Middle East Journal of
Scientific Publishing
Vol. (8) Issue (5)
Edition 29th
2025(1 - 8)

Visual impairment and low vision aids: A narrative review (2015–2025)

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Published on: 6 November 2025

Abstract

Background: Visual impairment affects more than 2.2 billion people globally, with at least one billion cases preventable or untreated. [1-3] Optical and electronic low vision aids are important rehabilitation tools, yet their relative prescribing patterns and effectiveness are controversial.

Methods: A narrative review for literature between the years 2015 and 2025 was conducted across PubMed, Scopus, and WHO resources. A priority was given to randomized controlled trials, systematic reviews, meta-analyses, cohort studies, and WHO/IPEC policy reports. Comparisons between optical and electronic low vision aids were synthesized across prescribing, usage, effectiveness, quality of life, and economics.

Results: Optical aids such as handheld magnifiers, and telescopes are the most prescribed worldwide due to affordability and simplicity of their use.[4- 6] Electronic aids such as video magnifiers, and smartphone/tablet applications provide adjustable magnification range, contrast enhancement, and a wider field of view, in addition, clinical trials showing superior reading performance and user satisfaction in selected populations. [7- 14] Prescribing patterns vary by the cause of visual impairment, region, and age, showing that macular degeneration and diabetic retinopathy patients most likely to benefit from electronic aids. Economic studies suggest that electronic aids may be more cost effective for frequent readers compared to optical aids, however affordability and training needs limit their adoption. [15-17]

Conclusions: Integration of optical and electronic aids, supported by patients' requirements and structured training, optimizes vision rehabilitation results. Future research must standardize outcome measures, evaluate long term cost effectiveness, and afford equitable access in the light of WHO's IPEC plan. [1-3]
Key words: Visual impairment, low vision, electronic low vision aids, vision rehabilitation.

*** Introduction**

Visual impairment is a leading global health issue. According to the WHO reports, more than 2.2 billion people live with visual impairment or blindness, of whom about one billion people could have been prevented or unaddressed. [1-3] The challenge is more profound in low and middle income countries, where inequality of the provision and access to eye care services increase. [18, 19] Visual impairment reduces educational achievement, workforce participation, and independence, while increases risks of depression, falls, and social isolation. [20]

Vision rehabilitation goal is to alleviate these burden through structured services and devices that enhance visual functions. Conventional optical low vision aids (LVAs) including handheld and stand magnifiers, and telescopes have been the major option to achieve rehabilitation. These devices are affordable, simple, and effective for spot and short-term reading or brief tasks. [4,5] Although, they show several limitations such as fixed magnification, narrow fields of view, task specific, and absence of contrast enhancement which intern limit their long-term usefulness. [6, 11]

Electronic low vision aids (ELVAs) have gained publicity over the last few decades. These include but are not limited to desktop and portable video magnifiers, head-mounted displays, and smartphone and tablet applications that incorporate built-in cameras. ELVAs have more flexible features that ease their use and meet the diverse requirements of visually impaired patients such as adjustable magnification range, adjustable contrast, and a wider field of view, and improved posture. [7, 8, 10, 12, 14] However their effectiveness in improving reading speed and task performance is well supported by a number of randomized clinical trials [8, 9, 13] their adoption by visually impaired patients remains limited because of their cost, and training requirements. [4,16,18] This review provide evidence between the years 2015 and 2025 on the prescribing and effectiveness of optical versus

electronic aids. It reviews their relative strengths, limitations, and adoption patterns, while highlighting policy implications under the WHO Integrated People-Centred Eye Care (IPEC) framework.

*** Methods**

A narrative review of studies published between January 2015 and August 2025. Searches were conducted in PubMed, Scopus, and WHO database using terms: low vision, rehabilitation, optical magnifier, visual impairment, magnifier, smartphone app, reading performance, and quality of life. Inclusion criteria encompassed randomized control trials, systematic reviews, meta-analyses, large observational studies, and policy documents. Excluded references were single case reports and studies prior to 2015. Evidence was synthesized thematically across epidemiology, quality of life, prescribing trends, comparative effectiveness, adoption barriers, and economics. This review did not follow a strict PRISMA process, however we adopted principles of transparency by reporting search sources and prioritizing high-quality evidence. Themes were categorized into epidemiology, quality-of-life outcomes, optical compared to electronic LVAs, prescribing patterns, and health economics.

