

EVIDENCE-BASED CLINICAL PRACTICE GUIDELINE

**Comprehensive Adult Eye and
Vision Examination**

Second Edition

29 SEPTEMBER 2022



American Optometric Association

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About the American Optometric Association

44 The American Optometric Association (AOA) is the leading authority on and advocate for quality eye
45 health care, representing more than 44,000 doctors of optometry, optometry students and optometric
46 professionals. As the sole primary eye care provider in many communities across America, doctors of
47 optometry are often a patient's first entry into the health care system, and have extensive, ongoing
48 training to examine, diagnose, treat and manage disorders, diseases and injuries that affect the eye and
49 visual system. Through a nationwide public health initiative, AOA's *Eye Deserve More* campaign is
50 fostering awareness of the importance of eye health and vision care and the overall health benefits of in-
51 person, comprehensive eye examinations with AOA doctors of optometry for all Americans.

Disclosure Statement

53 This Evidence-based Clinical Practice Guideline was funded by the AOA without financial support from
54 any commercial sources. The Evidence-based Optometry Guideline Development Group and other
55 guideline participants provided full written disclosure of conflicts of interest prior to each meeting and prior
56 to voting on the quality of evidence or strength of clinical recommendations contained within this
57 guideline.

58

Disclaimer

60 Recommendations made in this guideline do not represent a standard of care. Instead, the
61 recommendations are intended to assist the clinician in the decision-making process. Patient care and
62 treatment should always be based on a clinician's independent professional judgment, given the patient's
63 circumstances, and in compliance with state and federal laws and regulations.

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65 The information in this guideline is current to the extent possible at the time of publication.

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Comprehensive Adult Eye and Vision Examination

Second Edition

Developed by the AOA Evidence-based Optometry Guideline
Development Group

Approved by the AOA Board of Trustees **insert date**

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180 **EVIDENCE-BASED CLINICAL GUIDELINES**

181

182 **A. What is the Evidence-based Process?**

183

184 As a result of the Medicare Improvements for Patients and Providers Act of 2008, Congress
185 commissioned the Secretary of Health and Human Services to create a public-private program to
186 develop and promote a common set of standards for the development of clinical practice
187 guidelines (CPGs). These standards address the structure, process, reporting, and final products
188 of systematic reviews of scientific research and evidence-based clinical practice guidelines.

189 The Institute of Medicine (IOM), now the Health and Medicine Division of the National Academies
190 of Sciences, Engineering, and Medicine (NASEM), in response to a request from the Agency for
191 Healthcare Research and Quality (AHRQ), issued two reports in March 2011: *Clinical Practice*
192 *Guidelines We Can Trust* and *Finding What Works in Health Care: Standards for Systematic*
193 *Reviews*.

194 In *Clinical Practice Guidelines We Can Trust*,¹ the IOM redefined CPGs as follows:

195 *“Clinical practice guidelines are statements that include recommendations intended to*
196 *optimize patient care that are informed by a systematic review of the evidence and an*
197 *assessment of the benefits and harms of alternative care options.”*

198 The report states that to be trustworthy, guidelines should:

- 199 • Be based on a systematic review of existing evidence.
200
201 • Be developed by a knowledgeable, multidisciplinary panel of experts and key stakeholders.
202
203 • Consider important patient subgroups and preferences, as appropriate.
204
205 • Be based on a transparent process that minimizes conflicts of interest and biases.
206
207 • Provide a clear explanation of the logical relationships between alternative care options and health
208 outcomes.
209
210 • Provide a grading of both the quality of evidence and the strength of the clinical
211 recommendation.
212
213 • Be revised as appropriate when new evidence warrants modifications of recommendations.
214

215 Based on the IOM/NASEM reports, the AOA Evidence-based Optometry (EBO) Committee
216 developed a 14-step process to meet the current evidence-based recommendations for
217 trustworthy guidelines.

218

219

AOA's 14 Steps to Evidence-based Clinical Practice Guideline Development	
1.	Guideline Development Group (GDG): The Evidence-based Optometry (EBO) Committee selects a multidisciplinary panel of experts, including patient and public representatives, to act as the Guideline Development Group (GDG).
2.	Transparency and COI*: The GDG manages all conflict of interest (COI), which is documented by AOA staff and reviewed during face-to-face meetings.
3.	Clinical Questions*: The GDG defines the literature search criteria and identifies all clinical questions through a question formulation meeting.
4.	<p>Search for Evidence: The AOA staff sends the search criteria and clinical questions for a systematic review of the literature (outside researchers) and provides all obtained papers to the Guideline Development Reading Group (GDRG). Systematic reviews, when available, are included in the guideline. No systematic review authors are participants in the GDG or GDRG.</p> <p>Inclusion Criteria (must meet all): Scientific studies written in English that address the clinical question and that meet the patient population or age range being addressed.</p> <p>Exclusion Criteria (meets any of the following): Scientific studies that are not in English, animal studies, studies outside the patient population or age range (if relevant), studies not addressing any topic of the clinical questions searched.</p>
5.	Grade Evidence/Quality: Two scientific readers and one member from the GDRG are randomly selected to read and grade each paper. They separately grade the paper for quality of evidence based on predetermined grading criteria and state the clinical recommendation(s).
6.	Articulate Clinical Recommendations/Strength*: The GDRG and GDG clinical experts review all clinical recommendations and articulate each for inclusion in the guideline during an “articulation of recommendations” meeting(s). There are single and/or aggregate recommendations made and a strength level is assigned. Potential benefits and harms, costs, and patient preferences are identified, as well as any gaps in research, and each is documented.
7.	Write the Draft: The AOA staff send the articulation results to the writer to develop draft 1.
8.	Draft Review and Edits*: The GDG reads draft 1, discusses, and edits.
9.	Rewrite/Final Drafts: The AOA staff send the draft results to the writer for writing/revisions for draft 2 (peer review draft) and send to medical editor for copy editing. Additional reviews are completed as necessary.
10.	Approval and Posting for Peer Review: The AOA staff and/or EBO Committee chair sends the peer review draft to AOA Board of Trustees for approval to post for peer and public review. The draft is posted on the AOA website, along with a comment form, and the review period is announced. Comments are solicited/collected electronically and comment authors are not made public.
11.	Final Document Produced*: The GDRG and GDG clinical experts review all peer comments and revise the final document. They may choose to include the peer review comment, not include the comment, and/or identify further gaps to review when preparing the next edition. All comments are documented regarding actions taken/not taken and the final draft is produced.
12.	Final Draft Approval and Legal Review: The final draft is reviewed by the AOA Board of Trustees and AOA Legal Counsel for approval and verification that the GDG followed the evidence-based process as outlined by the National Academies of Sciences, Engineering, and Medicine (NASEM) – Health and Medicine Division, previously the Institute of Medicine.
13.	Post Guidelines: The AOA staff posts the evidence-based guideline to AOA website for public use.
14.	Schedule Reviews: The GDG schedules a review to meet the NASEM guideline development standards and reviews all previously identified gaps in medical research and any new evidence and revises the evidence-based guideline every 2 to 5 years.

