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Interventions to improve patients' knowledge in ophthalmology: A systematic review and narrative synthesis

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ABSTRACT

Low eye health knowledge is associated with suboptimal treatment adherence, self-care practice and follow-up rate leading to poorer outcomes. The aim of this review was to survey what interventions are effective at improving patients' knowledge of eye disease and treatments. Randomised controlled trials and cross-sectional studies delivering interventions to improve patients' knowledge about eye diseases were reviewed. Databases, grey literature, reference lists and journals were searched for relevant studies. Three authors reviewed and extracted the data and assessed quality. Seventeen publications were included examining different types of interventions. Thirteen studies showed significant improvements on patients' eye disease knowledge following intervention. These included all 5 verbal interventions, 5 out of 6 video interventions, 5 out of 8 written or image material interventions, and 1 out of 2 using other formats. Study quality varied, with 7 studies rated as having low risks of bias, 8 moderate, and 2 high. Intervention design varied considerably across studies, making comparisons challenging. Interventions to improve patients' knowledge of eye conditions show promising results in particular verbal and video interventions; however, higher quality studies, as well as standardisation of reporting and intervention formats, are required to strengthen the evidence base.

1. Introduction

According to the World Health Organisation, it is estimated that at least 2.2 billion people have a vision impairment or blindness, of whom at least 1 billion have a vision impairment that could have been prevented.[35] The most common reasons for blindness include refractive error, cataracts, glaucoma, corneal opacities, diabetic retinopathy, and trachoma.

The ability to read, understand, and act on health information [2] has been found to have a well-established link with eye health outcomes.[15] This includes tasks such as reading and comprehending prescription labels, interpreting appointment slips, following instructions for diagnostic tests, and understanding other essential health-related materials required to adequately function as a patient.[5,14,28]

Low eye health knowledge is associated with suboptimal adherence to eye examination guidelines, treatment adherence, self-care practice and follow-up rate leading to poorer eye health outcomes.[3,15,23,27]

Health knowledge varies by context and setting and may be significantly worse than one's general knowledge.[24] An individual may be able to read and understand materials with familiar content at home or at work but struggle when presented with medical material of the same complexity that contains unfamiliar vocabulary and concepts in, for example clinical letters.[24] Some population groups such as low socio-economic groups, older and disabled people have been identified as having lower health knowledge contributing to health inequalities.[29]

In the literature, there is variability in surveys measuring patients' health knowledge ranging from non-standardised questionnaires to standardised and validated ones. Interventional studies often use surveys on the targeted eye diseases, such as the Auckland Glaucoma Knowledge Questionnaire, [9] before and after intervention to assess change in patients' knowledge of the disease, signs detection and self-management.

There is now a large body of literature [29] showing promising interventional strategies to improve patients' knowledge on their eye conditions. Interventions can be used to test the effectiveness of new health education strategies or to compare them. For instance, an intervention

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could aim to provide materials with the use of simplified plain language or the use of pictures to illustrate the text. Our objective is to evaluate what type of interventions are effective at improving patients' knowledge of eye disease and treatments.

2. Results

2.1. Study selection

The search resulted in 580 identified papers. Figure 1 depicts the selection process. After removing 19 duplicated papers, 561 papers were screened for the titles and abstracts leaving 24 selected for full-text review. The full-text of 1 paper was not accessible and hence could not be retrieved for the full-text analysis. Hence a total of 23 papers were read in full-text. Based on the full-text screening 6 papers were excluded. The reasons for exclusion included: outcome measures did not meet the inclusion criteria (n = 4) and the studies were not an intervention (n = 2). After exclusion, a total of 17 papers were included in the review.

2.2. Study characteristics

The 17 selected studies included 12 randomized controlled trials RCTs) [4,6,8,10,11,13,17,18,20,25,31,34] with 5 studies delivering the intervention with printed materials,[10,17,18,20,25] 3 studies with video materials,[4,8,11] 1 study with verbal information [13] and 3 studies used a mix of the aforementioned formats.[6,31,34]

Five studies were cross-sectional [1,12,16,19,21] including 1 using video materials to deliver the intervention [16] and 1 provided the information verbally.[19] One study by Aleem and coworkers[1] used a mix of printed and video materials. Furthermore, 1 study by Goyal and coworkers[12] used a mix of printed and verbal information and another study by Li and coworkers[21] used an educational platform (based on WeChat). The study characteristics are summarized in Table 1 and Table 2.

2.3. Intervention setting and outcome measures

Studies were conducted in outpatient clinics, short-term residential treatment, screening services and academic centres across multiple countries (3 in China,[6,8,19] 3 in the USA,[11,12,34] 2 in India,[17,18] 2 in Australia,[20,31] and 1 each in Pakistan,[1] Switzerland,[4] the UK,[10] Iran,[13] New Zealand,[19] Canada,[25] and Thailand[16]). All studies measured the effectiveness of their interventions with an eye knowledge questionnaire. Twelve studies used validated questionnaires such as the Auckland Glaucoma Knowledge Questionnaire [9] and the "Eye-Q" Test [33] and 5 studies used their own (non-validated) questionnaires.

