review was published in the Open Source Framework.

PLAIN LANGUAGE SUMMARY

What are the different ways eye tests are carried out and spectacles provided in the community and in health clinics worldwide?

Key messages

1. Outreach (a community-based approach to provide eye care in various settings, which are often not permanent locations), and school-based service delivery approaches were mainly used to provide eye care in the community, while vision centres were mainly used in primary care (first-line health care).

2. In the World Health Organization (WHO) South-East Asia region, eye care was most often delivered using outreach and vision centres, whereas in the African region, school-based delivery and outreach were mainly reported. In the Americas, outreach was mostly used.

3. We need more information from the WHO Eastern Mediterranean region, and we need research to evaluate which approaches are most effective.

Why is it important to provide eye tests and spectacles?

Many sight problems are easily solved by wearing spectacles (eye-glasses). However, millions of people around the world don't have access to the tests and facilities they need to get the correct spectacles. This is a problem for many people because eye care services may be expensive, or located far away. Poor vision can affect children's ability to learn at school, and lead to people being unable to work.

Governments, health services, eye care organizations, and charities use different approaches to provide eye care services to a wide variety of people. This might be by bringing services to people in the community or by providing accessible primary eye care services locally.

What did we want to find out?

The World Health Organization (WHO) is working on advice to countries to help them improve their eye care services. The first step is to understand what eye care services are currently available worldwide, where they are based, and how they work. This information allows us to find the gaps in the evidence, to see where future research should be focused, and will help with the WHO guidance.

What did we do?

We searched for evidence about the different ways people can access eye tests and get spectacles in the community and at local health centres or doctors' clinics (primary care) anywhere in the world. We needed as much information as possible, so we gathered evidence from medical studies, and also from annual reports and websites of eye care organizations. We grouped the evidence according to the different ways eye tests and spectacles were provided, and we described how and where the services were delivered.

What did we find?

We found 175 studies, 146 records from eye care organizations and 81 records from websites (402 resources in total), which reported the ways eye care services were delivered in the community or in primary care. Most eye care services included eye tests, assessing the need for spectacles, and providing spectacles. The services were mainly carried out by eye care providers and sometimes with other people, like nurses, doctors and teachers.

Community eye care services are provided where people live or work.

1. Schools (154 resources): teachers are trained to give vision tests in school, or eye care workers visit the school to conduct tests. Sometimes a van or bus, equipped as an eye test centre, visits the school. Spectacles are usually prescribed if needed, and follow-ups or referrals for further eye care can be arranged. Schools sometimes partner with community or primary healthcare centres to provide eye care services.
2. Pharmacies (3 resources): community pharmacies provide vision tests and spectacles.
3. Outreach (157 resources): eye care providers go out into the community to provide care, for example in workplaces or homes. Outreach services are not in a permanent place but may be somewhere for a short period. They often visit very remote areas. They may offer free eye tests and spectacles.

In primary care, patients visit a permanent location to receive eye care services.

1. Vision centres (53 resources) are eye care clinics staffed by trained eye care workers. They carry out tests and provide spectacles. Patients usually pay for spectacles, but they may get a voucher to help with the cost.
2. Health centres (16 resources) are healthcare facilities but not eye care clinics. They usually provide eye tests and spectacles.
3. Vision and health centres plus door-to-door delivery (11 resources): a combination of services provided by vision and health centres and home visits.

In the WHO South-East Asia region, the outreach and vision centre approaches were most common. In the WHO African region, the school-based and outreach approaches were mainly reported. In the WHO Americas region, the outreach approach was mostly used.

What are the limitations of the evidence?

We found very few reports of how eye care services are delivered in the WHO Eastern Mediterranean region, so our picture of services there is limited. There was limited information about how well the delivery methods worked, so more research is needed about this.

How up to date is this evidence?

The evidence is up to date to November 2022.

BACKGROUND

Uncorrected refractive error is the leading cause of vision impairment in children and adults. It is estimated that, globally, only 36% of people with a distance vision impairment (myopia, hyperopia, astigmatism) due to refractive error have access to an appropriate pair of spectacles, while more than 800 million people have a near vision impairment (presbyopia) that could be addressed with a pair of near vision spectacles [1]. If left uncorrected, refractive error significantly impacts on well-being [2, 3], and can contribute to poor academic performance in children [4, 5]. To confound this problem, the number of people in need of spectacles is expected to increase substantially in the coming decade, since presbyopia (2.1 billion people affected by 2030) is part of the ageing process, while projected increases in myopia (3.36 billion people affected by 2030) in the younger population will be driven largely by life-style-related risk factors [6].

There is a strong health-economic rationale to increase spectacle coverage in the population. Annual global productivity losses related to vision impairment from "uncorrected myopia and presbyopia are estimated to be US$ [US dollars] 244 billion and US$ [USD] 25.4 billion, respectively" [6,7, 8]. These figures far outweigh the estimated cost gap of USD 16 billion to address the unmet need of vision impairment due to uncorrected refractive error through the provision of spectacles[6]. Given the large unmet need for care, coupled with the fact a highly cost–effective intervention exists (i.e. spectacles), the Seventy-fourth World Health Assembly (2021) endorsed a new global target – namely a 40-percentage-point increase in effective coverage of refractive error (eREC) (i.e. increasing testing and correction of refractive error) by 2030 [9].

There are several challenges to increasing spectacle coverage and achieving the ambitious World Health Assembly global target for eREC, particularly in low- and middle-income countries (LMICs). Firstly, the burden of uncorrected refractive error tends to be greater in underserved populations, such as people with low incomes, women, indigenous populations, ethnic minorities and people living in rural areas [6]. Secondly, refractive and optical services are commonly only available in the private sector, and therefore costs pose a major barrier. Other challenges include the insufficient availability of qualified personnel, limited government oversight and clinical regulation, scarce service availability outside urban areas, and low awareness and acceptance of spectacles among the population [10], which adds to the inequalities in access.

As part of meeting the eye care needs of the population in LMICs, which are substantial, it is crucial to make spectacles accessible as close as feasible to people's homes. To this end, a fundamental shift is required to reorient the model of care based on strengthening the provision of refractive and optical services at both primary and community (e.g. schools, workplace) levels of care.

In this review:

1. **refractive services** refers to conducting eye and vision screening, and measuring refractive error;
2. **optical services** refers to activities related to the filling of optical prescriptions and the dispensing or delivery of spectacles [11]; and
3. **approaches for service delivery** refers to any organized programme or activity developed and aimed at providing or improving the testing and correcting of refractive error, particularly regarding the provision of refractive and optical services [12].

It is important that the supply and access to refractive services (i.e. the demand) is matched for populations in need [13].

Why it is important to do this review

The WHO Vision and Eye Care Programme intends to develop technical guidance to support countries in their endeavours towards achieving the World Health Assembly-endorsed 2030 target for eREC in an equitable manner. One of the key areas of focus of this work will be to provide technical guidance to countries to strengthen the provision of refractive and optical services within community and primary care. Such efforts have the potential to enable ease of access to services in resource-limited locations, ensure that timely refractive and optical services are provided [6], and ultimately advance universal eye health coverage. Despite this, various barriers to the provision of refractive and optical services at community and primary care levels exist, including the insufficient availability of qualified personnel to provide refractive services and dispense spectacles, legislative challenges, limited government oversight and clinical regulation [10], and the reality that primary-level health facilities are overstretched in many parts of the world, making it difficult to effectively increase the scope of interventions to be delivered.

A scoping review is a systematic knowledge synthesis approach that summarizes findings from a body of knowledge and identifies knowledge gaps to assist the planning and implementation of future initiatives [14, 15]. A comprehensive and up-to-date review of studies and reports is needed to identify and summarize the available data on refractive and optical approaches for service delivery at community and primary care levels. This information can be leveraged to support countries to increase coverage of refractive error care towards meeting the World Health Assembly 2030 target on eREC.

OBJECTIVES

To determine the range of approaches for delivery of refractive and optical care services in community and primary care settings, and the methods employed for their evaluation.

METHODS

The protocol of this scoping review was published in the Open Source Framework [16]. We followed the guidance of the Joanna Briggs Institute in conducting this review [17]. The PRISMA extension for scoping reviews guided the reporting of the review [14]. In the protocol, we indicated that we would use bubble plots to provide a visualized summary of the approaches for service delivery. However, we utilized stacked bar charts for a better fit to illustrate and summarise the approaches for delivery of services.

Criteria for considering studies for this review

Types of study

We included:

1. observational and interventional studies (January 2002 to November 2022);

2. reviews (January 2002 to November 2022); and
3. reports of relevant organizations providing refractive and optical services, published within 20 years of the search date.

Multiple study types were eligible for inclusion to broadly identify and map the evidence of the approaches for service delivery. As such, we included published reports, abstracts, and comment articles that met our inclusion criteria. We searched for studies and reports published within the last 20 years because vision impairment due to uncorrected refractive error has only recently become a public health and eye health priority, therefore we did not expect to find much relevant literature until after 2002.

Settings

We considered services provided in primary or community-care settings. Community care involves eye care delivered at the community level, such as homes, schools, work, and wider community settings, while primary care services are those integrated and provided in primary healthcare facilities by trained primary health workers and allied personnel [10]. To be included in this scoping review, the setting had to provide refractive or optical services, or both, organized, linked, or conducted in a community- or primary-level setting. We excluded studies connected with secondary or tertiary settings, such as referrals to see specialists and services conducted at hospitals.

Population

We included reports of service delivery for pre-school (3 to 5 years), school-aged children (6 to 12 years), and adults (30 years and above). However, in this review, we broadly categorized the population into 'children' and 'adults' to report findings, since most studies did not clearly categorize study participants. Our review focuses on the mentioned age groups since distance and near vision impairment often occur and are identified at these ages. As such, children aged 13 to 18 years and adults aged 19 to 30 years are not included in this review.

Interventions

We included any study or report related to the delivery of refractive services (screening, refraction) and optical services (provision of near or distant spectacles, or both). We classified eligible interventions into three broad categories, as follows.

1. **Screening** involved the measurement of visual acuity (VA) at far or near, pinhole examination, and the use of screeners to determine the presence or absence of refractive error.
2. **Refraction** involved tests and examinations by a trained individual to determine refractive error or need for corrective spectacles or lenses, best possible correction, and to issue a spectacle prescription. Such tests and examinations include VA, objective refraction (including retinoscopy and autorefraction), subjective refraction, and cycloplegic refraction.
3. **Distribution of spectacles:** the provision of near or distant spectacles to individuals who have a refractive error that can be corrected by spectacles. For this review, we did not consider contact lenses.

Studies use terms interchangeably but for this review, we are using screening, refraction and the provision of near or distant spectacles.

Approaches for service delivery

To be eligible for inclusion, studies and records from reports and websites had to report at least one approach for service delivery, whether related to optical or refractive services.

Search methods for identification of relevant studies

An experienced Information Specialist (IG) designed the search strategy and executed the published medical literature searches. VU and NSH performed the grey literature search.

Electronic searches

Published medical literature

The search incorporated two aspects.

1. Setting: primary care, community care
2. Refractive service: refractive error, refraction, spectacles, near vision spectacles

We developed a comprehensive search strategy on MEDLINE (Ovid) and adapted and ran the search on the following electronic databases:

1. Cochrane Central Register of Controlled Trials (CENTRAL; 2022, Issue 11) in the Cochrane Library (searched 2 November 2022);
2. MEDLINE Ovid (1 January 2002 to 2 November 2022);
3. Embase Ovid (1 January 2002 to 2 November 2022);
4. Global Health Ovid (1 January 2002 to 2 November 2022).

See search strategies (Supplementary material 1). All databases were searched on 2 November 2022, from January 2002 to November 2022. We did not apply any language restrictions.

Grey literature

We also searched the following grey literature databases and web search engines from 1 January 2002 to 2 November 2022 to identify other potentially relevant studies.