*** Results**

*** Epidemiology**

The WHO (2019) estimates 2.2 billion people live with some form of visual impairment, with one billion are either preventable or unaddressed. [1, 3] (Figure 1) Cataract and uncorrected refractive error are the leading causes of visual impairment, although retinal diseases such as age related macular degeneration (AMD) and diabetic retinopathy are increasingly significant in aging populations and developed countries. Regional inequities also exist where low and middle income countries in Africa and Asia bear the greatest prevalence, alongside with more limited resources for vision rehabilitation. [18, 19] It is important to report that epidemiology affects low vision aids prescribing. For example, in the developed countries, where AMD is prevalent, ELVAs are increasingly adopted due to their utility in continuous text reading tasks. In the contrary, optical LVAs prescribing is more dominant in developing and low income countries because of affordability issues and limited access for technology. [4, 6]

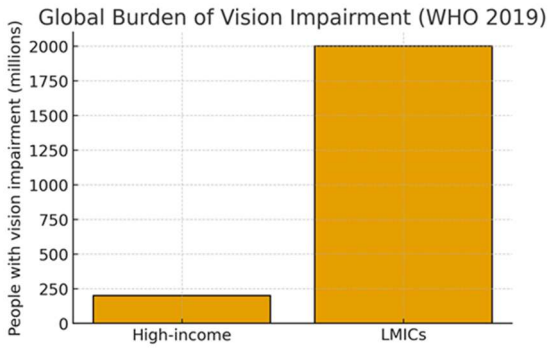

Figure 1. Global burden of vision impairment (WHO 2019). [1, 3]

*** Functional and quality of life outcomes**

Visual impairment affects performance and independence in activities of daily living (ADLs), mobility and orientation, and social participation. Validated tools such as the National Eye Institute Visual Function Questionnaire (NEI-VFQ), MNREAD charts, and EQ-5D have been adopted to measure outcomes of vision rehabilitation or the effectiveness of the use of LVAs. Meta-analyses confirm that structured rehabilitation programs incorporating LVAs improve quality of life, despite the fact that outcomes vary by patient goals or requirements, baseline function, and the number or category of low vision aids used. [21-24] Randomized control trials such as the Veterans Affairs Low Vision Intervention Trial (LOVIT II) demonstrate that combining optical and electronic LVAs improves outcomes attainment in terms of reading performance, and quality of life. [13]

*** Optical LVAs compared to ELVAs**

Optical LVAs remain the first-line intervention because these are affordable and simple to use. They are effective for spot reading such as reading bills or medicine labels but their use is limited for sustained reading tasks and/or variable font sizes. [4-6, 11] Compared to optical, ELVAs provide adjustable magnification and contrast, with randomized clinical trials proving better performance in continuous text reading and near viewing tasks. [7-11, 13, 14] (Table 1)

Table 1. Characteristics of optical LVAs and ELVAs (Bray 2016; Jackson 2017; Stolwijk 2022, Douglas 2016). [4, 7, 8, 11]

Characteristics	Optical LVAs	ELVAs	Notes
Magnification	Fixed	Adjustable	ELVAs allow task flexibility
Field of view	Narrow at high power	Wide, screen-based	Better for continuous text
Contrast	Not adjustable	Customizable	Helpful in AMD
Portability	High	Varies	Portable vs desktop trade-off
Cost	Low–moderate	Moderate–high	Barrier in LMICs
Training	Minimal	Essential	Affects uptake and satisfaction

*** Prescribing patterns**

Globally, optical LVAs constitute approximately 70% of the prescribed LVAs, although ELVAs uptake is improving particularly among AMD and diabetic retinopathy patients. [4, 6] Moreover, disease specific prescribing shows

that ELVAs are preferred in patients with central vision loss such as AMD, while telescopes (optical LVAs) remain important for patients with peripheral visual field loss such as retinitis pigmentosa. [5, 26]