*Denotes virtual meetings in 2020/2021/2022 due to the COVID-19 pandemic

221 **B. How to Use This Guideline**

222
 223 The following table provides the grading system used in this guideline for rating evidence-based clinical statements.
 224 Grades are provided for both quality of evidence and strength of clinical recommendations.

Key to Evidence Quality and Strength of Clinical Recommendation Levels	
Grade	Study Type
A	<ul style="list-style-type: none"> • Meta-Analysis • Systematic Review • Randomized Clinical Trial • Diagnostic Studies (Grade A) <ul style="list-style-type: none"> ○ Do not have a narrow population ○ Do not use a poor reference standard ○ No case control studies of diseases or conditions
B	<ul style="list-style-type: none"> • Randomized Clinical Trial (weaker design) • Cohort Studies <ul style="list-style-type: none"> ○ Retrospective ○ Prospective • Diagnostic Studies (Grade B - only one of the following) <ul style="list-style-type: none"> ○ Narrow population ○ Sample used does not reflect the population to whom the test would apply ○ Uses a poor reference standard ○ Comparison between the test and reference standard is not blinded ○ Case control studies of diseases or conditions
C	<ul style="list-style-type: none"> • Case Control Studies <ul style="list-style-type: none"> ○ Study of sensitivity and specificity of a diagnostic test, population-based descriptive study of diseases or conditions ○ Retrospective ○ Prospective • Diagnostic Studies (Grade C - at least two or more of the following) <ul style="list-style-type: none"> ○ Narrow population ○ Sample used does not reflect the population to whom the test would apply ○ Uses a poor reference standard ○ Comparison between the test and reference standard is not blinded • Studies of Strong Design <ul style="list-style-type: none"> ○ With substantial uncertainty about conclusions or serious doubts about generalizations, bias, research design, or sample size • Nonrandomized Trials
D	<ul style="list-style-type: none"> • Cross Sectional Studies • Case Reports/Series • Reviews • Position Papers • Expert Opinion • Reasoning from Principle

225

Strength of Clinical Recommendation Levels	
Strong Recommendation:	The benefits of the recommendation clearly exceed the harms (or the harms clearly exceed the benefits in the case of a negative recommendation) and the quality of evidence is excellent (Grade A or B). In some clearly identified circumstances, a strong recommendation may be made on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms. <i>This recommendation should be followed unless a clear and compelling rationale for an alternative approach is present.</i>
Recommendation:	The benefits of the recommendation exceed the harms (or the harms exceed the benefits in the case of a negative recommendation), but the quality of evidence is not as strong (Grade B or C). In some clearly identified circumstances, a recommendation may be made on lesser evidence when high-quality evidence is impossible to obtain and the anticipated benefits strongly outweigh the harms. <i>This recommendation should generally be followed but remain alert for new information.</i>
Discretionary:	The current evidence is insufficient to assess the balance of benefits and harms of the recommendation. Evidence may be lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined. <i>There should be an awareness of this recommendation but a flexibility in clinical decision-making, as well as remaining alert for new information.</i>

226

227 **Clinical Notes and Statements** shown throughout the guideline may have quality of evidence grades
 228 (A, B, C, or D). For example, a clinical note or statement with a quality of evidence grade of “B” is shown
 229 as “(Evidence Grade: B)”.

230 **Evidence-based Action Statements** will be highlighted in an “Action” box, with the quality of
 231 evidence, level of confidence, and clinical recommendation level information listed. For example:

EVIDENCE-BASED ACTION STATEMENT: Older individuals (≥60 years of age) with central and/or peripheral vision loss should be counseled by their eye doctor about the potential for an increased risk of falls. ²⁰⁵⁻²⁰⁸
Evidence Quality: Grade B, Systematic Review, Cohort-Prospective Studies, Cohort-Retrospective Study. Level of Confidence: Medium. Clinical Recommendation Level: Recommendation. This recommendation should generally be followed but remain alert for new information.
Evidence Statements: In the Salisbury Eye Evaluation Study, visual field loss was reported to be the primary vision component that increases the risk of falls. For each 10 percent loss in visual field, individuals experienced 8 percent higher odds of falling, after adjustment for other factors. Peripheral visual field loss, in particular, was statistically significant. Visual field reduction is most likely related to the risk of falls through its effects on postural stability, the ability to maneuver around objects and decreased ability to detect steps or changes in surfaces. Although visual field loss cannot be reversed,

persons with such deficits may benefit from mobility training to navigate the environment more safely and reduce the risk of falling.²⁰⁵ (Evidence Grade: B)

The Los Angeles Latino Eye Study found that both central and peripheral visual impairment were associated with increased risk of falls and falls with injury, independent of age, gender and co-morbidities. Impairment in central vision increased the risk of falls by 2.4 times and falls with injury by 2.8 times. Peripheral vision loss increased falls risk 1.4-fold for both outcomes. Patients may benefit from being counseled about the impact of impaired vision on the increased risk of falls.²⁰⁷ (Evidence Grade: B)

A combination of interventions, including exercise and vision assessment and treatment, may help prevent injurious falls.²⁰⁸ (Evidence Grade: B)

Impaired vision is an important and independent risk factor for falls. Strong association exists between depth perception and falls, and distance edge contrast sensitivity and visual acuity, have also been linked to the risk of falls. Good visual acuity and distance edge contrast sensitivity have been shown to be important for detecting and avoiding hazards in the environment, especially when walking. The strong association between depth perception and falls suggests intact stereoacuity may be important for fall prevention.²⁰⁶ (Evidence Grade: C)

Cost-effective measures such as ensuring patient's spectacle correction is current, or the use of cataract surgery, when indicated, may also maximize vision and have an impact on preventing falls in older people.²⁰⁶ (Evidence Grade: C)

Potential Benefits: Patients with central and/or peripheral vision loss/impairment may benefit from fall prevention counseling and intervention when initially diagnosed.