2.4. Interventions delivered with printed materials (written or images)

2.4.1. Randomized controlled trials

Six RCTs trials [10,18,20,25,34] delivered the intervention with printed

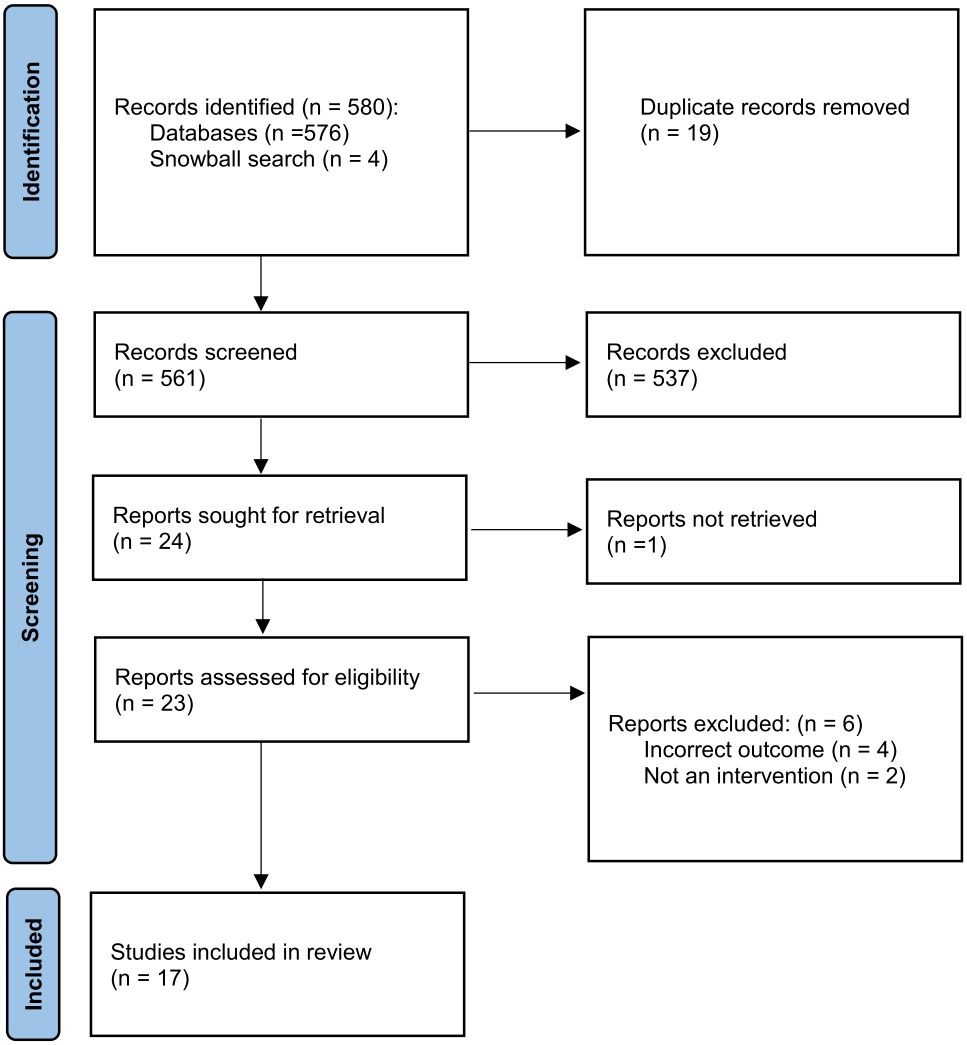

Fig. 1. PRISMA flow diagram of the study selection process.

Table 1
Characteristics of the seventeen studies.

Author	Study design	Country	Study population	Sample size	Intervention and Control	Format	Duration	Eye disease knowledge assessment
Aleem et al. 2021[1]	Cross-sectional	Pakistan	Geriatric patients with glaucoma	Total= 100Control= 50Intervention= 50	**Intervention:***Pharmacist-led intervention with routine medical care*Reminder medication regimen*Brochure in native language*Video demonstration of eye drop instillation**Control**: *Usual care	*Video*Written	6 months	Questionnaire knowledge on glaucoma
Baenninger et al. 2018[4]	Randomized control trial	Switzerland	Patients presenting for ametropia surgery	Total= 113Control= 58Intervention= 55	**Intervention**: *Informative video on surgery, risks, possible adverse events and video animation of procedure.**Control**: *Standard information communicated via verbally or in writing	Video	6 months	Questionnaire knowledge on ametropia surgery
Chen et al. 2020[6]	Randomized control trial	China	Parents' of children with congenital cataract	Total= 200Control= 107Intervention = 93	**Intervention**: *Informative presentation on cataract, treatment options*Informative video vignette on congenital cataract**Control**: *Conventional spoken information only	*Verbal*Video	6 months12 months	Questionnaire knowledge on congenital cataract
Dan et al. (2015)[8]	Randomized control trial	China	All patients attending outpatients clinic in ophthalmology	Total= 459Control= 218Intervention= 241	**Intervention**:*Explaining common eye disease (eg. glaucoma)*Importance of reporting signs for early detection*Importance of checking signs with eye care professionals**Control**: *Usual care	Video	NI	Knowledge questionnaire
Forbes et al. (2017)[10]	Randomized control trial	United Kingdom	Newly diagnosed glaucoma patients	Total= 122Control= 69Intervention= 53	**Intervention**: *Booklet with personalised information on glaucoma**Control**:*Usual care	Written	12 months	Visual Function Questionnaire
Goldstein et al. (2007)[11]	Randomized control trial	United States	Low vision patients	Total= 151Control= 77Intervention= 74	**Intervention**: *Video incorporating cognitive restructuring to change emotional response; a "virtual home"; a veridical simulation of vision with AMD and contrast enhancement of the video**Control**:*Did not receive videos	Video	3 months	8 knowledge questions via telephone survey
Goyal et al. (2023)[12]	Retrospective study	United States	Patients attending a vision screening service	Total= 217Control= NIIntervention=NI	**Intervention**: *Community Eye Health Intervention with teaching sessions and brochures**Control**:*NI	*Written*Verbal	NI	*Eye health knowledge pre/post test* 5-point teaching interventions (5-PTI)
Hazavehei et al (2010)[13]	Randomized control trial	Iran	Type 2 diabetes patients aged 40 and 60 years	Total= 100Control= 50Intervention= 50	**Intervention:** *Educational Intervention (6 educational sessions) **Control:** * Normal and ordinary observational diabetic's services by the centre	Verbal	5 months	Questionnaire knowledge
Juhong et al (2022)[16]	Prospective study	Thailand	Patients attending a contact lens clinic	Total= 132	**Intervention:** *5min 26 s video focusing on contact lens wear, handling, and care **Control:** NI	Video	2 months	Questionnaire knowledge
Karan et al (2011)[18]	Randomized control trial	India	Patients presenting for cataract surgery	Total= 60Control= 30Intervention= 30	**Intervention:** * A 24″ × 36″ poster displaying nine images. **Control**: *Listened to a scripted informed consent read by a native Tamil speaker.	*Image*Written	2 days	Oral and true/false quiz on cataract surgery
Karan et al (2014)[17]	Randomized control trial	India	Patients presenting for cataract surgery	Total= 97Control= 50Intervention= 47	**Intervention:** *Verbal informed consent read from a script by a native Tamil-speaking interviewer*Pamphlets outlining the surgical and post-operative	*Verbal*Written*Image	2 days	11-question true-false quiz on cataract surgery

(*continued on next page*)

Table 1 (*continued*)