1. Global Index Medicus (World Health Organization); searched 30 March 2023
2. Dissertations and Theses Global (ProQuest); searched 30 March 2023

Searching websites of relevant organizations

We conducted additional searches of websites of relevant organizations involved in eye care, reviewed the top 10 search results (first page of results), and identified annual reports from organizations within the last 20 years. These organizations included Brien Holden Foundation, Christian Blind Mission, Dot glasses, Fred Hollows Foundation, Helen Keller International, International Agency for the Prevention of Blindness, Light for the World, Lions Clubs International Foundation, One dollar glasses, Onesight, Optometry – Giving sight, Orbis International, Restoring Vision, Sight Savers International, Seva, Vision Health International, Vision Spring, and 2.5 New Vision generation. See search strategies (Supplementary material 1).

Language

Within the review team, we were able to accommodate studies written in English and French. Where required, we obtained translation of other languages.

Data collection and analysis

Study selection

Two review authors (VU and GL) independently screened the titles and abstracts of studies and reports identified from the search, excluding any irrelevant titles. We piloted the screening process on the first 100 records and, since there were no disagreements, we screened the remaining records without any amendment of the screening process. We used Covidence to manage, screen, and track the inclusion and exclusion decisions, and highlight disagreements between the review authors [18]. Working in pairs, four review authors (VU, SS, NSH, MY) independently performed full-text screening, applying the selection criteria set out above. We recorded the selection process in detail, and listed ineligible studies clearly as excluded, together with reasons for their exclusion. We documented the screening process in a PRISMA flow diagram [19].

Data extraction and management

We charted the data using a data extraction form generated in Microsoft Excel [20]. We tested the extraction form on at least five studies before use for the entire selection of studies. We followed an iterative approach, documenting any changes to the data extraction form [21]. Two review authors (VU and SS) extracted the data independently and resolved any disagreements through discussion, and by involving a third review author (SK) if necessary. If we obtained multiple publications of the same study, we extracted data from the most recent version or completed study. We extracted the following data from each eligible study and report.

1. Publication characteristics (i.e. title, author(s), year of publication, study design, country, WHO region
2. Characteristics of service delivery approaches:
   a. target population: children (preschool, school-age), adults;
   b. personnel: trained health providers and individuals delivering the service;
   c. setting: primary or community care;
   d. service provided: refractive service, optical service, or both; and
   e. evaluation: brief summary of any evaluation including how it was conducted and results.

Collation, summary, and reporting of results

One review author (VU) collated, summarized, and reported the extracted data, which two review authors (JE and SK) reviewed. There was much variation in the objectives of the studies included. We used the categories of intervention types (i.e. of refractive services, optical services); outcomes (i.e. approaches for service delivery), settings (i.e. primary, community care), type of publication (i.e. articles, abstracts, reports, website search) and study designs (i.e. randomized controlled trial (RCT), cross-sectional, cohort, economic evaluation), and approaches for service delivery to summarize and group information. We displayed and summarized the key characteristics of each included study in tabular form and via an evidence map. We also provided stacked bar charts and case studies to articulate and summarize the approaches for service delivery.

RESULTS

Search results

We summarized screening and study inclusion results in a PRISMA flow diagram (Figure 1). Our electronic searches of the published medical literature and grey literature generated 1469 records after removal of duplicates. Following title and abstract screening, we retained 355 articles for assessment at the full-text screening stage, of which 175 met the eligibility criteria. We included a total of 175 studies, of which 167 were peer-reviewed articles, seven were abstracts, and one was a thesis paper (Supplementary material 3). Please see Supplementary material 4 for the completed checklist for this scoping review.

Figure 1. Figure 1. PRISMA flow diagram

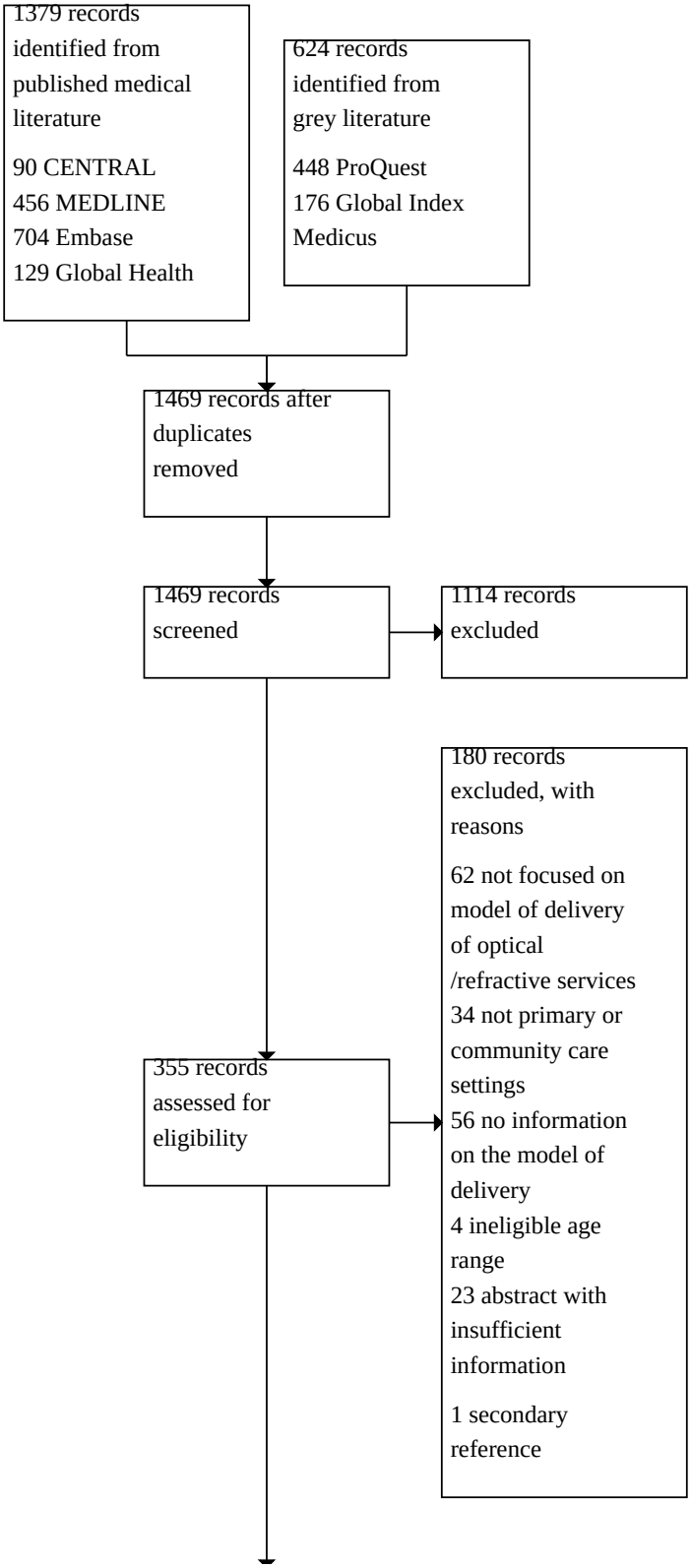
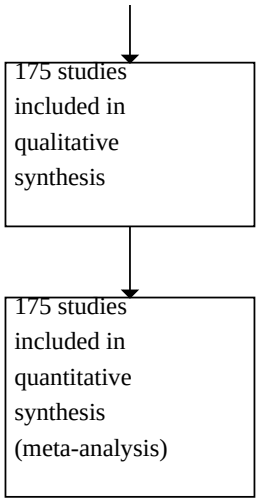


Figure 1. (Continued)



We reviewed 55 annual reports from 15 eye care organizations. In these reports, we identified 146 different records of delivery of refractive and optical care services in community and primary care settings. We searched the websites of 18 organizations and identified 81 records additional to those included in the annual reports (see Table 1; Supplementary material 5; Supplementary material 6).

Description of studies

In this section we have provided an overview of the key characteristics of the included studies based on study design, the population, setting, intervention (service provided), personnel, and approaches for service delivery categories. Most of the included studies were published in English, whilst four studies were published in Portuguese, one in Turkish, one in French, and two in Korean. The objectives of the included studies were very varied. This review shows the broad range of topics covered by the included studies, particularly regarding the services provided and approaches for service delivery. See Supplementary material 2 for 'Characteristics of included studies', and Table 2 for an overview of included studies and syntheses.

Study type

Most studies that we identified from the published and grey literature searches were cross-sectional in nature (n = 134, 76.6%). We also included 11 RCTs (6.3%). Two studies used non-randomized experimental study designs (1.1%), seven studies were cohort designs (4.0%), four studies drew on case study methods (2.3%), and three studies employed a mixed-methods design (1.7%). In addition, we included four systematic reviews (2.3%), three review articles (1.7%), three commentaries (1.7%), two descriptive studies (1.1%), one retrospective chart review (0.6%), and one economic evaluation (0.6%). See Table 3.

Population

Studies identified through published and grey literature searches, and reports and websites from relevant organizations, reported that services were delivered equally to both female and male patients. The website search identified eye care programmes that provided services to women only (n = 2, 2.5%), and to transgender adults (n = 1, 1.2%) (Table 4). Across all records, service delivery was predominantly aimed at children, followed by children and adults, and then adults alone, while a proportion of records did not report the population age. Compared to studies, a large number of organizational reports did not specify the population age.

Services were provided to an array of population groups. Across all records, refractive and optical services were provided mainly to population groups in rural and remote locations, low-income communities, working populations, people with either physical or learning disabilities, and vulnerable population groups. These included homeless people, street children, child and adult refugees, elderly people in residential care, nursing home residents, underserved veterans, immigrants, children in orphanages and special schools, indigenous peoples, and women affected by domestic violence. See Table 4.

Setting

Studies identified from searches of published and grey literature, and reports and websites of relevant organizations show services were located across all WHO regions. Service delivery was predominantly in WHO African, Americas, South-East Asia, and Western Pacific regions. Most of the studies and records were set in community care, followed by primary care, and both community and primary care (Table 5).

Interventions: services provided

Studies identified from the published and grey literature searches, and the organization reports and websites reported a wide variety of service provision, with many studies offering both refractive and optical services. Across all records, service delivery predominantly involved screening, refraction, and optical services, followed by screening alone. Few records reported provision of optical services only, among which custom-made, ready-made, and near vision spectacles were provided. Of the 83 studies from published and grey literature involved in delivering optical services, 16 studies clearly indicated the provision of free spectacles, while fewer

reported providing spectacles at subsidized rates (n = 2), or provided a voucher (n = 2); one study offered a voucher and free delivery of spectacles. Records from the reports and website search indicated delivery of eye examinations in addition to refractive and optical services (Table 5).

Service delivery personnel

Across all records, individuals involved in providing the refractive and optical services were predominantly eye care providers, followed by services provided by eye care providers in combination with other individuals, such as nurses, doctors, volunteers, teachers, students and health workers. Compared to studies, many organizational reports did not specify the personnel involved in service delivery (Table 5).

Approaches for service delivery

We identified two major categories of service delivery approaches along with subcategories.

1. Community care approaches (school-based, pharmacy, and outreach)
2. Primary care approaches (vision centre, health centre, a combination of vision centre, health centre and door-to-door delivery).

See Table 6 and Table 7.

Community care approaches for service delivery

This approach for service delivery refers to refractive and optical services provided predominantly in community care settings. See Table 8.

School-based approach

A significant number of studies, and eye care organization reports and websites reported a school-based approach for service delivery. The approach is further divided into two categories.

1. School-based only
2. School-based and other primary and community settings (e.g. vision centre, eye clinic, community centre, church, outreach, mobile vans or buses).

School-based only

In this approach, children receive refractive and optical services in their schools. This may be via trained school teachers or other trained individuals who conduct vision screening for children. For instance, VA is first ascertained and an eye care provider visits the school for re-evaluation and refraction for children with VA < 6/12 for prescription of spectacles and further care (von-Bischhoffshausen 2014 [22]). In some cases, ready-made spectacles are provided at the schools or custom-made spectacles delivered at a later period.

The school-based approach can also be delivered via mobile vans and buses, which bring eye care professionals to the schools. They provide comprehensive screening and examination of all children, via specially outfitted vehicles. Children with significant eye problems are referred for specialist care. The mobile buses are often fitted with optical diagnostic equipment, and children undergo tests such as monocular VA and cover testing at distance and near, stereopsis test, testing of versions, and external ocular inspection. Spectacles are prescribed and follow-up with an eye specialist is arranged, if required (Traboulsi 2008 [23]).