Potential Risks/Harms: None.

Benefits and Harms Assessment: Benefits significantly outweigh harms.

Potential Costs: Direct costs of counseling as part of a comprehensive eye and vision examination.

Value Judgments: None.

Role of Patient Preferences: Moderate.

Intentional Vagueness: Specific type/form of counseling is not stated, as it is patient specific.

Gaps in Evidence: Research is needed to further evaluate the relationship between different forms of vision loss/impairment and falls.

232

233 The Action Statement profile provides additional information related to the development and
 234 implementation of the clinical recommendation. The following is an explanation of the categories listed in
 235 the profile:

236 **Evidence Quality** – The quality of evidence grade (A, B, C, or D) or the aggregate quality of
 237 evidence grade (if multiple studies were available for review) and the type of research study or
 238 studies reviewed.

239 **Level of Confidence** – The consistency of the evidence and the extent to which it can be trusted,
240 specified as high, medium, or low.

241 **Clinical Recommendation Level** – The level (Strong Recommendation, Recommendation, or
242 Discretionary) assigned to the implementation of the clinical recommendation made in the Action
243 Statement.

244 **Evidence Statements** – The clinical statements derived from research studies reviewed that support
245 the Action Statement.

246 **Potential Benefits** – Favorable changes which would likely occur if the Action Statement was
247 followed.

248 **Potential Risks/Harms** – Adverse effects or unfavorable outcomes that may occur if the Action
249 Statement was followed.

250 **Benefits and Harms Assessment** – A comparison of the relationship of benefits to harms specified
251 as “benefits significantly outweigh harms” (or vice versa) or a “balance of benefits and harms.”

252 **Potential Costs** – Direct and indirect costs may include costs of the procedure, test, or medication;
253 time spent by the eye doctor counseling the patient; administrative time; patient/caregiver time off
254 from work; etc.

255 **Value Judgments** – Determinations made by the Guideline Development Group in the development
256 of the Action Statement relating to guiding principles, ethical considerations, or other priorities.

257 **Role of Patient Preference** – The role the patient has in shared decision-making regarding
258 implementation of the Action Statement specified as large, moderate, small, or none.

259 **Intentional Vagueness** – Specific aspects of the Action Statement that are left vague due to factors
260 such as the role of clinical judgment, patient variability, concerns over setting legal precedent, etc.

261 **Gaps in Evidence** – Areas identified during evaluation of the research that show gaps in available
262 evidence.

263 **Consensus-based Action Statements**, based on consensus by the GDRG, will be highlighted in an
264 “Action” box, without any strength of evidence or clinical recommendation grading information listed. For
265 example:

266 **CONSENSUS-BASED ACTION STATEMENT:** At the conclusion of an eye and vision examination, the
267 diagnosis of any eye or vision problems should be explained to the patient and related to the patient’s
268 symptoms, along with a discussion of treatment plans and prognosis.

269 **Evidence Quality:** There is a lack of published research to support or refute the use of this
270 recommendation.

271 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to increase patient
272 understanding of any diagnosed eye or vision problems and improve compliance with any recommended
273 treatment. The benefits of this recommendation were established by expert consensus opinion.

274 C. Summary Listing of Action Statements

275 The following is a listing of the evidence-based and consensus-based recommendations for care
276 contained in the guideline:

277 Eye doctors should not rely on a single, normal confrontation visual field test result as proof that a
278 field loss is not present and should conduct formal perimetry on patients if there is a clinical suspicion
279 of a visual field defect.¹³⁴⁻¹³⁷ (Evidence Grade: B, Recommendation)
280

281 A comprehensive adult eye and vision examination should include, but is not limited to:

- 282 • Patient and family history, including visual, ocular and general health, medication usage, and
- 283 vocational and avocational visual requirements
- 284 • Measurement of visual acuity
- 285 • Determination of refractive status
- 286 • Assessment of ocular motility, binocular vision, and accommodation, as appropriate, based on
- 287 patient's age, visual signs and symptoms
- 288 • Ocular health examination, including evaluation of the anterior and posterior segments,
- 289 measurement of intraocular pressure, and visual field testing
- 290 • Systemic health assessment, as indicated
- 291 • Ancillary testing, as needed. (Consensus Statement)

292
293 At the conclusion of an eye and vision examination, diagnosis of any eye or vision problems should
294 be explained to the patient and related to the patient's symptoms, along with a discussion of
295 treatment plans and prognosis. (Consensus Statement)
296

297 Eye doctors should advise patients on appropriate and trustworthy sources of eye and vision care
298 information, including providing educational materials and counseling about eye health and vision
299 care topics, as needed.^{155,156,160,161,163,164} (Evidence Grade: B, Recommendation)
300

301 Eye doctors should counsel their patients on the benefits of a healthy lifestyle and remain alert for
302 new research that demonstrates the effects of diet and exercise on ocular and general health.
303 (Consensus Statement)
304

305 Eye doctors should counsel their patients on smoking cessation. They should document discussions
306 with their patients about their smoking status and inform them about the benefits to their eyes, vision
307 and overall health through smoking cessation.^{176,183} (Evidence Grade: B, Recommendation)
308

309 Individuals performing medium- to high-risk activities, monocular persons and those with previous eye
310 trauma or eye surgery should be strongly advised by their eye doctor to wear appropriate eye
311 protection with impact resistant properties. (Consensus Statement)
312