Author	Study design	Country	Study population	Sample size	Intervention and Control	Format	Duration	Eye disease knowledge assessment
					procedure and general information on cataracts*3D demonstration of cataract formation **Control:** *A verbal informed consent read from a script by a native Tamil-speaking interviewer			
Ko et al (2021)[19]	Cross-sectional	New Zealand	Patients with cataract	Total= 112Control= 56Intervention= 56	**Intervention:** *Door-to-door health education by trained health educators once a month for three consecutive months using specifically designed materials on blindness and eye diseases**Control:** *A one-time group health education session that focused on treatment options for cataracts and locations for treatment was held before the intervention.	Verbal	6 months	6-part questionnaire designed according to the WHO cataract survey questionnaire
Lake et al. (2020)[20]	Randomized control trial	Australia	Young adults with type 2 diabetes	Total= 129 Control= 67 Intervention= 62	**Intervention**: *Leaflet on diabetic retinopathy screening for young people**Control:***No leaflet, usual care	Written	1 month	Questionnaire knowledge on diabetic retinopathy and eye screening
Li et al. (2019)[21]	Cross-sectional	China	Adults with glaucoma	Total= 1459Control with glaucoma= 223 Control no glaucoma= 362Intervention with glaucoma= 372Intervention no glaucoma= 502	**Intervention**: *Access delivered via 'WeChat' an educational platform for glaucoma patients**Control:***Usual care	Other	12 months	Questionnaire knowledge on glaucoma
Mikhail et al. (2015)	Randomized control trial	Canada	Patients with glaucoma	Total= 199Control= 75 Intervention= 124	**Intervention**: *Pamphlet on glaucoma with grade 5 reading level**Control**: *Pamphlet on glaucoma with grade 10 reading level	Written	NI	Questionnaire knowledge with blank spaces on glaucoma
Skalicky et al. (2018)[31]	Randomized control trial	Australia	Newly diagnosed glaucoma patients	Total= 102Control= 48Intervention= 54	**Intervention**: *Usual care*Educational intervention via telephone and email**Control:***Usual care *Verbal information by ophthalmologist	*Written*Verbal	1 month	Auckland Glaucoma Knowledge Questionnaire (AGKQ) 19
Wagner et al. (2008)[34]	Randomized control trial	United States	Diabetic patients seeking eye care in academiccentre	Total= 90Control= 45Intervention= 45	**Intervention**: *Written report of examination*Written educational materials on diabetes eye diseases*Seminar on diabetes eye diseases**Control:***Usual patient national education materials	*Written*Verbal	12 months	9 survey questions selected "Eye-Q" test

Table 2
Statistical test and summary of result.

Author	Statistical tests	Summary of results
Aleem et al. 2021[1]	*Chi square*Fishers' exact test**t*-test	Significant improvement in all 5 domains on knowledge on glaucoma vs control group:*Importance of medication adherence ($p = 0.030$)* Consequences of non-adherence ($p = 0.029$)* Intraocular pressure knowledge ($p = 0.024$)* Eye instillation technique ($p = 0.010$)* Counselling sessions about glaucoma ($p = 0.001$)
Baenninger et al. 2018[4]	*Wilcoxon–Mann–Whitney*Chi-square*t tests.	* No significant difference between the intervention and control group ($p = 0.957$) * No differences in patients younger than 38 years knowledge vs those who were 38 years or older in neither exposure group nor between the 2 exposure groups.
Chen et al. 2020[6]	*Chi-square*t tests*ANCOVA	Significant higher scores for knowledge for patients intervention group ($p < 0.001$).
Dan et al. (2015)[8]	Logistic regression models	Significant increase in mean scores on the knowledge after education among patients in the intervention group ($p < 0.0001$).
Forbes et al. (2017)[10]	*Mann-Whitney U*Multilinear regression	No statistically significant difference in knowledge.
Goldstein et al. (2007)[11]	*ANCOVA*Chi-square	* Knowledge scores were significantly higher at baseline for both the video and Control groups ($p < 0.001$).* Knowledge improvement scores were significantly higher in intervention group than control group ($p < 0.001$).
Goyal et al. (2023)[12]	Chi-square	Significant increase in eye-health knowledge scores between tests ($p < .00001$)
Hazavehei et al (2010)[13]	**t*-test*chi-square test*ANOVA*RMA test	Significant increase in knowledge after intervention and also 3 months following the intervention ($p < 0.001$) vs control group.
Juhong et al (2022)[16]	McNemar's tests	* Significant improvement in knowledge score after watching educational video ($p < 0.001$).* Significant change in hygienic behaviour 2 months after intervention ($p < 0.001$).
Karan et al (2011)[18]	Unpaired two-sample *t*-test	No statistically significant difference in the pre–informed consent scores or the post–informed consent scores between the two groups but a stronger trend in the intervention group.
Karan et al (2014)[17]	*Paired *t*-test	Significant improvement in scores between pre- and post-informed in intervention goup vs control group ($p < 10^{-6}$).
Ko et al (2021)[19]	*Chi-squared*MANOVA	Significant difference in knowledge and attitude ($p < 0.05$)
Lake et al. (2020)[20]	*Chi-square**t*-test	Significant difference in knowledge of diabetic retinopathy increased more among participants in the leaflet intervention arm relative vs control group ($p = 0.03$)
Li et al. (2019)[21]	*Chi-square*Mann–Whitney U *Linear regression	Significant knowledge score increase in glaucoma patients in intervention vs control group ($p < 0.001$)
Mikhail et al. (2015)	*t*-test	Significantly higher comprehension in intervention vs control group ($p = 0.0057$)
Skalicky et al. (2018)[31]	*t*-test	No significant increase in knowledge level
Wagner et al. (2008)[34]	Odds ratios	Significant differences in patient knowledge were found between those patients who participated in the intervention and those who did not ($p < 0.001$)

materials.

Forbes and coworkers[10] (moderate risk of bias) reported no statistically significant difference in knowledge between patients who received personalised information on glaucoma in the intervention group and patients who received the usual care in the control arm at 12 months follow up.