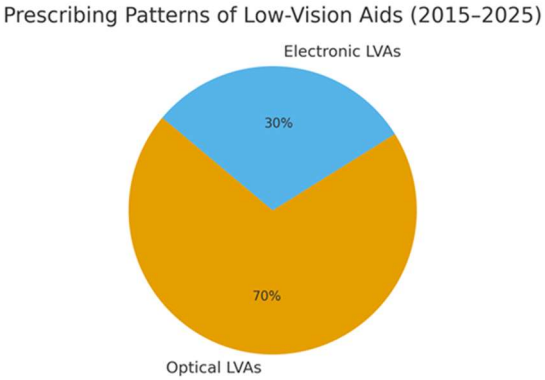

Figure 2. Prescribing patterns of LVAs, showing optical LVAs dominance [4, 6]

*** Effectiveness**

Randomized control trials and systematic reviews show that ELVAs improved reading speed by up to 50% compared to optical LVAs. [8, 9, 13, 26] In addition, ELVAs enhance task flexibility, for example letters, medication labels, and continuous reading, while optical LVAs are more task limited. Despite the fact that patient's training on their use is crucial; without instructions or guidance many patients may under-utilize these devices advanced device features. [16]

*** Discussion**

This narrative review shows that optical LVAs remain the foundation of vision rehabilitation, yet ELVAs are increasingly important for sustained reading and task flexibility. Service utilization data report that optical aids dominate the prescribed LVAs, although ELVA adoption is steadily growing. [4, 6] Among visually impaired patients cost of LVAs remains a barrier, with ELVAs often inaccessible in low and middle income countries. [18, 19] Evidence, however, suggests their cost effectiveness for frequent readers due to improved outcomes and reduced caregiver challenge. [15, 17]

Adoption of low vision aids is affected by cost, LVA weight, ergonomic and cosmetic acceptability, and training requirements. For example, head-mounted devices are effective but are often underutilized due to discomfort or stigma. [16] On the other hand, smartphone applications are affordable and discreet alternatives, however the small screen size may preclude prolonged use. [12, 14] (Table 2)

Table 2. Examples of RCTs, systematic reviews, and cohort studies on low-vision aids (optical and electronic) from 2015–2025.

Author (Year)	Design	Sample	Devices Studied	Outcomes Measured	Key Findings
Bray et al. (2016) [7]	RCT	100 adults	Portable ELVA (p-EVES)	Reading, QoL, cost	ELVAs improved reading; cost-effective for frequent users.
Jackson et al. (2017) [8]	RCT	82 adults	Video magnifiers + standard rehab	Goal attainment, reading	Adding ELVAs improved near goal attainment.
Virgili et al. (2018) [9]	Systematic review	12 RCTs	Optical & electronic LVAs	Near function, reading	ELVAs superior for continuous text; optical for spot reading.
Stelmack et al. (2017) [13]	RCT (LOVIT II)	150 veterans	Optical + electronic LVAs	Reading, QoL, goals	Combined rehab improved outcomes; sustained benefits.
Crossland & Silver (2018) [6]	Observational	3,500 patients	Optical & electronic	Prescribing patterns	Optical dominant; ELVA use rising.
Stolwijk et al. (2022) [4]	Multicenter cohort	2,500 patients	Optical & electronic	Utilization trends	Optical ~70% of prescriptions; ELVAs increasing.
Mahalingam et al. (2022) [5]	Observational	200 IRD	Optical vs electronic	Prescribing	Hand magnifiers most common; limited ELVA use in IRD.
Cai et al. (2025) [10]	Prospective cohort	180 patients	Mixed LVAs	QoL	Rehabilitation improved QoL and independence.
Bittner et al. (2024) [24]	RCT	40 adults	Telerehab vs in-office	Reading, satisfaction	Telerehab comparable to in-office training.
Yeo et al. (2022) [25]	Prospective	35 patients	Smartphone-based LVA	VA, reading, face recognition	Improved vision and reading accuracy; well tolerated.

Future innovations include AI-enabled smart glasses, wearable AR/VR systems (such as OrCam, and eSight), and tele-rehabilitation platforms, could increase access and reduce training barriers thus increasing their adoption. Integration of such devices into WHO's IPEC framework is crucial to ensure equitable service delivery worldwide. [1- 3]

* Conclusion

Vision rehabilitation should integrate both optical and ELVAs. Optical LVAs provide accessible first option support, while ELVAs enhance reading speed, accuracy, and task performance. Equitable access, structured training, and affordability strategies are critical to maximizing outcomes. Future research should prioritize comparative effectiveness trials, standardized outcomes, and cost-utility analyses, while rehabilitation policy must align with WHO's IPEC agenda.

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