313 Since exposure to ultraviolet (UV) radiation is a risk factor for disorders of the eye, eye doctors should
314 advise their adult patients about the benefits of the regular use of sunglasses that effectively block at
315 least 99 percent of UVA and UVB radiation and the use of hats with brims when outdoors.
316 (Consensus Statement)
317

318 Older individuals (≥ 60 years of age) with central and/or peripheral vision loss should be counseled by
319 their eye doctor about the potential for an increased risk of falls.²⁰⁵⁻²⁰⁸ (Evidence Grade: B,
320 Recommendation)
321

322 Patients who will undergo or have undergone ocular surgery or other specialty care should be
323 counseled by their eye doctor regarding their ongoing need for periodic comprehensive eye and
324 vision examinations. (Consensus Statement)
325

326 Comprehensive eye and vision examinations are recommended annually for persons 18 through 39
327 years of age to optimize visual function, evaluate eye changes and provide for the early detection of
328 sight-threatening eye and systemic health conditions. Risk factors present may result in
329 recommendations for more frequent evaluations. (Consensus Statement)
330

331 Comprehensive eye and vision examinations are recommended annually for persons 40 through 64
332 years of age to optimize visual function, evaluate eye changes and provide for the early detection of
333 sight-threatening eye and systemic health conditions. Risk factors present may result in
334 recommendations for more frequent evaluations. (Consensus Statement)

335
336 For persons 65 years of age or older, annual comprehensive eye and vision examinations are
337 recommended to optimize visual function, evaluate eye changes and provide for the early detection of
338 sight-threatening eye and systemic health conditions. Risk factors present may result in
339 recommendations for more frequent evaluations.^{18,30,223} (Evidence Grade: C, Recommendation)

340
341 Adult patients should be advised by their eye doctor to seek eye care more frequently than the
342 recommended re-examination interval if new ocular, visual, or systemic health problems develop.
343 (Consensus Statement)

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347 I. INTRODUCTION AND GUIDELINE OBJECTIVES 348

349 This Evidence-based Clinical Practice Guideline for the Comprehensive Adult Eye and Vision
350 Examination describes appropriate examination procedures for evaluation of the eye health and vision
351 status of adult patients to reduce the risk of vision loss and provide clear, comfortable vision. It contains
352 recommendations for timely diagnosis, intervention and, when necessary, referral for consultation with
353 and/or treatment by another health care provider.
354

355 The recommendations in this guideline were developed to assist doctors of optometry in providing eye
356 and vision examinations for adults. Others who assist in providing coordinated patient care for specific
357 services may also gain insight from this document.
358

359 The objectives of this Guideline are to help doctors of optometry achieve the following:
360

- 361 • Recommend an appropriate timetable for eye and vision examinations for adults (age 18 or older).
- 362 • Select appropriate examination procedures for adults.
- 363 • Effectively examine the eye health, vision status, and ocular manifestations of systemic disease of
364 adults.
- 365 • Minimize or avoid the adverse effects of eye and vision problems in adults through prevention, early
366 detection and diagnosis, and patient management, including education and counseling.
- 367 • Inform and educate individuals and other health care practitioners about the importance of good
368 vision and the need for, and frequency of, comprehensive adult eye and vision examinations.
369

370 II. BACKGROUND 371

372 Eye and vision disorders have broad implications in health care because of their potential for negatively
373 impacting activities of daily living, resulting in decreased quality of life.²⁻⁵ They are associated with loss of
374 mobility and independence,^{6,7} difficulty maintaining employment,⁸ and can lead to reduced social
375 interaction and depression.⁹⁻¹¹ Many eye and vision disorders are chronic conditions that can affect
376 individuals for their entire lives. The economic and social burdens of these conditions are substantial and
377 projected to continue to increase as the aging population expands.¹²⁻¹⁴
378

379 In 2015, a total of 1.02 million people in the United States were legally blind (best-corrected visual acuity
380 of 20/200 or less in the better-seeing eye) and approximately 3.22 million people had visual impairment
381 (best-corrected visual acuity less than 20/40 in the better-seeing eye). In addition, up to 8.2 million people
382 had reduced vision due to uncorrected refractive errors. By 2050, the number of individuals with these
383 conditions is projected to double to approximately 2.01 million people with legal blindness, 6.95 million
384 people with visual impairment and 16.4 million with reduced vision due to uncorrected refractive errors.¹⁵
385

386 Visual impairment increases with age among all racial and ethnic groups. The elderly population (65
387 years and older) in the United States was approximately 56 million in 2020 and is estimated by the United
388 States Census Bureau to reach nearly 86 million by 2050.¹⁶
389

390 It is estimated that at least 40 percent of vision loss in the United States is either preventable or treatable
391 with timely intervention, yet many people are undiagnosed and untreated.¹⁷ The diagnosis and treatment
392 of eye diseases such as cataracts and glaucoma, and vision problems including refractive errors and
393 presbyopia, can result in improved visual function and health-related quality of life for adults of all ages.<sup>18-
394 20</sup>

395 A. Adult Eye and Vision Changes 396

397 Adulthood involves a wide range of activities in which good visual function and eye health are of great
398 value and importance. Changes in visual function can affect an individual's ability to perform many
399 activities of daily living.^{3,4,21-26} Since these changes can develop gradually and occur without symptoms,
400 their effect on visual function and performance may not be readily apparent.²⁷⁻²⁹

401 Normal age-related changes in visual function and ocular structures, and increases in the prevalence and
402 incidence of ocular and systemic disease with age, combine to make comprehensive eye and vision care
403 services particularly important for older adults.³⁰ The leading causes of vision impairment and blindness in
404 the United States, other than refractive errors, are primarily age-related diseases such as cataracts,
405 glaucoma and age-related macular degeneration.³¹ In addition, diabetic retinopathy, the most common
406 microvascular complication of diabetes, can occur in adults of any age.³²

407 Refractive errors, cataracts, age-related macular degeneration and diabetic retinopathy usually reduce
408 central vision, especially for reading and other near activities. Glaucoma characteristically affects
409 peripheral vision, which may alter balance and walking. Untreated, these conditions lead to problems with
410 taking medications, keeping track of personal information, walking, watching television, driving and
411 reading, and often create social isolation. Early detection and treatment of these conditions are likely to
412 translate into substantial economic savings and result in improved quality of life.³³

413

414 **B. Ocular Manifestations of Systemic Disease**

415

416 The eye is the only part of the human body where blood vessels and nerve tissue can be viewed directly
417 in their natural state. Alterations in retinal blood vessels allow the clinician to draw conclusions about the
418 status of blood vessels in the entire body.³⁴ Changes in the eye often precede or occur concurrently with
419 various systemic conditions and can represent important prognostic indications of disease progression.³⁵
420 A comprehensive eye examination presents a unique opportunity to observe and evaluate the impact that
421 systemic health problems such as diabetes, hypertension and hyperlipidemia have on the body and the
422 eyes.