In Karan and coworkers [18] (moderate risk of bias) 60 patients received cataract surgery. The intervention group was provided with a poster with pictures relating to cataract surgery as an additional visual aid compared to the control group. The patients were then given a knowledge quiz (an eleven-item questionnaire) to complete at three-time points: before the intervention, after the intervention and one day later, after they had surgery. Although there was no statistically significant improvement in scores on the knowledge quiz before and after the intervention in either of the groups, the group that received the intervention had a greater improvement in scores than the control group. In their subsequent study in 2014,[17] Karan and coworkers (low risk of bias) repeated a similar study, but with more participants and a multimedia intervention, including a pamphlet and a verbal presentation. This time a significant improvement in the knowledge score was seen in both groups pre and post intervention, and furthermore, the improvement in the intervention group was significantly higher than in the control group.

Lake and coworkers [20] (moderate risk of bias) presented findings that explored the impact of an intervention providing leaflets on diabetic retinopathy to patients compared to patients who were not given leaflets. Knowledge of diabetic retinopathy was statistically significantly increased in the intervention group compared to the control arm at 4 weeks follow-up. In both groups, there were significant increases in knowledge of screening.

In another study, Mikhail and coworkers [25] (moderate risk of bias) associated the provision of grade 5 reading level leaflets on glaucoma with statistically significantly greater knowledge comprehension scores than patients who received grade 10 reading level leaflets.

In the intervention group of Wagner and coworkers [34] (moderate risk of bias), a written report of examination was given by the physician to diabetic patients, accompanied by written educational materials on diabetic eye diseases. Patients in the control group received the standard national educational materials on diabetic eye diseases. Patients' knowledge of diabetic eye diseases was assessed with the NEHEP's

"Eye-Q" test. They found that patients who participated in the intervention group were two times more likely to have higher scores on the test than those who did not.

2.4.2. Cross-sectional studies

Two cross-sectional studies delivered the intervention with printed materials. The intervention by Aleem and coworkers[1] (low risk of bias) partly included the distribution of brochures on glaucoma and their results suggested significantly higher scores on knowledge on glaucoma compared to patients who received the usual care in the control group.

Patients visiting a vision screening unit in Goyal and coworkers' study [12] (moderate risk of bias) were given brochures on eye health. Their scores on their eye health knowledge test were significantly higher after receiving the brochures than before.

2.5. Interventions delivered with video materials

2.5.1. Randomized controlled trials

Six studies evaluated the effectiveness of interventions delivered using video materials**:** 4 RCTs [4,6,8,11] and 2 cross-sectional studies.[1,16]

Baenninger and coworkers [4] (low risk of bias) presented data on 113 patients attending ametropia refractive surgery. Those randomised to the intervention group received informational video on the surgical procedure, including a video animation and visual communication of risks and possible adverse events associated with the surgery. The control group received standard information in writing. Both groups were able to ask questions during consultation time. There was no significant difference between the intervention and control group in terms of knowledge of the procedure or risks, assessed by questionnaire, nor in subgroup analysis between those aged below or over 38 years, however the consultation time was reduced for those that had seen the video.

Chen and coworkers [6] (moderate risk of bias) evaluated the effectiveness of a presentation and video vignette on the subject of congenital cataract in improving the knowledge of parents of children with congenital cataract. Parents had a sustained improvement in understanding, with higher knowledge scores on post-hoc questionnaires at 6 and 12 months than controls.

Dan and coworkers[8] (low risk of bias) conducted a RCT of an interventional video explaining common eye diseases and the importance of early detection and presentation, versus usual care among patients attending an outpatient ophthalmology clinic. Knowledge of the content of patients assigned to the intervention was significantly higher than controls. Scores were higher in those living within urban residences and in those who had received formal education.

Goldstein and coworkers [11] (high risk of bias) reported a RCT evaluating the impact of video information for patients with low vision and their caretakers on the use of low vision assistive devices. The intervention group received a video incorporating cognitive restructuring - an intervention that instils greater perceived control, confidence and a more realistic assessment of failures - and a visual simulation, and the control group did not receive the video. Both groups received pre- and post-intervention questionnaires on knowledge, self-efficacy, adaptive behaviours, willingness to use devices and emotional response. Knowledge scores improved significantly post-intervention for the intervention group but not for the control group.

2.5.2. Cross-sectional studies

Aleem and coworkers[1] and Juhong and coworkers [1,16] (low and moderate risk of bias) conducted cross-sectional studies of interventions involving videos. They evaluated the impact of a video demonstration of eye drop instillation (alongside a brochure and medication regimen reminder) in improving glaucoma knowledge among glaucoma patients. Statistically significant knowledge improvement in the intervention group versus control was noted**.** Juhong and coworkers assessed the impact of a short video on contact lens wear (based on recommendations by the American Academy of Ophthalmology) on participants' knowledge of and behavior regarding contact lens care, in a single-group, pre- and post-test design. Significant increases in knowledge scores and hygienic behaviour were recorded immediately after the intervention and persisted when assessed two months later.

2.6. Interventions delivered with verbal information

2.6.1. Randomized controlled trials

Three RCTs examined the effect of interventions delivered verbally on patients' knowledge of their eye disease. In Chen and coworkers' study [6] (moderate risk of bias), parents of children with congenital cataracts were shown a specially designed presentation with information on cataracts and treatment options in the intervention group whereas parents in the control group were presented with conventional information verbally. Findings suggested that parents in the intervention group had a significantly higher score on the knowledge questionnaire on cataracts compared to the control group.

Two studies were conducted on diabetic retinopathy patients. One study [13] (high risk of bias) found evidence that patients with diabetes who were presented with 6 educational sessions on diabetic retinopathy had a significantly higher mean score on the knowledge questionnaire compared to those who did not receive information in the control group. Another intervention[34] (moderate risk of bias) delivered a seminar on diabetes eye diseases among other elements delivered in writing format. Patients who received the interventions were twice as likely to have higher scores on the knowledge test than those who received the usual care in the control group.

2.6.2. Cross-sectional studies

Two cross-sectional studies investigated the effectiveness of interventions delivered verbally on patients' knowledge of eye diseases.

In the intervention (low risk of bias) by Ko and coworkers,[19] patients with cataracts in the intervention group were given three door-to-door sessions on cataracts with specifically designed materials by trained healthcare professionals whereas patients in the control group were provided a one-time health educational session on cataracts. They noted a medium but significant effect of the intervention on patients' knowledge.

Goyal and coworkers[12] (moderate risk of bias) assessed the effect of a community eye health intervention with teaching sessions on patients' eye health knowledge and found a significant increase in eye health knowledge between patients who received the intervention and those in the usual care (control group).