Sixty studies identified through published and grey literature searches (34%), offered school-based services only. The studies were predominantly cross-sectional (n = 46) and were conducted mostly in the WHO South-East Asian region (n = 18). Ten studies conducted subjective refraction. Four studies conducted objective refraction (including auto and retinoscopy). Twenty-one studies reported the use of objective and subjective refraction, 10 of which conducted cycloplegia refraction. Seven studies, and the report and website records did not specify the type of refraction conducted (Table 7).

School-based and other primary and community settings

This subcategory is often based in both community and primary care settings. Schools and health and vision teams conduct vision screenings in partnership with community or primary healthcare centres, or both. For example, teachers measure the VA of students and record their findings. Children with vision problems are then referred for further care to a team of eye professionals, who are often located at primary eye care centres.

Ten studies identified in published and grey literature (6%), offered services via this approach. Studies were mainly cross-sectional (n = 6) and were conducted mostly in the WHO South-East Asian region (n = 5). One study conducted objective refraction, two studies conducted subjective refraction, while one study did not specify the type of refraction. Five studies conducted objective and subjective refraction, one of which conducted refraction with cycloplegia. The report and website records did not specify the type of refraction conducted (Table 7).

Pharmacy approach

The pharmacy approach enables the delivery of refractive and optical services via pharmacies. Services are provided by pharmacists and nurses in community care settings. One study conducted in Europe and two records in the organization reports noted optical services delivery via a pharmacy.

For instance, a study in France indicated that, on average, 84.5% of ophthalmic products at the community pharmacies were near vision spectacles (Delolme 2011 [24]).

Outreach approach

The outreach approach is a community-based model that involves providing refractive and optical services in various settings, which are often not permanent locations. This may include hosting one- or two-day, free eye clinics, with vision screenings and spectacles delivered to those in need. Services are commonly offered at minimum or no cost to individuals, and low-cost spectacles and referrals for other eye conditions to primary or secondary eye care are provided, if needed. For example, a community screening programme that provides free eye exams, spectacles, and ophthalmologic referral to community groups. Basic optical equipment such as a trial lens kit (Singh 2016 [25]), and portable screening units such as Portable Eye Examination Kit (PEEK) (Bright 2018 [26]), are used. Outreach accesses people in some of the most remote areas and visits are often scheduled at the invitation of, or in partnership with host communities, which may include local leaders, organizations, regional or national bodies, or eye care or medical providers, and may involve assistance from

local personnel. Services and referrals from outreach services are sometimes linked to a health facility.

The approach is further divided into three subcategories (see Table 6).

1. Outreach in community and primary care locations
2. Work-based outreach
3. Home-based outreach

Outreach in community and primary care locations

Studies identified from searches of published and grey literature, and from reports and websites, indicated that the outreach approach is mostly used in community care settings. Outreach occurred at various locations including churches, fuel stations, schools, medical health camps, vision centres, mobile clinics, community health centres, health fairs, homeless shelters, seniors' centres, marketplaces, and via teleophthalmology. Services can also be provided in eye camps and through mobile vans or buses. The vans are mobile eye units where screening and tests at camps are conducted, and spectacles are distributed. Eye examinations at eye camps may include VA testing, anterior segment and posterior segment examination, objective and subjective refraction, cover test, convergence, accommodation, and colour vision tests (Pant 2014 [27]). One study reported an integrated optical service with hearing care (Andrusjak 2021 [28]).

Fifty-one studies identified through published and grey literature searches (29%) offered services via outreach in the community and primary care locations. The studies were mainly cross-sectional studies (n = 39) and were conducted mostly in the WHO South-East Asian region (n = 22). Four studies conducted objective refraction, 12 studies conducted subjective refraction only, and 12 studies conducted both objective and subjective refraction, three of which conducted refraction with cycloplegia. Six studies, and reports and websites, did not specify the type of refraction (Table 7).

Work-based outreach

This refers to refractive and optical services conducted for working groups and may occur at work sites. All work-based outreach occurred in community care settings. Findings show that refractive and optical services are provided in this approach. In studies from published and grey literature, three studies (2%) offered services via the work-based outreach approach. All studies were cross-sectional studies and were conducted mostly in the WHO South-East Asian region (n = 2). One study conducted refraction via subjective and objective assessment (non-cycloplegic refraction). In the report and website records, the type of refraction was not specified.

Home-based outreach

Home-based outreach involves the provision of refractive and optical services in people's homes via door-to-door service delivery. Home-based outreach is often incorporated in cross-sectional household surveys, where trained eye care teams move from house to house examining and questioning residents on eye care and health-seeking behaviour (Kimani 2013 [29]), along with prescribing spectacles. Home delivery of eye care services allows eye care teams to reach individuals who are house bound, such as people living with a disability and children who are home-schooled.

The home-based services occur in community eye care settings. Findings show that refractive services, particularly screening and spectacles, including near vision spectacles, are provided via this approach. In studies identified from published and grey literature, five studies (3%) offered services via home-based outreach. All studies were cross-sectional studies, and were conducted mostly in the WHO South-East Asian region (n = 4). Screening was provided in most studies. In one study, screening and refraction were conducted via subjective assessment. The report and website records did not specify the type of refraction.

Primary care approaches for service delivery

This involves services provided at primary care facilities and includes 1) vision centres, 2) health centres, and 3) vision or health centre and door-to door delivery. Services are delivered at primary care settings with access to basic or extensive eye care services via eye care professionals and trained healthcare providers.

Vision centre approach

The vision centre approach comprises the provision of refractive and optical services in primary eye care clinics and optical facilities by trained eye care workers (Khanna 2020 [30]). In this approach, eye clinics often provide refractive and optical services at permanent locations, and may have an optical laboratory for cutting, fitting, and dispensing spectacles. They commonly rely on a tertiary eye hospital for support and referral for specialised care. Spectacles are prescribed as appropriate, patients pay for spectacles at the clinic, or a voucher can be provided towards purchasing spectacles, which is made available at the clinic. For instance, when spectacles are prescribed, they may be selected and ordered at the same appointment (Donaldson 2002 [31]).

Twenty-three studies identified from published and grey literature searches (13%), offered services via vision centres. The studies were predominantly cross-sectional studies (n = 17) and were conducted mostly in the WHO South-East Asian region (n = 9). Eight studies conducted objective and subjective refraction, one of which conducted cycloplegic refraction. Two studies conducted subjective refraction. Five studies did not specify the type of refraction the conducted. In the report and website records, the type of refraction was not specified (Table 7).

Health centre approach

The health centre approach involves the provision of refractive and optical services in health facilities that are not eye care centres. Twelve studies identified from published and grey literature searches (7%) offered services via the health centre approach. The studies were mainly cross-sectional studies (n = 11) and were conducted mostly in the WHO Americas region (n = 18). Screening, refraction, and spectacles were provided. One study conducted objective refraction, one study conducted subjective refraction, and one study conducted both objective and subjective refraction. One article did not specify the type of refraction conducted, and the report and website records did not specify the type of refraction.

Vision or health centre and door-to door approach

This refers to primary eye care services provided via vision centres or health centres along with home visits on community-based premises. Ten studies identified from published and grey literature searches (6%) offered services via this approach. The studies were predominantly cross-sectional studies (n = 7) and were conducted

mostly in the WHO South-East Asian region (n = 5). In this approach, studies reported utilising subjective refraction (n = 4). One study conducted non-cycloplegic objective refraction and another study carried out non-cycloplegic objective and subjective refraction. Two studies did not specify the type of refraction. Two studies provided near vision spectacles. The report and website records did not specify the type of refraction.

Evidence map and summary

The evidence map presents a graphical overview of the approaches for service delivery examined in the included studies, and the distribution of services provided through which each approach was investigated (Figure 2).

Figure 2. Figure 2. Evidence map of approaches for service delivery to provide refractive and optical services. Each square represents the case in which a single included study utilised or evaluated an approach (rows) against a service provided (columns). The study type is shown in different colours.

Figure 2. Evidence map of approaches for service delivery to provide refractive and optical services: studies

Services		Refractive services							Opt. serv.	Refractive and optical services								
		Screening			Ref.	Screening & refraction			Specs.	Screening & specs.		Ref.& specs	Screening, refraction & specs. provided		
Community care model of delivery															
School-based	School-based only	CS	CS	CS		RCT	CS	CS		CS			RCT	CS	CS
		CS	CS	CS		CS	CR	CS					NR	CS	CS
		CS	CS	CS		CS	CS	CS					CS	CS	CS
		NR	EE	SR		CS	CS	CS					RCT	CS	CS
		CS	CS	CS		CS	CS	CS					CS	CS	CS
		CS	CS	CS		CR	CS	CS					CS	CS	SR
						CAS							SR	CS	CR
													RCT		
	School-based & primary/community settings	CS				CS							CS	CS	RCT
													CS	DES	CS
													COM	REV	
Pharmacy									COM						
Outreach	Work-based outreach	CS								CS			CS		
	Home-based outreach	CS	CS	CS		CS									
		CS													
	Outreach in primary and community locations	CS	CS	CS		CS	CS	CS	RCT	CS	CS		RCT	CS	RCT
		CS	CS	CS		CS	CS	CS		CS	CS		CS	CS	CS
		CS	CS	CS		CS	CS	CR		CS	CAS		CAS	RCR	CS
		CS	CS	CS		CS	CS					MM	REV	DES	MM
		CS	CS	CS									CS	CS	CS
													SR	CS	
Primary care model of delivery															
Vision centre		CS	CS	CS	CS	CS	CS	CR		CAS	CS	CS	CS	MM	COM
		CS	CR	CS	CS	CS				CS			CS	REV	CS
													CS		
Health centre		CS	CS	CS		CS				CS			CS	CS	CS
		CS	CS	CS											
		CR													
Vision/health centre & door-to-door		CS	CS			CS							RCT	CS	CS
													RCT	RCT	CS
													CS		

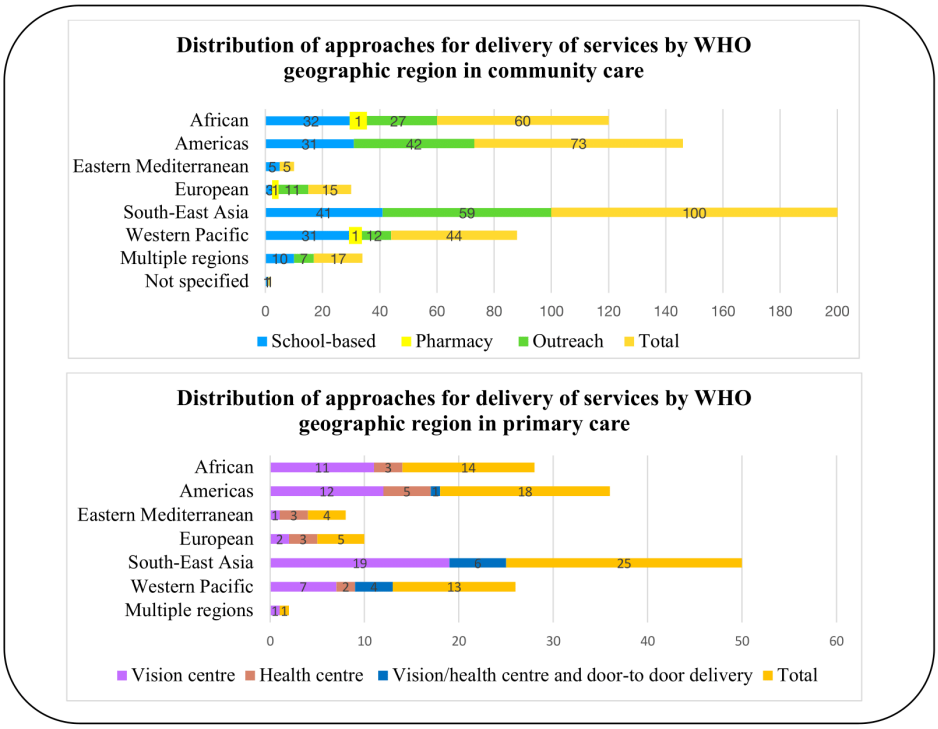
Study Designs	
Randomized controlled trial	RCT
Cohort	CR
Cross sectional	CS
Case study	CAS
Non-randomized experimental study	NR
Mixed methods	MM
Economic evaluation	EE
Systematic review	SR
Retrospective chart review	RCR
Descriptive study	DES
Review article	REV
Commentary	COM

Across all studies and reports, the outreach and school-based service delivery approaches were predominantly utilized in community care, while the vision centre approach for service delivery was mainly used in primary care. In the WHO South-East Asia region, the outreach (n = 59) and vision centre (n = 25) approaches for service delivery were predominantly used, whereas

in the African region, the school-based (n = 32) and outreach (n = 27) approaches were mainly reported. In the Americas, the outreach approach (n = 43) was mostly used. The review identified limited reported approaches for service delivery in the Eastern Mediterranean region. See Figure 3.