423

424 For some individuals, signs of an undetected systemic disease may initially be found during an eye
425 examination. Detection of systemic diseases through a comprehensive eye and vision examination can
426 lead to earlier treatment resulting in better patient care, avoidance of complications and reduced health
427 care costs.^{36,37}

428

429 The following is a partial listing of systemic diseases whose ocular signs or symptoms may be observed
430 or reported during a comprehensive eye and vision examination.

431

432

433

434

**Table 1:
Systemic Diseases with Ocular Complications**

Albinism ³⁸	Influenza ⁵⁵	Scleroderma ⁷³
Alzheimer's disease ³⁹	Kawasaki disease ⁵⁶	Sickle cell disease ^{74,75}
Ankylosing spondylitis ⁴⁰	Leukemia ⁵⁷	Sinusitis ⁷⁶
Arteriosclerosis ³⁵	Marfan syndrome ⁵⁸	Sjögren's syndrome ^{56,77}
Behçet's disease ⁴¹	Migraine ⁵⁹	Stevens-Johnson syndrome ⁷⁸
Chlamydia ^{42,43}	Multiple sclerosis ^{60,61}	Sturge-Weber syndrome ⁷⁹
Cogan's syndrome ⁴⁴	Myasthenia gravis ⁶²	Syphilis ⁴²
Crohn's disease ⁴⁵	Nerve diseases and palsies ³⁵	Systemic lupus ^{80,81}
Diabetes mellitus ^{32,35}	Neurofibromatosis ⁶³	Thyroid dysfunction (e.g., Graves' disease) ³⁵
Fabry disease ⁴⁶	Pituitary tumors ⁶⁴	

Gonorrhea ⁴³	Psoriasis ⁶⁵	Toxocariasis ^{82,83}
Hepatitis ⁴⁷	Reiter's syndrome ⁶⁶	Toxoplasmosis ⁸⁴
Herpes simplex ⁴⁸	Rheumatoid arthritis ^{67,68}	Tuberculosis ^{85,86}
Herpes zoster ⁴⁹	Rosacea ^{69,70}	Usher syndrome ⁸⁷
Histoplasmosis ⁵⁰	Rubella ⁷¹	Vitamin A deficiency ⁸⁸
HIV/AIDS ^{51,52}	Sarcoidosis ⁷²	
Hypertension ^{53,54}		

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436 **C. Failure to Seek Care**

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Although comprehensive eye and vision examinations are essential for timely diagnosis and treatment of eye diseases and maintenance of good vision, many individuals do not seek regular eye care.⁸⁹ The cost of eye care, lack of insurance or the perception that no care is needed were found to be the most common reasons for not seeking eye care in adults age 40 years or older.^{90,91} A lack of transportation and difficulty trusting and communicating with the doctor have also been reported as barriers to care.^{92,93} In addition, many individuals may be unaware they have a sight-threatening eye condition due to a lack of early symptoms^{27,94} and some people may not seek care because they wrongly assume nothing can be done to improve their vision.⁹⁵ Others are not well informed or knowledgeable about eye health, eye disease and the need for regular eye examinations because messages about eye health and vision care may not be conveyed to them by the media or their primary care provider.⁹⁶

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Also, there may be confusion regarding the terminology of what constitutes an “eye examination.” Limited screening procedures, such as a visual acuity test given during a general physical examination or by the state Department of Motor Vehicles, use of an online visual acuity screening and other forms of public health vision screenings are not a substitute for a comprehensive eye and vision examination. There is no evidence that visual acuity screening alone for older adults is any better for improving clinical outcomes than no screening at all.⁹⁷ (Evidence Grade: A)

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Some individuals may choose to compensate for blurred vision by purchasing over-the-counter reading glasses instead of seeking an examination to determine the cause of any reduced vision. In so doing, they fail to receive the benefit of a comprehensive eye and vision examination, which may uncover sight-threatening eye or health problems.

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The comprehensive adult eye and vision examination is an important component in the evaluation of an individual's overall health status. Its extensive nature enables assessment of an individual's eye, vision and related health care needs and may provide access to other primary and preventive care services.

465

466 **D. Epidemiology of Eye and Vision Disorders in Adults**

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469

The prevalence of common eye and vision conditions underscores the importance of regular eye and vision care. Among the more frequent eye and vision conditions experienced by adults are:

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473

- Refractive errors

Vision changes due to refractive errors (myopia, hyperopia and/or astigmatism) are among the most frequent reasons for consultation with an eye care practitioner. In addition, uncorrected refractive

474 errors are the most common cause of reduced vision.⁹⁸⁻¹⁰¹ Blurred vision due to uncorrected refractive
475 errors can have immediate and long-term consequences such as lost educational and employment
476 opportunities, reduced productivity, impaired safety and decreased health-related quality of life.^{100,102}
477 Correction of refractive errors can lead to improvement in visual acuity in the majority of patients over
478 a wide range of ages.¹⁰³
479