2.7. Interventions delivered in other formats

2.7.1. Randomized controlled trials

One study by Skalicky and coworkers [31] (low risk of bias) offered an educational intervention to newly diagnosed glaucoma patients via telephone and email. The control group was offered verbal information by an ophthalmologist. The intervention group noted a significantly higher score on the Auckland Glaucoma Knowledge Questionnaire after the intervention compared to before; however, the control group did not find a significant difference in the scores before and after the verbal information was provided.

2.7.2. Cross-sectional studies

Li and coworkers[21] (low risk of bias) investigated the effectiveness of an online educational platform using 'WeChat' in increasing the knowledge of glaucoma among patients diagnosed with the disease. The findings suggested that patients who were in the educational platform group had a significantly higher knowledge score on glaucoma than patients who did not have access to the educational platform in the control group.

2.8. Interventions by ophthalmic disease

Of the 17 interventions, 5 were related to glaucoma,[1,10,21,25,31] 4 were related to cataract surgery,[6,17–19] 3 were related to diabetes and the remaining 5 were a mix of ametropia surgery patients,[4] contact lens clinic patients,[16] low vision patients,[11] patients attending a vision screening service[12] and general ophthalmology patients.[8]

In the 5 glaucoma interventions, Aleem and coworkers' study [1] was a cross-sectional intervention set in Pakistan for geriatric patients that involved video and written demonstration for treatment, followed by a questionnaire on glaucoma. Significant improvements in all 5 domains of glaucoma knowledge were found post-intervention. Forbes and coworkers provided a written booklet as part of an RCT intervention over 12 months in newly diagnosed glaucoma patients in the UK. No significant increase in glaucoma knowledge was detected. Similarly, Skalicky and coworkers[31] lead an RCT study in newly diagnosed glaucoma patients in Australia, with an educational intervention delivered over the phone or by email over a period of 1 month; however, no significant knowledge improvement was found. A cross-sectional intervention in glaucoma patients took place in China over 12 months (Li et al., 2019)[21] where a WeChat educational platform allowed users to have direct access to information. A significant increase in knowledge was found. An RCT intervention in Canada by Mikhail and coworkers in 2015[25] provided a pamphlet with a lower reading level than the control group and found significant improvements.

In the 4 cataract surgery interventions, Chen and coworkers[6] was set in China for parents of children with congenital cataract and was delivered via an RCT where a video was compared to verbal information only. The video made a significant difference. Two RCTs, Karan and coworkers in 2011[18] and 2014,[17] were set in Indian over 2 days. For Karan and coworkers, a poster was used as an intervention. For Karan and coworkers, images and written information, as well as a 3D model were used compared to spoken only. Both studies showed significant improvements in knowledge, but the magnitude of the latter was greater. Ko and coworkers led a cross-sectional study, set in New Zealand comparing the effectiveness of one-on-one door-to-door meeting by health educators to that of one-time only group health education that focused on treatment options. Over 6 months, a significant improvement in knowledge and attitude was found in the intervention arm.

In the 3 diabetes interventions, Hazavehei and coworkers'[13] was set in Iran over 5 months, and 6 educational sessions were held. In Australia, Lake and coworkers[20] provided a leaflet over 6 months. In USA, Wagner and coworkers[34] provided a written report, educational material, and a seminar over 12 months. All 3 studies found their interventions to be effective.

In anametropia surgery clinic in Switzerland, Baenninger and coworkers[4] showed that a video was not significantly better retained than verbal and writing for knowledge of surgery. For contact lens patients clinic in Thailand, Juhong and coworkers showed that a 5-minute video led to significant improvements in knowledge and behaviour for contact lens wear when assessed 2 months later. For a group of low vision patients and their care givers in the USA, Goldstein and coworkers[11] showed that video and vision simulation were effective interventions to gain knowledge of low vision assistive devices when assessed at three

Table 3
Quality appraisal NI= No Information.

	Selection bias		Performance bias		Attrition bias	Measure bias	Reporting bias	
Author	Random sequence generation	Timing of recruitment	Assigning intervention	Adhering intervention	Incomplete outcome data	Measurement of outcome	Selection reported results	Overall
Aleem et al. (2021) [1]	Low	Low	Low	Low	Low	Low	Low	Low
Baenninger et al. (2018) [4]	Low	Low	Low	Low	Low	Moderate	Low	Low
Chen et al. (2020) [6]	Moderate	Moderate	Low	Low	Low	Moderate	Low	Moderate
Dan et al. (2015) [8]	Low	Low	Low	Low	Moderate	Low	Low	Low
Forbes et al. (2017) [10]	Low	Low	Low	Low	Low	High	Low	Moderate
Goldstein et al. (2007) [11]	Low	Low	Moderate	Moderate	Low	High	Low	High
Goyal et al. (2023) [12]	High	High	Low	Low	Low	Moderate	Low	Moderate
Hazavehei et al. (2010) [13]	High	High	Low	Low	Low	Moderate	High	High
Juhong et al. (2022) [16]	High	Moderate	Moderate	Moderate	Not reported	Low	Low	Moderate
Karan et al. [18]	Low	Low	Moderate	Moderate	Low	Low	Low	Moderate
Karan et al. (2014) [17]	Moderate	Moderate	Low	Low	Low	Low	Low	Low
Ko et al. (2021) [19]	Low	Low	Low	Low	Low	Low	Low	Low
Lake et al. (2020) [20]	Low	Low	Low	Low	Moderate	Low	Low	Moderate
Li et al. (2019) [21]	Low	Low	Low	Low	Low	Low	Low	Low
Mikhail et al. (2015) [25]	Low	Low	Low	Low	Moderate	Low	Low	Moderate
Skalicky et al. (2018) [31]	Low	Low	Low	Low	Low	Low	Low	Low
Wagner et al. (2008) [34]	Moderate	Moderate	High	High	Low	Moderate	Low	Moderate

months. For patients attending screening service in the USA, Goyal and coworkers[12] demonstrated effectiveness of verbal and written intervention. For general ophthalmology patients, including mostly glaucoma and diabetic eye disease in China, Dan and coworkers[8] demonstrated the effectiveness of a video intervention to increase knowledge of the benefits of a comprehensive eye examination.