Figure 3. Figure 3. Stacked bar chart of approaches for refractive and optical service delivery across geographic locations from all resources. Each bar represents the number of included resources per approach for service delivery and the total number of refractive and optical services per approach per setting (primary or community care) in that region (x-axis) and the WHO region (y-axis). The bars are colour-coded to the service delivery approach.

Figure 3. Stacked bar charts of approaches for service delivery by geographic location (WHO regions): studies, reports, and websites



Evaluation of approaches for service delivery

The included studies and reports in this review consisted of limited RCTs and observational studies that reported on the evaluation of the service delivery approaches. Most of the studies in this review that conducted an evaluation, assessed eye care interventions or diagnostic test accuracy (i.e. effectiveness of clinical examinations by various trained individuals for detecting refractive error, or made comparisons between different approaches for measuring refraction and spectacle delivery). The case studies in Table 8 provide examples of the service delivery approaches, and Table 9 provides a summary of the range of outcomes that were identified in the studies used to evaluate aspects of the service delivery approaches.

School-based approach

The studies and reports evaluated various aspects of the school-based approach, including the validity and reliability of services provided by trained personnel in schools, the impact on the ownership and use of spectacles, and the accuracy of autorefraction in children. For instance, in a school-based-only screening programme in India, a cross-sectional study evaluated the reliability and validity of results of refractive error screening by school teachers empowered to screen for refractive error, compared with the indicated standard approach (screening of refractive error by medical doctors). Teachers were trained to identify reduced vision in school children using a Snellen chart. Following training, teachers examined school children, and a community medicine faculty examined the same students (Patel 2018 [32]). Similarly, three trials in a systematic review assessed alternative VA screening methods. Two trials compared alternative

teacher approaches and one compared screening carried out by teachers to screening carried out by primary eye care workers (Reddy 2017a [33]; Reddy 2017b [34]). Another study compared screening carried out by teachers to screening carried out by primary eye care workers - teachers performed similarly to primary eye care workers in identifying children with visual disorders (Sexena 2015 [35]).

Additionally, in China, an RCT evaluated a combined school-based and vision-centre programme, wherein teachers conducted screening and refraction, and provided children with a free pair of spectacles if needed (Ma 2018a [36]). Also, in a study with children (5 to 15 years) in South Africa, objective refraction with cycloplegic refraction was conducted with a retinoscope and a handheld autorefractor. The study documented differences between retinoscopy and autorefraction measurements after cycloplegia, which were dependent on the child's age and underlying refractive error (Naidoo 2003 [37]).

Pharmacy approach

We did not identify any record of an evaluation of the pharmacy approach for service delivery in this review. We did not identify evidence of effectiveness of the pharmacy approach. However, case studies show that via this approach, individuals requiring near vision spectacles can benefit from low cost and adequate access.

Outreach approach

In addition, we did not identify studies that evaluated the outreach approach itself but identified the evaluation of outreach projects, comparison of spectacle delivery systems, and the accuracy of refraction using autorefraction in children via this approach. For instance, in a study that examined access to eye health services in rural Timor-Leste, outreach activities included vision screening and spectacle dispensing for the community and primary school children (Pereira 2012 [38]).

A cluster-randomized trial was used to compare spectacle delivery systems in India. Participants were randomized into three arms, that is, prescription only, placing an order for spectacles (with subsequent delivery), and on-the-spot delivery. More individuals bought spectacles among those who placed an order for spectacles with subsequent delivery and for individuals who received on-the-spot delivery of spectacles when compared with participants who were issued a spectacle prescription only (Ramasamy 2013 [39]).

In a population-based, cross-sectional survey of school-aged children (7 to 15 years) in India, cycloplegic refraction was conducted with a retinoscope and a handheld autorefractor and assessed to show if cycloplegic retinoscopy and autorefraction demonstrated good reproducibility (Dandona 2002 [40]).

Vision centre approach

We did not identify an evaluation of the vision centre approach for service delivery, however, a cross-sectional study in rural communities in India assessed the accuracy of vision technicians in screening at vision centres. Vision technicians conducted vision screening on patients, and this was followed by an examination by a consultant ophthalmologist. The ophthalmologist's findings were considered as the reference standard. Agreement was assessed between vision technicians and the ophthalmologist for screening of ocular conditions and referral (Suram 2016 [41]).

Health centre approach

To reduce the unmet need for presbyopia treatment in Zanzibar, East Africa, a pilot scheme was developed to integrate the distribution of ready-made near vision spectacles into six primary healthcare facilities, following the training of medical officers. The scheme was evaluated and training was evaluated to determine its relevance, effectiveness, sustainability, equity, and replicability (Laviers 2011 [42]).

Vision centre, health centre and door-to-door combined approach

We did not identify studies that evaluated the combined vision or health centre and door-to door approach for service delivery. However, one study assessed the role of autorefraction in the vision-screening programme for 3.5-year-old children, and conducted an evaluation of the accuracy of refraction using a hand-held autorefractometer without cycloplegia (Matsuo 2009 [43].

DISCUSSION

Summary of results

In this scoping review, we mapped the evidence on the approaches for delivery of refractive and optical services at community and primary care levels. We identified 176 studies, 146 records from reports and 81 records from website searches of organizations involved in eye care that described at least one delivery approach. The most common approaches for service delivery across all resources included in this review are the school-based (n = 154) and outreach (n = 157) approaches at the community level and vision centres (n = 53), health centres (n = 16), and a combination of vision or health centre and door-to door delivery (n = 11) at the primary-care level. However, there was limited evidence of complete evaluations of the approaches for service delivery, as well as economic evaluations.

Overall completeness and applicability of evidence

For service delivery approaches where an evaluation was available, there were differences in the type of assessments carried out. Most studies in this review evaluated the accuracy of assessment by different cadres of staff or trained individuals, or used different assessment techniques to make comparisons for measuring refraction and spectacle delivery systems (i.e. diagnostic test accuracy that addressed how good the approach is at identifying people who need spectacles), or evaluated the impact of an approach on a selected number of people receiving refractive or optical services, or both (i.e. an intervention study that addressed how good the approach is at delivering refractive or optical services). The few studies that attempted to evaluate different aspects of the approaches for service delivery measured a variety of outcomes. These included assessments of the accuracy of vision technicians in screening at vision centres, the accuracy of refraction using autorefraction in children in vision or health centre and door-to door delivery, outreach, and school-based approaches. They also included the validity and reliability of refractive services provided by trained personnel in schools, the impact of school-based approaches on the ownership and use of spectacles, the comparison of spectacle delivery systems in the outreach approach, and the effectiveness, sustainability, relevance, equity, and replicability of an eye care scheme via the health-centre approach.

Most of the studies included in this review were cross-sectional, and these studies provided a description of the approaches for delivery of refractive and optical care services, but there was limited evidence of effectiveness. There are evidence gaps on the effectiveness of these approaches for service delivery to support any future recommendations. Studies that provide information on the approach(es) to refractive and optical services that are likely to be the most effective in increasing the testing and correcting of refractive error, could usefully be included in a subsequent systematic review with appropriate risk of bias to provide more compelling evidence.

Comparison with other reviews

Eye care workforce

Although this review identified various cadres of eye healthcare workforce involved in providing refractive and optical services, lack of qualified and skilled personnel is one of the biggest challenges to scaling up access to refractive and optical services and for a sustainable and stable eye care delivery system. There are inequities in the availability and distribution of eye care providers in rural versus urban areas, which increases the inequity of access to eye care [44]. Policies and regulations also limit the availability of skilled eye care providers. In some countries, allied ophthalmic personnel such as optometrists and ophthalmic technicians are not accredited to carry out eye care services independently [45]. Thus, in community and primary care settings, it is challenging to deliver and integrate refractive and optical services into low-resource health systems due to limitations of trained eye care personnel [46]. There is a need to train and retain eye care personnel, as well as explore innovative approaches to provide eye care services in resource-limited settings.

Innovations in eye care service delivery

This review identified the use of objective refraction in providing refractive services across the approaches for service delivery. Conducting standard subjective refraction can be resource-intensive due to the need for appropriately trained personnel who may not be readily available, thereby adding to the cost of care, especially in resource-limited settings. There have been several technological developments, particularly with autorefraction devices that have the potential to bridge and overcome a major bottleneck in refractive service delivery due to their portability, low-cost, limited training requirements, and ease of use by non-eye care workers. Some research shows that autorefractors can be an effective replacement for subjective refraction in adults [47]. For example, in one study, when comparing patient preferences for spectacles prescribed using a low-cost, portable autorefractor versus standard subjective refraction, there was a strong agreement between the prescriptions from subjective refraction and autorefraction, and patients equally preferred spectacles prescribed using both methods [47]. Similarly, another study assessed the quality of spectacle prescriptions via an autorefractor operated by a technician with minimal training. Although the average VA from autorefractor-prescribed spectacles was one letter worse than those from subjective refraction, the study indicated that more than half of participants either had no preference or preferred spectacles prescribed by the autorefractor [48]. While the use of autorefractors may not be appropriate for all segments of the population, especially children, who benefit more from a traditional refraction by a skilled eye care worker given high accommodation power, autorefractors have the potential to streamline refractive error care [49], and, if affordable, may offer a feasible substitute for subjective refraction and providing spectacle prescriptions in resource-limited settings.

Telehealth also provides an opportunity to increase refractive service delivery to remote, rural, and underserved areas [50]. Telerefraction involves conducting refraction remotely through information and communication technology by transmitting refraction results for remote analysis [51]. Though there is limited literature to better understand the impact of telerefraction on patient satisfaction and its efficacy and cost-effectiveness [51], it has shown to be promising in providing early intervention for corrective lenses in underserved communities. For instance, a study that compared tele-optometric and in-person eye exams indicated that spectacle prescriptions were similar. Nonetheless, the researchers reported the need for careful binocular balance to make sure patients with myopia are not over-corrected [52].

Continuity of care in outreach approaches

The results of this review suggest that the outreach approach was predominantly used at the community-care level (n = 158). The outreach approach is often a short-term strategy to meet needs but can play a significant role in supporting permanent vision or health centres, increase access by bringing services to the community, particularly underserved areas, and reduce costs for patients [53]. For example, refraction camps conducted at workplaces have the potential to identify and address uncorrected refractive error in the working-age group [54]. Outreach camps are often designed to include a refraction assessment as part of the standard clinical examination and on-the-spot dispensing of ready-made spectacles at the outreach sites, ensuring uptake and use of spectacles [54]. When needed, custom-made spectacles are often produced and sent to the outreach clinic where the patient was seen. However, random spectacle distribution breaks the chain of patient care and can be counterproductive [55]. This approach is usually not 'sustainable' as it is often dependent upon ad-hoc funding that may not always be available, and at times uses visiting eye care workers who do not service the community in the long term. Since services provided via the outreach delivery approach are not permanent, there are challenges with the use of this approach, including creating and increasing the expectation of a continued 'free' outreach camp by community members, which may not occur and have no clear connection with primary care for continuity of care and comprehensive eye examination. To make this approach more sustainable, it is vital that there is buy-in from local health departments and training of health workers in the region for continuity of care when the service provider group or organization departs the community. It is important that the outreach approach provides optimal refractive and optical services and has clear links and referral network systems to a comprehensive package of eye and health services [53].