480 Clinically significant refractive errors affect more than half of the United States population age 20
481 years or older. Estimates based on the 1999-2004 National Health and Nutrition Examination Survey
482 found the prevalence of refractive errors in persons 20 years of age or older to be: myopia ($\leq -1.00D$)
483 33.1 percent; severe myopia ($\leq -5.00D$) 6.5 percent; hyperopia ($\geq +3.00D$) 3.6 percent; astigmatism (\geq
484 1.00D) 36.2 percent. The prevalence of myopia is approximately equal in 20 to 39 and 40 to 59-year
485 age groups (36.2 percent compared to 37.7 percent) but is markedly lower for the ≥ 60 -year age
486 group (20.5 percent). Hyperopia increased from 1.0 percent in the 20- to 29-year age group to 2.4
487 percent in 40 to 59-year age group and to 10 percent in ≥ 60 -year age group.¹⁰⁴
488

489 Although most refractive errors first develop in childhood, the eye continues to undergo refractive
490 changes throughout adult life. The Beaver Dam Eye Study, involving persons older than 40 years of
491 age, reported changes in refractive error occurring over ten years. Younger people became more
492 hyperopic, while older people became more myopic.¹⁰⁵
493

494 • Presbyopia
495

496 Presbyopia, which results from the loss of eye focusing ability with age, can have multiple effects on
497 quality of vision and activities of daily living. Because presbyopia is the result of aging changes to the
498 eye's accommodative mechanism,¹⁰⁶ its prevalence is directly related to the proportion of the aging
499 population. Most individuals first begin experiencing the effects of presbyopia around ages 40 to 45.
500

501 When presbyopia is defined as a visual condition of everyone over the age of 45, the United States
502 Census Bureau 2020 population estimates would suggest that about 139 million Americans have
503 presbyopia. Approximately, one in eight Americans ≥ 50 years of age have near-vision impairment
504 due to uncorrected presbyopia.¹⁰⁷
505

506 • Cataracts
507

508 A cataract is an opacification of the crystalline lens of the eye. It is a leading cause of vision loss in
509 adults. Cataracts are clinically significant if they cause a decrease in visual acuity or a functional
510 visual impairment. Advancing age is the major risk factor for the development of cataracts; however,
511 a cataract may be present at or develop shortly after birth or occur later as a result of a metabolic
512 condition, medications, exposure to radiation, electric shock, trauma and ocular or systemic diseases.
513

514 Approximately 17.2 percent of Americans age 40 years and older have developed cataracts in one or
515 both eyes. By age 80, more than half are affected.¹⁰⁸
516

517 • Glaucoma
518

519 Glaucoma is a group of eye diseases characterized by optic neuropathy often resulting from
520 abnormally high intraocular pressure. It is one of the leading preventable causes of blindness.
521 Primary open-angle glaucoma is the most common form of the disease and is often asymptomatic in
522 the initial stages. The disease process can begin at any age, but the risk of glaucoma development
523 increases greatly after age 40.
524

525 An estimated 2.1 percent of persons 40 years of age and older in the United States have glaucoma.
526 It affects 2.9 million individuals, including 1.4 million women; 1.5 million men; 2.3 million people 60
527 years of age and older; and 0.9 million minorities, including Black and Hispanic Americans. Cases of
528 glaucoma are expected to reach 5.5 million by 2050, an increase of over 90 percent from 2014.¹⁰⁹
529

530 The National Health and Nutrition Survey (2005-2008) found over half of persons with glaucoma
531 were unaware that they had the disease.¹¹⁰ It is estimated that approximately 2.4 million persons in
532 the United States have undetected and untreated glaucoma. Overall, prevalence of both diagnosed
533 and undiagnosed glaucoma is much higher in minorities and the elderly. Among those with definite
534 glaucoma, individuals younger than 60 years of age have a greater proportion of undetected
535 disease.¹¹¹

536
537 ([Link to AOA Evidence-based Clinical Practice Guideline on Care of the Patient with Open Angle](#)
538 [Glaucoma](#), when available)

- 539
540 • Diabetic retinopathy

541
542 Diabetic retinopathy (DR), one of the most common microvascular complications of diabetes, is the
543 leading cause of new cases of blindness and low vision among adults 20 to 74 years of age in the
544 United States.^{32,112} It is often asymptomatic early in the disease, and visual loss is primarily due to the
545 development of diabetic macular edema, vitreous hemorrhage or traction retinal detachment.¹¹³
546 Diabetes duration and sustained hyperglycemia are among the primary risk factors for the
547 development of diabetic retinopathy;¹¹⁴ however, vision loss from DR is preventable with early
548 detection and prompt intervention.¹¹⁵

549
550 The number of persons with diabetes having diagnosed DR increased from 4.06 million to 7.69 million
551 between 2000 and 2010. Projected numbers from the Vision Health Initiative by the Centers for
552 Disease Control and Prevention (CDC) predict that the number of people with DR by 2050 will
553 increase to 16 million.¹¹²

554
555 [AOA Evidence-based Clinical Practice Guideline on Eye Care of the Patient with Diabetes Mellitus](#)

- 556
557 • Age-related macular degeneration

558
559 Age-related macular degeneration (AMD) causes a progressive loss of photoreceptors in the macula.
560 Risk factors include older age, smoking, dyslipidemia, obesity, white race, female sex and a family
561 history of AMD. There are two types of AMD: nonexudative (dry or geographic atrophy) and exudative
562 (wet or neovascular). Both cause progressive central vision loss with intact peripheral vision.
563 Nonexudative AMD accounts for 80 to 90 percent of all advanced cases, and more than 90 percent of
564 patients with severe vision loss have exudative AMD.¹¹⁶

565
566 AMD is among the most common causes of legal blindness in the United States, and some form of
567 AMD is thought to affect more than 9 million individuals.¹¹⁶ Persons with AMD are expected to double
568 by 2050, reaching 17.8 million among people age 50 or older.¹⁰⁹

- 569
570 • Dry eye disease

571
572 Dry eye disease (DED), a form of ocular surface disease, is one of the most common ocular problems
573 in the United States, particularly among older women.¹¹⁷ It is a multifactorial disease of the tears and
574 ocular surface resulting in symptoms of discomfort, visual disturbance and tear film instability, with
575 potential damage to the ocular surface.¹¹⁸

576
577 Results from the National Health and Wellness Survey estimate 6.8 percent of adults in the United
578 States (aged ≥18 years) have diagnosed DED. Prevalence is higher among women (8.8 percent)
579 than men (4.5 percent) and for individuals with autoimmune disease. DED increases with age from
580 2.7 percent in persons aged 18-to-34 to 18.8 percent in persons ≥75 years old.¹¹⁹