3. Quality appraisal

The scores of each study quality appraisal are presented in Table 3. A total of 7 studies were rated as having low risks of bias,[1,4,8,17,19,21,31] 8 moderate [6,10,12,16,18,20,25,34] and 2 high.[11,13]

This suggests greater clarity of the methodology, data analyses, and results are needed to improve the quality of the literature. For instance, in relation to the intervention assignment, there were varying levels of information provided on the randomization process. In addition, few studies reported *a priori* estimate for sample size, which is particularly important to handle attrition and interpret the inferential statistics. There was also variation across studies in the eye disease knowledge measurements and time of follow-up. The content, delivery and length of intervention differed considerably across studies.

4. Discussion

A total of 17 studies investigating the effectiveness of interventions at improving patients' knowledge in ophthalmology were identified for inclusion in this review. The interventions were categorised as verbal, written (including images), video or other (which included phone and social media application "WeChat").

Out of the 17 studies, 5 were verbal interventions, 8 were written or image materials, and 6 were video. Other interventions included 1 phone/email intervention and 1 social media intervention using WeChat. All 5 verbal interventions reported a significant effect on patients' knowledge. Five out of the 8 written or image material interventions were significant. Five out of 6 video interventions detected a significant effect. For the other format, the intervention involving social media was significant, whereas the one involving phone/email was not significant.

While this review provides a clearer picture of the general effectiveness of verbal interventions in ophthalmology compared to other formats, interventions' efficacy were likely to be influenced by participants' eye condition, level of education,[10] age [22] and social economic group.[32] Furthermore, a previous study in ophthalmology by Muir and coworkers [26] suggested that patients who experience difficulties understanding health-related information are less likely to benefit from educational programs. In line with this, the reading levels of participants are often overlooked in studies, which can affect the effectiveness of written interventions. Muir's group's paper also emphasizes the importance of considering patients' learning styles, which could be assessed beforehand to choose the most suitable format for the intervention. Future research should aim to capture intervention efficacy by considering these parameters as well as taking in consideration long-term retention of information among participants.

In terms of the study design and the evidence provided, it is important to note that the evidence provided by RCTs is usually more robust than that provided by cross-sectional (observational) studies, as those would be more prone to bias linked to age or level of education for example which are important confounders and usually controlled for in RCTs. Furthermore, cross-sectional studies are usually observing difference in practice so can only make associations rather than infer causality.

In terms of the type of intervention by ophthalmic disease, the findings from glaucoma interventions highlight that written or immediately accessible information helps glaucoma patients better capture knowledge whereas email and phone were not found to be significant perhaps due to a lack of visual cues or some other confounders such as time spent with the patient.[31] The findings from cataract interventions, suggest that given cataracts can be particularly debilitating to vision, a combination of verbal and visual information is usually more effective in this group of patients.[18] All diabetes interventions involved written or verbal information delivered as educational sessions, and those were found to be effective in improving knowledge.

The strengths of this review were that a broad range of interventions across different eye conditions were rated. Two established quality rating scales were completed independently by 2 authors to minimise rating errors. The risk of publication bias was minimized through the use of several search mechanisms which strengthened the search strategy. The broad search strategy gives confidence that all currently available evidence has been identified in this review. This, to our knowledge, is the first review of interventional studies to improve patients' knowledge in ophthalmology.

The limitations of this review are mostly due to the heterogeneity of the interventions. Meta-analysis could not be conducted due to the heterogeneity in the studies including the differences in intervention format, eye condition, comparison groups and outcome measures. Because of this, we were not able to combine the effect sizes found in the studies or combine the results of studies to increase the power of statistical tests. More standardization of intervention formats and reporting is needed to draw meaningful comparisons. Certain interventions contained various formats (e.g., written and video materials) without assigning distinct scores to each intervention format or controlling for the influence of other intervention types. Furthermore, it was not possible to rate the quality of the intervention design or the material provided, especially as it was not always included in sufficient details in the studies. This could impact the assessment of the effectiveness of the interventions. Consequently, findings from this study need to be taken with caution as the interpretation of the efficacy of each intervention format and quality design within mixed-interventional studies was less clear. Future research should address this methodological issue by identifying which specific type of intervention has a significant effect on patients' knowledge. Sample sizes should be planned prospectively to ensure adequate power to identify beneficial interventions.

Verbal interventions were overall the most successful, which might be expected given their interactive nature, that they can be tailored to patients and that they may be better suited for visually impaired patients. There was a mix of different types of verbal communication from one-to-one consultations to seminars. Of the nonverbal interventions, written and images proved to be also quite successful, although probably more appropriate for patients who have sufficient vision. Images especially if combined with verbal and/or written communication are more accessible means of knowledge transfer to individuals with different levels of knowledge and socioeconomic status. Video interventions were also very successful which makes them promising interventions along with social media. Overall, it is likely that certain intervention formats are better tailored for certain demographics and participants' needs.

In terms of additional benefits of interventions beyond improved knowledge, as reported by Baenninger and coworkers,[4] interventions can also reduce consultation time without compromising patient's knowledge by providing them with information they can assimilate in their own time prior to or after consultations.

5. Conclusion

Interventions to improve patients' knowledge of eye disease in ophthalmology appear to show promising results, in particular verbal and video interventions; however, higher quality studies, standardized reporting, intervention design, and knowledge assessment will be useful to strengthen the evidence base so that interventions can be meaningfully compared.

5.1. Method of Literature search strategy

The systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline.[30] A literature search was conducted between the 5th and 6th of September 2023 using four electronic databases: PubMed, MEDLINE, Embase and PsychINFO. The literature search could include articles in English and French and would be expanded using a snowballing method to the references of retrieved papers. The search terms used can be found in Appendix 1. This study was registered to the International Prospective Register of Systematic Reviews (PROSPERO, registration number CRD42023440322).

5.2. Eligibility criteria

The inclusion criteria were: (1) peer-reviewed intervention studies aimed at increasing patients' knowledge (2) the interventions should be delivered to eye patients, (3) the interventions could include but not limited to self-help tools (eg. leaflets), confidence building activities, knowledge sharing, peer support, teach-back methods. Qualitative studies, study protocols or studies reporting solely non-measurable outcomes were excluded. There were no date restrictions to the search. When necessary, the authors were contacted by email to request further information. The systematic review management software Covidence was used for this review.