School-based approach opportunities

This review indicates that the school-based approach is a commonly used entry point for service delivery to children, particularly those who have not received preschool screening, or those who develop refractive error or other ocular conditions later in childhood. However, the school-based approach can be hindered by the need to co-ordinate services through the education system, which works differently to the health system and will need different approvals and processes. In addition, teachers or school health

nurses will require appropriate training to conduct screenings. Often, this approach will not be sustainable unless eye health is included in the school health policy and, as such, advocacy that emphasizes the importance of school eye health programming is required [56].

On the other hand, the school-based approach combined with services delivered in other community settings enables children who are not in schools to be reached, such as those who are home-schooled. A school-based approach combined with primary care creates an opportunity to integrate a school-based approach into existing health systems. It enhances continuity of eye care services by offering a care pathway for children to access further eye care [57], and children are followed by eye specialists beyond the initial screening [58].

This review identifies that ready-made spectacles are often provided to children via the school-based approach. Ready-made spectacles can be dispensed immediately and are often less expensive than custom-made spectacles, however it often requires a large inventory of frames with different lens power ranges and these are often only suitable if the prescription is the same in both eyes [59]. A large proportion of children can be suitably corrected through ready-made spectacles, which can be made available at schools and improve the logistics of optical service delivery. Evidence suggests that about 46.5% of children requiring distance prescriptions could be corrected via ready-made spectacles [60]. A study that evaluated visual performance and satisfaction with ready-made spectacles and custom spectacles in a school-based programme showed that although VA was better with custom spectacles, among the study participants who mostly had simple myopic refractive error, there was no difference in the acceptability of ready-made spectacles, thus supporting the provision of school-based optical services through the use of ready-made spectacles (Zeng 2009 [61]). Despite this, planning for the provision of customized spectacles following cycloplegic examinations remains a necessity for many school-aged children, including those with high astigmatism, myopia, and hyperopia refractive errors.

Additionally, although low-cost, ready-made spectacles are effective at correcting refractive error, for individuals requiring custom spectacles, which often cost more than ready-made spectacles, a spectacle reimbursement scheme could be a cost-effective intervention to enable the provision of spectacles at a subsidized rate [62]. This may require a national reform or policy to efficiently provide a spectacles subsidy for populations in need [63].

To ensure responsible and effective delivery of eye care to children served through the school-based approach, it is crucial for existing systems to create a referral pathway for children from school-based programmes to eye care providers in community and primary eye care for further examinations or long-term care [64]. This is because many children who are prescribed spectacles may require long-term follow-up to update prescriptions and monitor for complications associated with significant refractive error [64]. The school-based approach has been reported to be cost-effective and does not involve substantial indirect costs as the children would already be in the location for screening [65]. However, the location of the school-based programme affects its cost. For example, school-based screening for uncorrected refractive error in urban locations would likely be more cost-effective than in a rural area due to the ready availability of eye care resources [65]. It is important to note that in the absence of existing school health programmes, the prevalence of refractive error in school-age children should guide decisions on whether standalone eye and vision screening interventions are warranted in schools [10]. Nonetheless, the school-based approach could be highly cost-effective for providing refractive and optical services and should be considered along with other public health and child health interventions where possible [65].

Potential of pharmacy approach for service delivery

Although only few resources in this scoping review identified the pharmacy approach for refractive and optical service delivery, this approach shows promise, especially in resource-limited settings, where pharmacies are often visited by individuals when they feel unwell. Pharmacists are recognized as integral members of healthcare teams, providing accessible medication supply and health advice to urban and rural communities. The range of products and services provided by the pharmacies varies across countries. For instance, in most high-income countries, pharmacies can sell medical devices and near vision spectacles [66]. Pharmacies are well placed to facilitate optical and refractive services; given limited eye service access, awareness, and long waiting times, people often do not want to go to the eye clinic or hospital. Thus, the pharmacy approach can provide readily accessible near vision spectacles. An example of this is a wholesale approach adopted by VisionSpring, where near vision spectacles are distributed through pharmacies in urban and rural centres. The organization tested this approach with Apollo, one of the largest pharmacy chains in India and has launched operations in 11 countries in Asia, Latin America, and Africa, and has a significant presence in India [67]. In addition, VisionSpring has launched the 'Reading Glasses in Pharmacies Project' in Ghana, with support from Latter-Day Saint Charities to make eye care more accessible by training pharmacists to perform vision screenings, offer near vision spectacles, and facilitate referral to a nearby clinic for a more detailed eye examination, if required [68]. The pharmacy approach for service delivery increases access, shows promise to be effective, has the capacity to provide a solution to presbyopic problems, and may encourage more people to seek care. Nonetheless, to allow for a more integrated model of quality eye care, appropriate connection to primary care should be established [55]. There is a need to evaluate the pharmacy approach to understand its effectiveness.

Eye care service integration and delivery in primary care

Service delivery approaches for primary care are well positioned to integrate eye care services, increase access to the required refractive and optical services, and advance sustainability. A well-designed primary eye care delivery approach needs to be comprehensive and include refractive assessment, provision of prescription, and spectacle dispensing [54]. In this review, vision centres were mostly identified as the approach for service delivery predominantly used in primary care in the WHO South-East Asia region, particularly India. Vision centres are often located closer to the community, part of a larger eye care network, and may have a telemedicine component to enable face-to-face interaction between the healthcare provider and patient. For instance, the Aravind eye care system in India is a network of primary eye care centres or vision centres designed to provide accessible and affordable eye care, such as screening and refraction services often offered free of cost or at a nominal fee to marginalized populations [69]. Vision centres combine refractive error services

and dispensing at a single service point, and are linked to tertiary care to improve the sustainability of the service and increase uptake by patients [53]. Some factors that make the vision centre approach for service delivery effective, include organization and leadership, human resource planning, integrated service delivery, supply chain management, financial sustainability, utilising technology for planning and to reach population groups, and quality and monitoring [30]. It is important to note that vision centres are often standalone eye care centres that use a private model, which is not integrated into existing government facilities. However, we did not identify any evidence of the evaluation of the effectiveness of the vision centre approach.

Although limited resources in the review identified the health centre approach, this approach for primary care strengthens service provision and increases access to refractive services. Services are delivered at government health facilities by trained healthcare providers, and patients can access basic eye care services much closer to home. Regarding its sustainability, this approach for service delivery is promising, due to the availability of health workers who can be trained to conduct eye examinations. The health centre approach has the potential to integrate a vertical referral pathway to optical labs and spectacle shops, as well as secondary and tertiary care [70].

In general, approaches for the delivery of refractive and optical services in primary care should employ appropriate health technologies to increase the effectiveness and efficiency of services, for example, point-of-care screening or eye tests, optical labs to make custom-made spectacles, and provision or distribution, or both, of spectacles. The availability of affordable, quality-assured spectacles is critical to primary care and there is a need to develop an innovative distribution strategy. Distribution logistics and costs may be reduced by leveraging existing networks, such as community health services, co-ordinated action across different arms of health care, the optical sector, government (health ministries), and a strong management system [71]. Community and primary eye care consistently struggle for sustainability in countries without universal health care; however, linking refractive and optical services positively with primary eye care may facilitate the development of a system to finance these services and create a low-cost and sustainable spectacle delivery system [55].

Strengths and limitations of this review

There were some strengths and limitations in our review. We did not search ongoing trials registers for this scoping review, therefore no evidence from ongoing studies has been presented in this review. As a result of the scoping nature of this review we included all studies irrespective of design in addition to information from organizational reports and website searches, as such allowing for the inclusion of a broad selection of potentially relevant literature. The information obtained from the reports may be incomplete. This is because the implementation of these approaches for service delivery in countries are often not provided by a single non-governmental organization, but in collaboration with other organizations and local partners. For example, an outside party may conduct the refraction, but this would usually be counted as part of the organization's service, as there is often service co-ordination and potentially some funding support. Thus, consulting each non-governmental organization with a template to fill out about their activities worldwide may have provided a more comprehensive picture of the services provided.

Furthermore, key aspects of each approach for service delivery were not analysed, such as the cost, quality (e.g. of spectacles), and sustainability. This review found limited evidence for evaluation of the service delivery approaches. Due to considerable variation in the approaches for delivery of services, objectives of the included studies, and the evidence gaps in the literature, it is difficult to draw overarching conclusions about the effectiveness of these approaches for service delivery.

Potential biases in the review process

This scoping review may have been susceptible to selection bias as a result of the terms used to describe refractive and optical services in studies from published and grey literature and from organizational reports. The terms 'screening', 'examination', and 'refraction' were at times used interchangeably. 'Eye examinations' could include screening, refraction, and provision of spectacles. On the other hand, it could involve examination for eye pathology. Similarly, screening in some cases includes other refractive and optical services. Although some reports indicated that both screening and dispensing of spectacles were conducted, they most likely provided a refraction service or a complete eye examination. As such, this may have limited the selection of resources and data obtained. We excluded studies that focused on low vision services. Refractive services are at times included in low vision services, so we may have missed some refractive services in such studies. On the other hand, information on the website about an approach for service delivery may have also been mentioned in a report from the same organization, resulting in duplication. In addition, we did not conduct risk of bias of the included studies and reports. As such, we cannot draw strong conclusions for policy or practice because we did not assess the quality of the approaches.

AUTHORS' CONCLUSIONS

This scoping review aimed to identify, synthesize, and summarize the existing literature on approaches for refractive and optical service delivery. The findings present multiple approaches for service delivery that may be used to provide refractive and optical services in community and primary care. Prominent gaps exist regarding the evaluation of the approaches with a variety of outcomes measured in few studies that attempted to evaluate different aspects of the approaches for service delivery. Future research to evaluate the approaches for service delivery such as randomized controlled trials, economic evaluations, and cost-benefit analysis will better inform the application of these approaches. The review outcomes will help guide World Health Organization country support approaches to strengthen refractive and optical services at community and primary care levels.

SUPPLEMENTARY MATERIALS

Supplementary materials are available with the online version of this article: 10.1002/14651858.CD016043.

Supplementary material 1 Search strategies

Supplementary material 2 Characteristics of included studies

Supplementary material 3 Data package

Supplementary material 4 Completed Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

Supplementary material 5 Extracted data from reports of organizations

Supplementary material 6 Extracted data from websites of organizations

ADDITIONAL INFORMATION

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Contributions of authors

SK, VU, JE, and AM: defined the study scope and developed the study protocol with significant input from all review authors.

IG: developed the search strategy.

IG and NK: conducted the searches.

VU and SK: co-ordinated the entire study process.

VU and GL: conducted title and abstract screening.

VU, SS, and NK: conducted full-text screening.

VU, SS, MY, and NK: extracted data.

VU and SK: drafted the manuscript.

All review authors reviewed, revised, and approved the manuscript.

Declarations of interest

Valerie Umaefulam: no conflict of interest
Safi Sare: no conflict of interest
Gareth Lingham: no conflict of interest
Iris Gordon: no conflict of interest
Andreas Mueller: no conflict of interest
Neha S. Krishnam: no conflict of interest
Vera L Alves Carneiro: no conflict of interest
Mitasha Yu: no conflict of interest
Jennifer R Evans is an investigator of one of the included studies [72]
Stuart Keel: no conflict of interest

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Registration and protocol

The protocol of this scoping review was published in the Open Source Framework https://doi.org/10.17605/OSF.IO/7EGS5

Data, code and other materials

See Cochrane's editorial policy on data sharing for more information and what is automatically shared through a published Cochrane review.

As part of the published Cochrane review, the following is made available for download for users of the Cochrane Library:

1. full search strategies for each database;
2. full citations of each unique report for all studies included, ongoing or awaiting classification, or excluded at the full text screen, in the final review;
3. study data, including study information and study results; and
4. analysis data, including settings.