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583

584 **E. Cost of Eye and Vision Disorders**

585
586 Eye disorders and vision loss are generally chronic conditions that continue for the duration of an
587 individual's life, resulting in ongoing expenses for treatment and the related social costs of vision loss.
588 The total economic costs of eye disorders and vision loss for all adults 18 years of age or older in the
589 United States in 2013 was estimated to be \$133.2 billion.¹²⁰ This includes both the direct costs for eye
590 care services and vision aids, as well as the indirect costs for reduced productivity, decreased quality of
591 life and loss of independence. The majority of these costs (55 percent) occur in persons aged 65 years
592 and older and is likely to increase due to the aging population. Adults younger than 40 years of age may
593 incur as much as \$21.6 billion of the total cost of vision loss and eye disorders. When the costs of lost
594 productivity are included, adults younger than 40 years of age may account for more than a third of the
595 total cost.¹²

596
597 In 2013, the costliest eye and vision condition for adults was refractive error (\$14.2 billion). Cataracts
598 were the second costliest disorder (\$10.6 billion), followed by blindness and low vision (\$9.9 billion).
599 Costs for retinal disorders and glaucoma totaled \$8.6 billion and \$5.7 billion, respectively. Although
600 correction of refractive error is the costliest disorder due to the high prevalence of this condition in the
601 adult population, per-person vision correction costs were lower than all other eye and vision disorders at
602 an estimated \$81 per person, per year.¹²⁰

603 **III. CARE PROCESS**

604 **A. Comprehensive Adult Eye and Vision Examination**

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606
607 The comprehensive adult eye and vision examination provides the means to evaluate the structure,
608 function and health of the eyes and vision system. The examination is a dynamic and interactive process.
609 It involves collecting subjective data directly from the patient and obtaining objective data by observation,
610 examination and testing. (See Appendix 1: Comprehensive Adult Eye and Vision Examination: A
611 Flowchart)

612
613 The nature of the eye and vision system is such that many conditions have the same or similar
614 symptoms. For example, blurred vision can result from many causes, including uncorrected refractive
615 errors, binocular vision dysfunction, ocular and systemic diseases and sight- or life-threatening conditions
616 such as eye or brain tumors. In addition, potentially blinding conditions such as glaucoma or diabetic
617 retinopathy may cause no symptoms until they are advanced and the ocular damage is irreparable.

618
619 The goals of the comprehensive adult eye and vision examination are to:

- 620
621 • Evaluate the functional status of the eyes and vision system, taking into account special vision
622 demands and needs.
- 623
624 • Assess ocular health and related systemic health conditions.
- 625
626 • Establish a diagnosis (or diagnoses).
- 627
628 • Formulate a treatment and management plan.
- 629
630 • Counsel and educate the patient regarding his or her visual, ocular and related systemic health
631 care status, including recommendations for prevention, treatment, management, or future care.

632 **1. General Considerations**

633
634 This Guideline describes the comprehensive eye and vision examination for patients 18 years of age or
635 older. The examination components described are not intended to be all-inclusive. Professional judgment
636
637

638 and individual patient symptoms and findings may significantly influence the nature and course of the
639 examination. The examination process may also vary from that delineated in this Guideline according to
640 patient cooperation and comprehension, as well as the examination setting. For example, professional
641 judgment may dictate modification of the examination for the developmentally delayed or frail adult, or for
642 the adult in an institutional setting such as an extended care facility.

644 It is important for eye care services to be provided in a healthy and safe environment. Doctors of
645 optometry should take reasonable precautions to minimize the risk of exposure to infection for patients
646 and staff. This may include routine application of standard infection control precautions including
647 appropriate handwashing, utilization of single use medical supplies/instruments, appropriate disposal of
648 waste, proper methods of disinfection when items are reused, staff vaccinations and use of more rigorous
649 infection control procedures for individuals who are known to be infected or
650 immuno-suppressed.¹²¹

651 **2. Examination Procedures***

654 A comprehensive eye and vision examination includes an in-depth patient history; tests to thoroughly
655 evaluate the patient's visual function, ocular health, and related systemic health status; an assessment of
656 examination findings; and the development of a plan for treatment/management and future care.

658 ***NOTE:** Specific test and procedures listed are provided as examples only and are not a complete listing
659 of testing options. Clinicians should remain alert for new and emerging technologies, instruments and
660 procedures, and incorporate them into the clinical examination, as appropriate.

662 The examination should include:

664 **a. Patient History**

666 The patient history is an initial and ongoing component of the examination. The objective is to obtain
667 specific information about the patient's perception of their eye and vision status and important background
668 information on related medical issues. It helps to identify and assess problems, and it provides an
669 opportunity to become acquainted with the patient, establishing a relationship of confidence and trust.
670 The collection of demographic data generally precedes the taking of the patient history.

672 Major components of the patient history include:

- 674 • Nature and history of the presenting problem, including chief complaint.
- 676 • Visual and ocular history.
- 678 • General health history, including a social history and review of systems.
- 680 • Family ocular and health histories.

682 ***Clinical note:*** *Some patients may fail to disclose medically relevant information to clinicians which*
683 *can undermine patient care or even lead to patient harm. Nondisclosure of information may occur*
684 *because of embarrassment or a desire to avoid potential judgement or lecturing.*¹²²

- 686 • Medication usage, including prescription and nonprescription drugs; use of mineral, herbal, and
687 other vitamin supplements; documentation of medication allergies; and utilization of other
688 complementary and alternative medicines.

689 ***Clinical note:*** *Any systemic medication or supplement used by a patient should be reviewed for*
691 *ocular risk factors or side effects.*¹²³ ([U.S. National Library of Medicine information regarding the](#)
692 [side effects of Drugs, Herbs and Supplements](#))

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- Vocational and avocational visual requirements.
- Names of and contact information for the patient's other health care providers.

b. Visual Acuity

Visual acuity should be measured monocularly and binocularly, with and without the patient's most recent spectacle or contact lens correction, using the following procedures:

- Distance visual acuity.
- Near visual acuity.
- Pinhole acuity, when indicated.
- Visual acuity at identified vocational or avocational working distances.