5.3. Study selection, data extraction and quality appraisal

Three authors (DS, EI, RR) independently reviewed the titles/abstracts and subsequently, the full-texts generated by the search. Discrepancies were resolved by DS and NP. A data extraction table was designed to capture all relevant information required for analysis. For all included studies, the following information was recorded: author, date of publication, country, study design, study population, sample size, eye health knowledge assessment, description of the intervention, duration, outcome measures, statistical tests and summary of results.

Three authors independently assessed the quality of included studies (DS, EI, JP) and then a discrepancy check was implemented to compare assessments. Discrepancies and disagreements were resolved by consensus, and/or resolution of the conflict was performed by a third reviewer when necessary. The risk of bias and quality of primary studies or systematic reviews were assessed with a revised version of the Cochrane risk of bias tool (RoB 2) for randomised-controlled trials or the ROBINS-I or non-randomised studies.[7] The risk of bias was graded as low, moderate or high. The quality assessment did not affect the inclusion of studies.

5.4. Data analysis

Due to the heterogeneity of the study population, interventions, comparison groups and outcome measures, there was no set of studies that were sufficiently similar to combine them in a meta-analysis. Hence, data was synthesised using narrative synthesis, which describes the scope of existing research and summarises data using structured narratives and summary tables. Studies were categorised according to the typology of interventions and the study design. Results were briefly summarised by the outcome.

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CRediT authorship contribution statement

Konstantinos Balaskas: Conceptualization, Writing – original draft, Writing – review & editing. **Peter Thomas:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing. **Nikolas Pontikos:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Dayyanah Sumodhee:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Validation, Writing – original draft, Writing – review & editing. **Rishi Ramessur:** Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing. **Estelle Ioannidou:** Conceptualization, Data curation, Validation, Writing – original draft, Writing – review & editing. **Mohammed Abbas:** Conceptualization, Investigation, Writing – original draft. **Jai Prashar:** Data curation, Methodology, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

NP is a co-founder, shareholder and director of Phenopolis Ltd. PT is a shareholder and director of Thomas Medtech Advisory Ltd which undertakes digital health consultancy.

Appendix 1

MEDLINE, Embase, PsychINFO
1. exp Patient$/
2. exp Health Literacy/
3. exp Readability/
4. exp Health Education/
5. exp Information Literacy/
6. 2 or 3 or 4 or 5
7. exp Intervention$/
8. exp Health Service$/
9. 7 or 8
10. 9 and 10
11. 3 and 12
12. exp "Systematic Review"/ or exp "Review"/
13. 14 and 15

PubMed

((((ophthal* OR optom* AND (fft[Filter])) AND (health literacy OR readability OR health education OR information literacy AND (fft[Filter]))) AND (intervention* AND (fft[Filter]))) AND ((((patient* AND (fft[Filter])) AND (ophthal* OR optom* AND (fft[Filter]))) AND (health literacy OR readability OR health education OR information literacy AND (fft[Filter]))) AND (intervention* AND (fft[Filter])) AND (fft[Filter])) AND (fft[Filter])) NOT (systematic review OR meta analysis AND (fft[Filter]))

References

1. Aleem A, Amin F, Asim MH, Farooq N, Arshad S, Raziq M. Impact of pharmacist-led interventions in improving adherence to glaucoma medications in the geriatric population. *Eur J Hosp Pharm Sci Pr.* 2021;28(2):e191–e196. https://doi.org/10.1136/ejhpharm-2021-002788.
2. Andrus MR, Roth MT. Health literacy: a review. *Pharmacotherapy.* 2002;22(3):282–302. https://doi.org/10.1592/phco.22.5.282.33191.
3. Austin PE, Matlack R 2nd, Dunn KA, Kesler C, Brown CK. Discharge instructions: do illustrations help our patients understand them? *Ann Emerg Med.* 1995;25(3):317–320. https://doi.org/10.1016/s0196-0644(95)70286-5.
4. Baenninger PB, Faes L, Kaufmann C, Reichmuth V, Bachmann LM, Thiel MA. Efficiency of video-presented information about excimer laser treatment on ametropic patients' knowledge and satisfaction with the informed consent process. *J Cataract Refract Surg.* 2018;44(12):1426–1430. https://doi.org/10.1016/j.jcrs.2018.07.052.
5. Baker DW. Reading between the lines: deciphering the connections between literacy and health. *J Gen Intern Med.* 1999;14(5):315–317. https://doi.org/10.1046/j.1525-1497.1999.00342.x.