Appropriate permissions have been obtained for such use. Analyses and data management were conducted within Cochrane's authoring tool, RevMan, using the inbuilt computation methods. Template data extraction forms from Covidence and Excel are available from the authors on reasonable request.

Notes

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ADDITIONAL TABLES

Table 1. Characteristics of identified resources: general information

Publication format	Number of resources reviewed	Number of resources included
Studies	1469	175
Organization reports	55	146
Websites	18	81

Table 2. Overview of included studies and synthesis

Study	Year	Gender	Age, description	Other PROGRESS-Plus[a]	Service provided	Type of refraction
Abdullah 2006 [73]	2006	Not specified			Screening, refraction, spectacle delivery	Subjective
Addo 2021 [74]	2021	Male and female	≥ 15 years		Screening	
Adhikari 2013 [75]	2013	Male and female	5-15 years		Screening, refraction, spectacle delivery	Auto and subjective
Adio 2011 [76]	2011	Not specified	46.2 years (SD ± 17.55) Range of 1.5 years-99 years		Screening	
Ajibode 2022 [77]	2022	Male and female	30-86 years	Rural/urban	Screening, refraction, spectacle delivery	Auto and subjective
Akinbinu 2022 [78]	2022	Male and female	5–14 years		Screening, refraction, spectacle delivery	Auto and subjective
Al 2016 [79]	2016	Male and female	Not specified		Screening, refraction	Auto and subjective
Alabi 2018 [80]	2018	Male and female	Mean (SD) age: 38.6 (16.2) years		Screening	
Alexander 2009 [81]	2009	Male and female	Range: 5 years to < 16 years Mean age of 12.03 years		Screening	
Alrasheed 2016 [82]	2016	Male and female	< 18 years		Screening, refraction, spectacle delivery	
Al-Shaaln 2011 [83]	2011	Male and female	6-15 years		Screening	Auto and subjective
Alvi 2015 [84]	2015	Not specified	Not specified	Low income areas	Screening, refraction, spectacle delivery	Subjective
Amritanand 2018 [85]	2018	Male and female	0-99 years		Screening	
Andrusjak 2021	2021	Not specified	Not specified	Elderly people in care homes	Screening	
Anuradha 2015 [86]	2015	Male and female	5-19 years		Screening, refraction, spectacle delivery	Not specified
Arnold 2006 [87]	2006	Not specified	Not specified		Screening, refraction	Auto
Asare 2017 [88]	2017	Not specified	18–59 months		Screening	
Ayorinde 2016 [89]	2016	Not specified	Not specified		Screening	
Balarabe 2015 [90]	2015	Male and female	11-20 years		Screening, refraction	Auto and subjective

Table 2. Overview of included studies and synthesis *(Continued)*

Baptista 2017 [91]	2017	Male and female	30-44 years		Screening	
Bardes 2016 [92]	2016	Male and female	Not specified		Screening	
Bin 2019 [93]	2019	Male and female	Median age 8 years (IQR 5-11)	Pediatric refugee	Screening	
Bowser 2021 [94]	2021	Male and female	Not specified		Screening, refraction, spectacle delivery	Not specified
Bright 2018	2018	Male and female	≥ 7 years		Screening	
Burnett 2018 [95]	2018	Male and female	3-18 years		Screening, refraction, spectacle delivery	Not specified
Campus 2015 [96]	2015	Not specified	12-70 months		Screening	
Chande 2015 [97]	2015	Not specified	Not specified	Urban slums	Screening, refraction, spectacle delivery	Auto and subjective
Chen 2008 [98]	2008	Male and female	> 40 years		Screening, refraction	Auto and subjective
Chen 2015 [99]	2015	Not specified	Not specified	Indigenous villages and remote districts	Screening, spectacle delivery	Auto and subjective
Chin 2015 [100]	2015	Not specified	4-19 years	Different ethnic groups	Screening, refraction	Auto and subjective
Choi 2006 [101]	2006	Male and female	3-6 years		Screening	
Choi 2022 [102]	2022	Male and female	14.3 ± 4.3 years, range 4–19 years	Children with special educational needs	Screening, refraction	Auto and subjective
Collins 2020 [103]	2020	Male and female	Mean age: 9.0 ± 2.8 years		Screening, refraction, spectacle delivery	Auto
Cunha 2018 [104]	2018	Male and female	≥ 45 years		Screening, refraction, spectacle delivery	Subjective
Cypel 2017 [105]	2017	Male and female	≥ 80 years	Elderly population	Screening	
D'Ath 2016 [106]	2016	Male and female	Mean age: 47.9 years (SD = 12.3; range: 22–87 years)	Homeless population	Screening, spectacle delivery	Not specified

Table 2. Overview of included studies and synthesis *(Continued)*

Damaris 2018 [107]	2018	Male and female	6 months to 16 years		Screening, refraction	Subjective
Dandona 2002	2002	Male and female	7-15 years		Screening, refraction, spectacle delivery	Auto and subjective
Darge 2017 [108]	2017	Male and female	5-16 years		Screening	
Day 2022 [109]	2022	Male and female	Not specified	School Vision Program for Pre-K, Kindergarten, and 1st grade students	Screening, refraction, spectacle delivery	Auto
Delolme 2011	2011	Not specified	Not specified	Communication	Spectacle delivery	
Dole 2021 [110]	2021	Not specified	5-15 years		Screening	
Donaldson 2002	2002	Male and female	0-9 years		Refraction, spectacle delivery	Not specified
Donaldson 2019 [111]	2019	Not specified	Mean age: 10.7 years (range was 3.0-19.8 years)	Special schools, children with disabilities	Screening, refraction, spectacle delivery	Auto and subjective
Eisenbarth 2018 [112]	2018	Male and female	Mean age: 43.77 years, SD: 12.96; range: 19–72 years	Work setting, people with intellectual disabilities	Screening, refraction, spectacle delivery	Subjective
Ejimadu 2014 [113]	2014	Male and female	Mean age: 36.7 ± 3.8		Refraction	Auto and subjective
Ellis 2018 [114]	2018	Male and female	Range: 2-97 years. Mean age 48.7 years		Screening, refraction, spectacle delivery	Subjective
Ethan 2010 [115]	2010	Male and female	Not specified		Screening, refraction, spectacle delivery	Not specified
Evans 2018 [72]	2018	Not specified	Not specified		Screening, refraction, spectacle delivery	Not specified
Ezisi 2017 [116]	2017	Male and female	42.3 ± 20.2 SD years (range 4–80 years)		Screening, refraction, spectacle delivery	Auto and subjective
Ferdausi 2017 [117]	2017	Male and female	≥ 40 years Mean age: 53.48 years	Northern rural region	Screening, refraction, spectacle delivery	Subjective
Glewwe 2018 [118]	2018	Male and female	Not specified		Screening, refraction, spectacle delivery	Auto

Table 2. Overview of included studies and synthesis *(Continued)*

Gogate 2011 [119]	2011	Male and female	Mean age: 12.1 years	Children with learning disabilities in special education schools	Screening, refraction, spectacle delivery	Auto and subjective
Gudlavalleti 2014 [120]	2014	Not specified	All ages		Screening, refraction, spectacle delivery	Auto and subjective
Gyllencreutz 2019 [121]	2019	Male and female	5-8 years		Screening, refraction	Subjective
Halegoua 2015 [122]	2015	Male and female	6-72 months		Screening, refraction	Auto
Halim 2020 [123]	2020	Male and female	11–15 years	Suburban areas	Screening, refraction	Subjective
Hark 2021 [124, 125]	2021	Male and female	70.0 ± 9.8 (range: 42.9- 88.0)		Screening, refraction, spectacle delivery	Subjective
Harpal 2011 [126]	2011	Male and female	5-16 years		Screening	
Hennein 2019 [127]	2019	Male and female	Mean age: 50 years (range: 48-53)	Homeless population	Screening, refraction	Not specified
Hennein 2021 [128]	2021	Male and female	Mean (SD) age was 51.9 (12.4) years	Homeless population	Screening	
Hussain 2019 [129]	2019	Male and female	Mean age: 9.8 years (SD: 4.3; range: 0-14 years)		Screening	
Ilechie 2020 [130]	2020	Male and female	5–15 years. Mean: 12.24 (SD: 2.73) years	School for blind children	Screening, refraction	Subjective
Isawumi 2013 [131]	2013	Male and female	Mean age: 39.73 years		Screening, refraction	Auto and subjective
Isralowitz 2005 [132]	2005	Male and female	≥ 21 years (range: 19-62 years; mean age 35 years)	People with intellectual disabilities in residential facilities and community-based homes	Screening	
Jain 2016 [133]	2016	Not specified	5-8 years	Not specified	Screening	

Table 2. Overview of included studies and synthesis *(Continued)*

Jenchitr 2008 [134]	2008	Male	12-88 years	Priests/ novices	Screening	
Jha 2008 [135]	2008	Male and female	≤ 15 years		Screening	
John 2012 [136]	2012	Not specified	Not specified		Screening, refraction, spectacle delivery	Auto
Junghans 2003 [137]	2003	Male and female	4-12 years		Screening, refraction	Auto and subjective
Kalyoncu 2011 [138]	2011	Male and female	Not specified		Screening	
Kammari 2019 [139]	2019	Male and female	0-100 years		Screening	
Kattouf 2009 [140]	2009	Male and female	5 months to 6 years		Screening, refraction, spectacle delivery	Auto and subjective
Kaur 2016 [141]	2016	Male and female	School-going children up to the age of 16 years		Screening, refraction, spectacle delivery	Subjective
Kehinde 2005 [142]	2005	Male and female	5-18 years		Screening	
Khandekar 2004 [143]	2004	Not Specified	6-17 years		Screening, refraction, spectacle delivery	Auto and subjective
Khanna 2020	2020	Male and female	Not specified		Screening, refraction, spectacle delivery	Auto and subjective
Khurana 2018 [144]	2018	Male and female	6–16 years		Screening, refraction, spectacle delivery	Auto and subjective
Kimani 2013	2013	Male and female	≥ 35 years		Screening, refraction	Auto and subjective
Kumah 2012 [145]	2012	Male and female	5-17 years (mean age: 12.3 years)		Screening, refraction	Auto and subjective
Laviers 2010 [146]	2010	Male and female	≥ 50 years		Screening, refraction, spectacle delivery	Auto and subjective
Laviers 2011	2011	Male and female	≥ 50 years		Screening, spectacle delivery	
Lenhart 2009 [147]	2009	Not specified	Not specified		Screening	
Lim 2003 [148]	2003	Male and female	3-6 years		screening	
Losonczy 2022 [149]	2022	Male and female	20-64 years old		Screening	
Ma 2018a	2018	Male and female	Not specified	Rural school-	Screening, refraction, spectacle delivery	Auto and subjective

Table 2. Overview of included studies and synthesis *(Continued)*

				aged children, grades 4–6		
Ma 2018b [150]	2018a	Male and female	8.1 ± 1.1 years		Screening, refraction	Auto
Maake 2018 [151]	2018	Male and female	Not specified		Screening, refraction, spectacle delivery	Not specified
Manna 2022 [152]	2022	Male and female	All ages	Urban slums and resettlement colonies	Screening, refraction, spectacle delivery	Auto and subjective
Marmamula 2011 [153]	2011	Male and female	≥ 40 years	Coastal region, fishing community	Screening	
Marmamula 2013a [154]	2013	Male and female	Mean age 70 years	Elderly population in residential care	Screening	
Marmamula 2013b [155]	2013a	Male and female	≥ 40 years	Weaving community	Screening	
Marmamula 2013c [156]	2013b	Male and female	15-49 years		Screening	
Marmamula 2013d [157]	2013c	Male and female	≥ 40 years		Screening	
Marmamula 2016 [158]	2016	Male and female	≥ 40 years		Screening	N/A
Marmamula 2017 [159]	2017	Male and female	≥ 40 years		Screening	
Marmamula 2018 [160]	2018	Male and female	9.8 ± 3.04 years		Screening	
Marmamula 2019 [161]	2019	Male and female	≥ 40 years		Screening	
Marmamula 2020 [162]	2020	Not specifed	Not specifed		Screening, refraction, spectacle delivery	Auto and subjective
Marmamula 2021 [163]	2021	Male and female	≥ 40 years		Screening, spectacle delivery	Subjective
Martin 2015 [164]	2015	Not specified	Not specified		Screening, spectacle delivery	Subjective
Matsuo 2009	2009	Male and female			Screening, refraction	Auto