6. Chen H, Lin Z, Chen J, et al. The impact of an interactive, multifaceted education approach for congenital cataract on parental anxiety, knowledge and satisfaction: a randomized, controlled trial. *Patient Educ Couns*. 2020;103(2):321–327. https://doi.org/10.1016/j.pec.2019.09.002.
7. Cumpston M, Li T, Page MJ, et al. Updated guidance for trusted systematic reviews: a new edition of the cochrane handbook for systematic reviews of interventions. *Cochrane Libr*. 2019;10(10). https://doi.org/10.1002/14651858.ed000142.
8. Dan A, Raubvogel G, Chen T, et al. The impact of multimedia education on uptake of comprehensive eye examinations in rural China: a randomized, controlled trial. *Ophthalmic Epidemiol*. 2015;22(4):283–290. https://doi.org/10.3109/09286586.2015.1056812.
9. Danesh-Meyer HV, Deva NC, Slight C, et al. What do people with glaucoma know about their condition? A comparative cross-sectional incidence and prevalence survey. *Clin Exp Ophthalmol*. 2008;36(1):13–18. https://doi.org/10.1111/j.1442-9071.2007.01624.x.
10. Forbes M, Fairlamb H, Jonker L. Impact of patient-held record on knowledge at 1-year follow-up for glaucoma patients: single-center randomized controlled trial. *Eur J Ophthalmol*. 2017;27(5):542–547. https://doi.org/10.5301/ejo.5000939.
11. Goldstein RB, Dugan E, Trachtenberg F, Peli E. The impact of a video intervention on the use of low vision assistive devices. *Optom Vis Sci*. 2007;84(3):208–217. https://doi.org/10.1097/OPX.0b013e3180339a03.
12. Goyal A, Richards C, Freedman RL, et al. The vision detroit project: integrated screening and community Eye-Health education interventions improve eyecare awareness. *Ophthalmic Epidemiol*. 2023;30(4):367–375. https://doi.org/10.1080/09286586.2022.2127785.
13. Hazavehei S.M.M., Khani Jeihooni A., Hasanzadeh A., Amini S. The Effect of Educational Program Based on BASNEF Model for Eye Care in Non-insulin Dependent Diabetic Patients. *J Res Health Sci*. 2010;10(2):81-90. https://www.ncbi.nlm.nih.gov/pubmed/22911929.
14. Institute of Medicine, Board on Neuroscience and Behavioral Health, Committee on Health Literacy. *Health Literacy: A Prescription to End Confusion*. National Academies Press; 2004. https://play.google.com/store/books/details?id=pj2cAgAAQBAJ.
15. Iskander M, Hu G, Coulon S, Seixas AA, McGowan R, Al-Aswad LA. Health literacy and ophthalmology: a scoping review. *Surv Ophthalmol*. 2023;68(1):78–103. https://doi.org/10.1016/j.survophthal.2022.08.007.
16. Juhong J, Mordmuang A, Jewboonchu J, Udomwech L. Effectiveness of an online educational video intervention to improve the knowledge and behavior of contact lens care during the COVID-19 pandemic: a pre-test/post-test design. *Heliyon*. 2022;8(10), e11009. https://doi.org/10.1016/j.heliyon.2022.e11009.
17. Karan A, Somasundaram P, Michael H, Shayegani A, Mayer H. The effect of multimedia interventions on the informed consent process for cataract surgery in rural south India. *Indian J Ophthalmol*. 2014;62(2):171–175. https://doi.org/10.4103/0301-4738.116488.
18. Karan AM, Campbell DJ, Mayer HR. The effect of a visual aid on the comprehension of cataract surgery in a rural, indigent south Indian population. *Digit J Ophthalmol*. 2011;17(3):16–22. https://doi.org/10.5693/djo.01.2011.05.001.
19. Ko KK, Pumpaibool T, Wynn MMM, Win Y, Kyi TM, Aung PL. Door-to-Door eye health education to improve knowledge, attitude, and uptake of eyecare services among elderly with cataracts: a Quasi-Experimental study in the central tropical region, Myanmar. *Clin Ophthalmol*. 2021;15:815–824. https://doi.org/10.2147/OPTH.S287257.
20. Lake AJ, Hateley-Browne JL, Rees G, Speight J. Effect of a tailored leaflet to promote diabetic retinopathy screening among young adults with type 2 diabetes: a randomised controlled trial. *BMC Ophthalmol*. 2020;20(1):80. https://doi.org/10.1186/s12886-020-1311-y.
21. Li J, Huang W, Gao J, Li D, Xu L, Huang J. Impact of Mobile-Based health education on the awareness and knowledge of glaucoma in Chinese patients. *Telemed J E Health*. 2019;25(6):455–461. https://doi.org/10.1089/tmj.2018.0123.
22. McClure LA, Tannenbaum SL, Zheng DD, et al. Eye health knowledge and eye health information exposure among Hispanic/Latino individuals: results from the hispanic community health Study/Study of latinos. *JAMA Ophthalmol*. 2017;135(8):878–882. https://doi.org/10.1001/jamaophthalmol.2017.1998.
23. Meade CD, McKinney WP, Barnas GP. Educating patients with limited literacy skills: the effectiveness of printed and videotaped materials about colon cancer. *Am J Public Health*. 1994;84(1):119–121. https://doi.org/10.2105/ajph.84.1.119.
24. Medical Association A, Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs. Health literacy: report of the Council on Scientific Affairs. *J Am Med Assoc*. 1999.
25. Mikhail D, Visscher KL, Chen N, Wang J, Emara BY, Hutnik CM. Patient-appropriate health literacy educational materials in ophthalmology. *Can J Ophthalmol*. 2015;50(1):19–25. https://doi.org/10.1016/j.jcjo.2014.08.002.
26. Muir KW, Ventura A, Stinnett SS, Enfiedjian A, Allingham RR, Lee PP. The influence of health literacy level on an educational intervention to improve glaucoma medication adherence. *Patient Educ Couns*. 2012;87(2):160–164. https://doi.org/10.1016/j.pec.2011.09.009.
27. Murphy P.W., Chesson A.L., Walker L., Arnold C.L., Chesson L.M. Comparing the effectiveness of video and written material for improving knowledge among sleep disorders clinic patients with limited literacy skills. *South Med J*. 2000;93(3):297-304. https://www.ncbi.nlm.nih.gov/pubmed/10728518.
28. Parker RM, Baker DW, Williams MV, Nurss JR. The test of functional health literacy in adults: a new instrument for measuring patients' literacy skills. *J Gen Intern Med*. 1995;10(10):537–541. https://doi.org/10.1007/BF02640361.
29. Robert J. *Local action on health inequalities improving health literacy to reduce health inequalities* (Published online). UCL Institute of Health Equity; 2015.
30. Shamseer L, Moher D, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ*. 2015;350:g7647. https://doi.org/10.1136/bmj.g7647.
31. Skalicky SE, D'Mellow G, House P, Fenwick E. Glaucoma Australia educational impact study contributors. Glaucoma Australia educational impact study: a randomized short-term clinical trial evaluating the association between glaucoma education and patient knowledge, anxiety and treatment satisfaction. *Clin Exp Ophthalmol*. 2018;46(3):222–231. https://doi.org/10.1111/ceo.13016.
32. Sørensen K, Pelikan JM, Röthlin F, et al. Health literacy in Europe: comparative results of the european health literacy survey (HLS-EU). *Eur J Public Health*. 2015;25(6):1053–1058. https://doi.org/10.1093/eurpub/ckv043.
33. Take This Eye-Q Test: *See How Much You Know about Diabetic Eye Disease*. National Eye Institute, National Institutes of Health, Public Health Service, U.S. Department of Health and Human Services; 2000. ⟨https://play.google.com/store/books/details?id=Jk7nOwAACAAJ⟩.
34. Wagner H, Pizzimenti JJ, Daniel K, Pandya N, Hardigan PC. Eye on diabetes: a multidisciplinary patient education intervention. *Diabetes Educ*. 2008;34(1):84–89. https://doi.org/10.1177/0145721707312205.
35. Yang X, Chen H, Zhang T, et al. Global, regional, and national burden of blindness and vision loss due to common eye diseases along with its attributable risk factors from 1990 to 2019: a systematic analysis from the global burden of disease study 2019. *Aging (Albany NY)*. 2021;13(15):19614–19642. https://doi.org/10.18632/aging.203374.