Table 2. Overview of included studies and synthesis *(Continued)*

McAlister 2014 [165]	2014	Male and female	41.34 ± 22.80 years (1-96 years)		Screening, refraction	Auto and subjective
Miller 2003 [166]	2003	Not specified	3-5 years		Screening	
Misra 2015 [167]	2015	Not specified	Not specified		Screening, refraction, spectacle delivery	Not specified
Mittal 2020 [168]	2020	Male and female	5-70 years		Screening, refraction	Subjective
Mohamed 2021 [169]	2021	Not specified	Not specified		Screening, refraction, spectacle delivery	Not specified
Mohammed 2005 [170]	2005	Male and female	Age range: birth to 15 years (average: 5.8 years)	Rural community	Screening	
Mohd-Ali 2022 [171]	2022	Male and female	8-9 years	Ethnicity, education	Refraction	Auto and subjective
Moreira 2022 [172]	2022	Male and female	Birth to ≥ 65 years old		Screening, refraction	Auto
Morjaria 2020 [173]	2020	Male and female			Screening, refraction	Subjective
Muralidhar 2019 [174]	2019	Not specified	Not specified		Screening, refraction, spectacle delivery	Auto and subjective
Muralikrishnan 2022 [175]	2022	Male and female	< 20 to > 75	Not specified	Screening, refraction, spectacle delivery	Auto and subjective
Naidoo 2003	2003	Male and female	5-15 years		Screening, refraction	Auto and subjective
Namperumalsamy 2020 [176]	2020	Not specified	All ages		Screening, refraction, spectacle delivery	Not specified
Narayanan 2021 [177]	2021	Male and female	Mean age: 9.89 ± 3 years (range: 4–17 years)		Screening, refraction	Auto and subjective
Noma 2011a [178]	2011	Male and female	7-10 years		Screening, spectacle delivery	Not specified
Noma 2011b [179]	2011a	Male and female	7 - 10 years		Screening	
O'Brien 2020 [180]	2020	Not specified	≥ 60		Screening, refraction, spectacle delivery	Not specified
Okoye 2009 [181]	2009	Male and female	Range: 12-33 years (19.4)	School for blind children	Screening, refraction	Subjective

Table 2. Overview of included studies and synthesis *(Continued)*

Oliveira 2013 [182]	2013	Male and female	5-15 years		Screening	
Ovenseri-Ogbomo 2013 [183]	2013	Male and female	Mean: 15.9 ± 4.0 years (range of 9–27 years)	Deaf and hearing-impaired school children	Screening, refraction	Subjective
Padhy 2022 [184]	2022	Male and female	44 ± 18 years	Vulnerable tribal group	Screening, refraction, spectacle delivery	Subjective
Pant 2014	2014	Male and female	Mean age: 12.9 ± 2.9 years (range 6–18 years)	Street children	Screening, refraction, spectacle delivery	Auto and subjective
Patel 2018	2018	Male and female	5-8 years	Rural	Screening	
Pereira 2012	2012	Male and female	Not specified	Rural	Screening, spectacle delivery	Subjective
Pereira 2019 [185]	2019	Male and female	5-18 years		Screening	
Port 2015 [186]	2015	Male and female	43.4 ± 18.9		Screening, spectacle delivery	
Prakash 2022 [187]	2022	Male and female	9.69 ± 3.26 years (4–15 years)		Screening, refraction, spectacle delivery	Subjective
Quigley 2002 [188]	2002	Male and female	Median age of 45 years		Screening, spectacle delivery	Subjective
Ramasamy 2013	2013	Male and female	Mean age (prescription only) 49.1 Mean age (on-the-spot delivery)= 49.0		Screening, refraction, spectacle delivery	Subjective
Ramke 2008 [189]	2008	Not specified	Not specified		Refraction, spectacle delivery	Not specified
Ransbarger 2013 [190]	2013	Male and female	Range: 6-72 months	Hispanic children, preschool	Screening	
Rao 2012 [191]	2012	Not specified	Not specified		Screening, refraction, spectacle delivery	Not specified
Reddy 2017a	2017	Male and female	Mean: 41 ± 16 Range: 7–84 years	Rural	Screening, refraction, spectacle delivery	Auto and subjective
Reddy 2017b	2017a	Not specified			Screening	

Table 2. Overview of included studies and synthesis *(Continued)*

Ribeiro 2015 [192]	2015	Male and female	5-19 years old		Screening	
Rodriguez 2014 [193]	2014	Male and female	40-89 years old		Screening, refraction	Subjective
Sabherwal 2021 [194]	2021	Male and female	Not specified		Screening, refraction, spectacle delivery	Not specified
Sabherwal 2022 [195]	2022	Male and female	Mean: 11 ± 3.24 (5-18 years)	Urban-slum	Screening, refraction, spectacle delivery	Subjective
Sengo 2021 [196]	2021	Male and female	12-20 years		Screening, refraction	Auto and subjective
Senjam 2016 [197]	2016	Male and female	≥ 40	Urban population	Screening	
Sexena 2015	2015	Male and female	6-15 years		Screening, refraction, spectacle delivery	Not specified
Shane 2011 [49]	2011	Male and female	46 (18–102) years	Rural	Screening, refraction, spectacle delivery	Auto
Sharma 2020 [198]	2020	Male and female			Screening, refraction, spectacle delivery	Auto and subjective
Sheeladevi 2019 [199]	2019	Male and female	≥ 30	Rural/urban	Screening, refraction, spectacle delivery	Auto and subjective
Shukla 2018 [200]	2018	Male and female	8-10 years		Screening, refraction, spectacle delivery	Auto and subjective
Singh 2016	2016	Male and female	Range: 1 to > 40 years	Remote islands	Screening	
Srisuwanporn 2008 [201]	2008	Male	9-92 years Mean 34.1 years	Priests and novices	Screening, spectacle delivery	Subjective
Suram 2016	2016	Male and female	32.86 ± 21.84 years	Rural areas	Screening, refraction	Subjective
Swamy 2009 [202]	2009	Male and female	≥ 70 years (mean age 81 years)	Frail elderly people	Screening, refraction, spectacle delivery	Subjective
Sylvia 2022 [203]	2022	Male and female	6-11 years		Spectacle delivery	
Tahhan 2009 [204]	2009	Male and female	All ages		Screening, refraction, spectacle delivery	Subjective
Thom 2017 [205]	2017	Male and female	4-18 years		Screening, refraction	Subjective

Table 2. Overview of included studies and synthesis *(Continued)*

Thulasiraj 2006 [206]	2006	Male and female	All ages		Screening, refraction, spectacle delivery	Subjective
Thulasiraj 2022 [207]	2022	Not specified	Not specified		Screening, refraction, spectacle delivery	Not specified
Traboulsi 2008	2008	Not specified	Not specified		Screening, refraction	Auto and subjective
Tsui 2015 [208]	2015	Male and female	Median age 48 years (range: 17-67 years)	Rural	Screening	
Umar 2015 [209]	2015	Male and female	≥ 40 years		Screening, refraction, spectacle delivery	Auto and subjective
Uzma 2009 [210]	2009	Male and female	7-15 years old	Urban and rural school children	Screening, refraction	Auto and subjective
Vieira 2018 [211]	2017	Not specified	All ages		Screening	Auto and subjective
von-Bischhoff-shausen 2005a [212]	2005	Male and female	< 6 years and > 45 years of age		Screening, spectacle delivery	
von-Bischhoff-shausen 2005b [213]	2005a	Male and female	< 6 years and > 45 years of age		Screening, spectacle delivery	
von-Bischhoff-shausen 2014	2014	Male and female	10.4 (3.3, 4–19) years		Screening, refraction, spectacle delivery	Not specified
Wahl 2019 [214]	2019	Male and female	7-80 years		Screening, refraction	Not specified
West 2003 [215]	2003	Male and female	≥ 65 years	Nursing home residents	Screening, refraction, spectacle delivery	Auto and subjective
Winters 2008 [216]	2008	Male and female	49.4 years (range 18-83)	Low-income and uninsured population	Screening, refraction, spectacle delivery	Not specified
Woodhouse 2014 [217]	2014	Male and female	2–21 years	Special schools	Screening, refraction	Auto and subjective
Yelle 2022 [218]	2022	Male	Median age: 49 years old (interquartile range 38–56.5)	Homeless population	Screening, refraction	Auto
Yi 2015 [219]	2015	Male and female	Mean age 10.10 years	Urban migrant Chinese school children	Screening, refraction, spectacle delivery	Auto and subjective

Table 2. Overview of included studies and synthesis *(Continued)*

Ying 2014 [220]	2014	Male and female	3-5 years old	African-American, American Indian, Asian, Hispanic, and non-Hispanic white preschool children	Screening, refraction	Auto and subjective
Yoseph 2002 [221]	2002	Male and female	Mean: 10.2 (5-15) years		Screening, refraction	Subjective
You 2022 [222]	2022	Male and female	1-6 years		Screening	
Yusuf 2019 [223]	2019	Male and female	5-11 years	At-risk urban school districts. School age	Screening, refraction	Subjective
Zeng 2009	2009	Male and female	12-15 years		Screening, refraction, spectacle delivery	Auto and subjective

IQR: interquartile range: **SD:** standard deviation

[a]PROGRESS-Plus: characteristics that classify health opportunities and outcomes

Table 3. Characteristics of identified studies: study type

Study characteristic		**No (%)**
Publication format	Full text	167 (95.4)
	Abstract	7 (4.0)
	Thesis	1 (0.6)
Study design	Randomized controlled trial	11 (6.3)
	Cohort	7 (4.0)
	Cross-sectional	134 (76.6)
	Case study	4 (2.3)
	Commentary	3 (1.7)
	Descriptive	2 (1.1)
	Mixed methods	3 (1.7)
	Systematic review	4 (2.3)
	Review	3 (1.7)

Table 3. Characteristics of identified studies: study type *(Continued)*

	Economic evaluation	1 (0.6)
	Non-randomized experimental study	2 (1.1)
	Retrospective chart review	1 (0.6)
Total		**175**

Table 4. Characteristics of studies, reports, and websites: population

Characteristics		Type of resource		
		Studies	**Reports**	**Websites**
		n (%)	**n (%)**	**n (%)**
Age	Children	86 (49.1)	35 (23.9)	30 (37.0)
	Adults	47 (26.9)	9 (6.2)	8 (9.9)
	Children and adults	33 (18.8)	35 (23.9)	14 (17.3)
	Not specified	9 (5.1)	67 (45.9)	29 (35.8)
Gender	Female	-	-	2 (2.5)
	Male	3 (1.7)	-	-
	Female and male	140 (80.0)	19 (13.0)	3 (3.7)
	Transgender	-	-	1 (1.2)
	Not specified	32 (18.3)	127 (87.0)	75 (92.6)
Population groups	Remote/rural communities and slums	14 (8.0)	17 (11.6)	6 (7.4)
	Urban communities	8 (4.6)	-	1 (1.2)
	Physical or learning disabilities	8 (4.6)	-	3 (3.7)
	Low-income communities	2 (1.1)	5 (3.4)	1 (1.2)
	Vulnerable population groups (homeless, street children, refugees, elderly population in residential care, frail old people, nursing home residents, indigenous peoples, transgender, and women affected by domestic violence)	21 (12.0)	13 (8.9)	8 (9.9)
	Working population	5 (2.9)	8 (5.5)	11 (13.6)
	Not specified	117 (66.9)	103 (70.6)	51 (63.0)

Table 5. Characteristics of studies, reports, and websites: settings, interventions, and personnel

Characteristics		Type of resource		
		Studies	**Reports**	**Websites**
		n (%)	**n (%)**	**n (%)**
WHO region	African	29 (16.6)	32 (21.9)	18 (22.2)
	Americas	42 (24.0)	40 (27.4)	10 (12.4)
	Eastern Mediterranean	4 (2.3)	2 (1.4)	3 (3.7)
	European	13 (7.4)	4 (2.7)	3 (3.7)
	South-East Asia	65 (37.1)	31 (21.2)	28 (34.6)
	Western Pacific	18 (10.3)	28 (19.2)	12 (14.8)
	Multiple regions	4 (2.3)	7 (4.8)	7 (8.6)
	Not specified	-	2 (1.4)	
Settings	Community	127 (72.6)	118 (80.8)	66 (81.5)
	Primary	29 (16.6)	12 (8.2)	3 (3.7)
	Community and primary	19 (10.8)	14 (9.6)	12 (14.8)
	Not specified		2 (1.4)	
Refractive/optical services	Screening	54 (30.8)	11 (7.5)	12 (14.8)
	Refraction	2 (1.1)	4 (2.7)	1 (1.2)
	Provision of spectacles	2 (1.1)	7 (4.8)	6 (7.4)
	Screening and refraction	38 (21.7)	-	
	Screening and spectacles provided	12 (6.8)	65 (44.5)	61 (75.3)
	Refraction and spectacles provided	2 (1.1)	3 (2.1)	-
	Screening/refraction and spectacles provided	65 (37.1)	22 (15.1)	1 (1.2)
	Eye examination	-	1 (0.7)	-
	Eye examination and spectacles provided	-	4 (2.7)	-
	Screening and eye examination	-	1 (0.7)	-
	Screening, eye examination and spectacles provided	-	28 (19.2)	-
Personnel	Doctors and Medical Officers	5 (2.9)	-	1 (1.2)
	Nurses	6 (3.4)	2 (1.4)	-

Table 5. Characteristics of studies, reports, and websites: settings, interventions, and personnel *(Continued)*

	Doctors and nurses	3 (1.7)	-	-
	Eye care professionals[a]	59 (33.7)	17 (11.6)	10 (12.4)
	Eye care professionals[a] and other trained individuals[b]	54 (30.8)	9 (6.2)	7 (8.6)
	Teachers	4 (2.3)	8 (5.5)	4 (4.9)
	Medical students	6 (3.4)	1 (0.7)	-
	Health workers	3 (1.7)	1 (0.7)	5 (6.2)
	Pharmacists	1 (0.6)	1 (0.7)	-
	Not specified	27 (15.4)	93 (63.7)	51 (63.0)
	Other trained individuals	7 (4)	14 (9.5)	3 (3.7)

WHO: World Health Organization

[a]Eye care professionals: ophthalmologists, optometrists, refractionists, vision/ophthalmic technicians, orthoptists, ophthalmic officers, eye care workers, ophthalmic technologists, opticians.
[b]Other trained individuals: nurses, doctors, teachers, students, pupils, health workers, interviewers, vision screeners, field workers, paramedics, postgraduates, and fellows.

Table 6. Approaches for service delivery

Approaches for service delivery		Type of resource		
		Studies	**Reports**	**Websites**
		n (%)	**n (%)**	**n (%)**
Primary care	**Vision centre**	23 (13.1)	19 (13.0)	11 (13.6)
	Health centre	12 (6.9)	1 (0.7)	3 (3.7)
	Vision/health centre and door-to-door delivery	10 (5.7)		1 (1.2)
Community care	**School-based**			
	School-based only	60 (34.3)	27 (18.5)	21 (25.9)
	School-based and other primary/community settings	10 (5.7)	30 (20.5)	6 (7.4)
	Pharmacy	1 (0.6)	2 (1.4)	
	Outreach			
	Outreach in community and primary locations	51 (29.1)	60 (41.1)	28 (34.6)
	Work-based outreach	3 (1.7)	3 (2.1)	4 (4.9)

Table 6. Approaches for service delivery *(Continued)*

	Home-based outreach	5 (2.9)		3 (3.7)
	Not specified	-	4 (2.7)	4 (4.9)
Totals		**175**	**146**	**81**

Table 7. Services provided via service delivery approaches from studies, reports, and websites

Service delivery setting, approach and subcategories	**Services provided and type of refraction**		
	Studies	**Reports**	**Websites**
Community care			
School-based			
School-based only	Screening Refraction • Subjective: 10 • Objective: 4 • Subjective and objective: 21 • Not specified: 7 Spectacles provided	Eye examination Screening Refraction Spectacles provided	Eye examination Screening Refraction Spectacles provided
School-based and other primary/community settings	Screening Refraction • Subjective: 2 • Objective: 1 • Subjective and objective: 5 • Not specified: 1 Spectacles provided	Screening Refraction Spectacles provided	Eye examination Screening Refraction Spectacles provided
Pharmacy	Spectacles provided • Near vision: 1	Eye examination Screening Refraction Spectacles provided (near vision)	-
Outreach			
Outreach in community and primary locations	Screening Refraction • Subjective: 12 • Objective: 4 • Subjective and objective: 12	Eye examination Screening Spectacles provided	Screening Spectacles provided

Table 7. Services provided via service delivery approaches from studies, reports, and websites *(Continued)*

	• Not specified: 6 Spectacles provided		
Work-based outreach	Screening Refraction • Subjective and objective: 1 Spectacles provided	Screening Spectacles provided	Screening Spectacles provided
Home-based outreach	Screening Refraction • Subjective: 1 Spectacles provided	-	Screening Spectacles provided
Not specified	-	Screening Refraction Spectacles provided	Screening Refraction Spectacles provided
Primary care			
Vision centre	Screening Refraction • Subjective: 2 • Subjective and objective: 8 • Not specified: 5 Spectacles provided	Eye examination Screening Refraction[a] Spectacles provided	Eye examination Screening Refraction[a] Spectacles provided
Health centre	Screening Refraction • Subjective: 1 • Objective: 1 • Subjective and objective: 1 • Not specified: 1 Spectacles provided	Eye examination Screening Refraction Spectacles provided	Screening Spectacles provided
Vision/health centre and door-to door delivery	Screening Refraction • Subjective: 4 • Objective: 1 • Subjective and objective: 1 • Not specified: 2 Spectacles provided		Screening Spectacles provided

[a]Type of refraction not specified.

Table 8. Case studies of approaches for delivery of refractive and optical services in community and primary care settings

Approaches and settings for service delivery		Case studies
Community care	School-based only	In a school vision programme in the USA, which operates through several teams that partner to provide vision screenings and perform eye exams, an optometrist provides technical assistance and consultation to the teams and Office of School Health (OSH). The pre-kindergarten screening staff, use the Welch-Allyn Sure Sight and SPOT auto-refractors to screen children in the Department of Education Universal Pre-K Program (Day 2022).
	School-based and other primary/community settings	In a study in India, preliminary school-based vision screening was performed by trained community eye health workers. They tested the VA of children using 6/12 optotype letters at a 3-m distance. Those who were unable to identify 6/12 or those with any obvious eye conditions were referred to the vision centre for further evaluation by a vision technician. At the vision centre, the referred children underwent a complete eye examination, including refraction, and spectacles were provided for children whose VA improved in one or either eye after the refractive correction (Prakash 2022).
	Pharmacy	The Brien Holden Foundation fostered partnership between Papua New Guinea (PNG) Eye Care and the PNG pharmacy chain, CPL Group, to support a reliable spectacle distribution scheme. Nurses and pharmacists provided refractive and optical services at pharmacies in Papua New Guinea [224]. Similarly, the 2017 annual report of One-Dollar glasses indicated that similar services were offered in Malawi where they established two "shop-in-shop" systems, whereby shopkeepers – or One-Dollar Glasses pharmacies – utilize part of their shop for eye tests and spectacle sales. Similarly, in Bolivia, smaller pharmacies or One-dollar drugstores provided space for the One-Dollar Glasses presentation and supplies; the owners/operators re trained in simple refraction, and they sell the spectacles on their premises [225].
	Outreach only	In the Hoffberger programme in the USA, eye screenings were conducted at churches, housing complexes for the elderly, community centres, and health fairs by trained teams consisting of at least one locally trained health worker and at least one community volunteer. The programme organized and publicised screenings, recruited volunteers for the event, counselled individuals needing further eye care services post-screening, and led training sessions for volunteers. The programme provided spectacles at a cost of USD 40 and a majority of those given a prescription utilized the spectacles arrangement (Quigley 2002).
	Work-based outreach	A study in Germany recruited workers from a workshop for people with intellectual disabilities, to participate in a vision examination programme. The assessment occurred in the local gym and objective refraction was conducted. Individuals with refractive errors were fitted with spectacles following the screening programme and an optician was available onsite to book appointments for other eye services, as needed (Eisenbarth 2018).
	Home-based outreach	In India, teams consisting of one ophthalmic paramedic and two community eye health workers conducted screening in a door-to-door survey in selected study clusters. Eye examination was performed in households using a Snellen chart and the VA was re-assessed using a pinhole, if VA was < 6/12 in either eye. Near vision was assessed using N notation chart binocularly. All individuals with visual impairment presenting in any eye, or needing additional services were referred to the nearest eye care facility for management (Marmamula 2011).

Table 8. Case studies of approaches for delivery of refractive and optical services in community and primary care settings *(Continued)*

	Outreach in community location	In a study in Canada to provide community vision screening to preschoolers, screening sessions were held at Ontario Early Year Centers and community playgroups, the children's museum, family resource centres, and fairs. Post-screening, parents were given a letter indicating the screening result and recommendation to take their children to an optometrist for a comprehensive eye assessment (Asare 2017). An example of an outreach approach with a mobile van is the eye programme conducted by Orbis International along with partners at Akhand Jyoti Eye Hospital. Orbis International 2020 in Nepal took their REACH (Refractive Error Among CHildren) eye screening programme door-to-door. Since many people were confined to their homes due to COVID pandemic lockdowns and school closures, specially trained community health workers visited households in the final months of 2020 and conducted screening activities door-to-door and children with refractive errors were referred for a second eye exam at the Vision Van. The Orbis Vision Van, a mobile eye care facility, was staffed with professional optometrists and medical assistants and outfitted with state-of-the-art equipment [226].
Primary care	Vision centre	Vision centres were set up at 25 slum clusters in Delhi, India with outpatient services available once weekly. Vision centre teams included one optometrist and two health workers. A total of five teams visited one designated centre daily and provided services, including educating patients about healthy vision, performing comprehensive eye examinations, conducting refractions, prescribing spectacles, and referring to specialists as needed. Refraction is conducted at the vision centres by the optometrist using objective and subjective methods (Manna 2022).
	Health centre	Refractive and optical services were provided at outpatient community health centres in Haiti and Belize. Refraction was conducted using autorefractors, and patients with refractive error were treated with new, isometropic, spherical, ready-made spectacles. Although this approach does not benefit all patients and is not gold standard, i.e. a traditional refraction followed by provision of custom-made lenses by an eyecare provider, the approach for service delivery was able to provide access to screening and spectacles to some of the patients for refractive error correction (Shane 2011).
	Vision/health centre and door-to door	In a study in India, screening teams spent four hours a day conducting door-to-door screenings of children. Children requiring further tests were referred to a vision centre and the vision technicians conducted examinations, including refraction. Ready-made spectacles were provided at the vision centre for children for whom the appropriate frame and lens power were available. Where not available, the spectacles were produced and delivered to individuals' homes within two weeks of refraction (Sabherwal 2022).

VA: visual acuity

Table 9. Summary of outcomes evaluated in the approaches for service delivery

Approaches and settings for service delivery		Outcomes evaluated
Community care	School-based	• The validity and reliability of refractive services provided by trained personnel in schools • The impact of school-based approaches on ownership and use of spectacles • The accuracy of refraction using autorefraction in children

Table 9. Summary of outcomes evaluated in the approaches for service delivery *(Continued)*

	Pharmacy	None
	Outreach	• Comparison of spectacle delivery systems • The accuracy of refraction using autorefraction in children
Primary care	Vision centre	• The accuracy of vision technicians in screening at vision centres
	Health centre	• Effectiveness, sustainability, relevance, equity, and replicability of an eye care scheme
	Vision/health centre and door-to-door delivery	• The accuracy of refraction using autorefraction in children