Clinical note: When assessing visual acuity in patients without pre-existing ocular disease, Snellen and Early Treatment Diabetic Retinopathy Study (ETDRS) charts can be used interchangeably.¹²⁴ (Evidence Grade: C)

c. Refraction

A refraction may include objective and subjective assessment of the patient's refractive status; however, the results of a refraction do not provide all the information needed to determine an optical prescription. The refractive error measured should be analyzed with other testing data and an assessment of the patient's visual needs obtained during an in-person examination. This information is used to determine if, and in what amount, an optical correction is needed to provide optimal vision and comfort for all viewing distances. The refractive analysis may include:

- Measurement of the patient's most recent or habitual optical correction (e.g., lensometry).
- Objective measurement of refractive status (e.g., retinoscopy, autorefraction).
- Subjective measurement of refractive status (e.g., phoropter).
- Cycloplegic refraction, if needed.

d. Ocular Motility, Binocular Vision and Accommodation

Depending on the patient's age, visual signs and symptoms, and preliminary test results, appropriate tests of ocular motility, binocular visual function at distance and near, and accommodation may be incorporated into the examination. The interrelationship of these functional aspects of vision is especially critical for clear, comfortable vision for reading and other close work. Procedures may include:

- Evaluation of ocular alignment and motility (e.g., cover test, versions).

Clinical note: The estimated cover test, prism neutralized objective cover test, and the prism neutralized subjective cover test are equally reliable and comparable when performed by skilled clinicians for determining heterophoria, while the subjective prism neutralized test is recommended for those less experienced in use of the cover test.¹²⁵ (Evidence Grade: C)

746 **Clinical note:** A focused patient history can often provide a framework for accurately localizing
747 the cause of any diplopia and help to direct the examination to an underlying cause.¹²⁶ (Evidence
748 Grade: D)
749

- 750 • Assessment of heterophorias, vergence amplitude and facility (e.g., near point of convergence
751 (NPC), heterophoria measurement).
752

753 **Clinical note:** Measurement of lateral heterophoria may be performed using the prism
754 neutralized cover test, von Graefe test, or Modified Thorington test. The Modified Thorington test
755 has been shown to have the highest inter-examiner correlation and provides the most repeatable
756 method of the three cover tests for evaluating near heterophoria.¹²⁷ (Evidence Grade: C)
757

758 **Clinical note:** Diagnosis of binocular vision dysfunctions for the symptomatic patient with normal
759 distance phoria and accommodative convergence/accommodation (AC/A) ratio can be improved
760 through the use of vergence facility testing at near.¹²⁸ (Evidence Grade: D)
761

762 **Clinical note:** Clinicians should consider screening for near point of convergence as part of a
763 concussion evaluation in athletes to help diagnose and guide treatment recommendations,
764 academic accommodations, and referrals for vision therapy, when needed.¹²⁹ (Evidence Grade:
765 D),¹³⁰ (Evidence Grade: C)
766

- 767 • Testing for suppression (e.g., stereopsis testing).
768
- 769 • Measurement of accommodative amplitude and facility (e.g., push-up technique, positive and
770 negative relative accommodation, flipper lenses).
771

772 e. Ocular Examination and Systemic Health Assessment 773

774 Thorough assessment of the health of the eyes and associated structures is an important and integral
775 component of the comprehensive adult eye and vision examination. The eyes and associated structures
776 are not only sites for primary ocular diseases, but are also subject to systemic disease processes that
777 affect the body as a whole (e.g., disorders of neurologic, vascular, endocrine, immune, or neoplastic
778 origin). This part of the examination contributes to the diagnosis of diseases and disorders that have
779 ocular manifestations and helps determine the impact of any systemic disease on the eye and associated
780 structures.

781 The components of an ocular and systemic health assessment may include:
782

- 783 • Observation of pupil size and pupillary responses.
784
- 785 • Evaluation of the ocular anterior segment and adnexa (e.g., slit lamp biomicroscopy).
786
- 787 • Measurement of intraocular pressure (IOP) (e.g., tonometry).
788

789 The Goldmann applanation tonometer is considered the reference standard for the measurement of
790 IOP. Non-contact and handheld applanation tonometers, however, can provide IOP measurements
791 close to, but marginally higher than, the Goldmann.¹³¹ (Evidence Grade: A) Because of intra-
792 measurement variations, clinicians may want to take more than one reading when using an
793 applanation tonometer to reduce measurement errors.¹³² (Evidence Grade: D)
794

795 **Clinical note:** Measurement of a patient's IOP should include a record of the type of instrument
796 used and time of day. Consistent use of the same tonometer during clinical follow-up testing may
797 be as important as the choice of tonometer.¹³³
798

- 799 • Evaluation of the ocular media (e.g., slit lamp biomicroscopy).
800

- 801 • Evaluation of the ocular posterior segment (e.g., direct or indirect ophthalmoscopy).
802
803 • Visual field testing (e.g., confrontation visual field, Amsler grid).
804
805 Confrontation visual field testing may be used as a screening test, if the clinician understands its
806 limitations.¹³⁴ (Evidence Grade: B) It is a simple and inexpensive method of identifying visual field
807 loss. Subjective description of the clinician's face and quadrant finger counting are not very
808 sensitive, but might quickly identify a substantial loss in visual field. A study of persons who
809 underwent confrontation visual field testing and automated static perimetry at the same time found
810 that normal visual fields on automated perimetry were often normal on confrontation testing, with a
811 high specificity of 93.4 percent.¹³⁵ (Evidence Grade: B)
- 812 When a defect is detected with confrontation visual fields, it is almost always real; however,
813 confrontation fields have a relatively low sensitivity for detecting visual field defects (63 percent)
814 due to poor sensitivity to arcuate and superior defects. Confrontation visual fields can find large
815 peripheral and dense defects and should be a part of the adult eye examination when a field defect
816 is suspected.¹³⁶ (Evidence Grade: B)
- 817 The diagnostic accuracy of confrontation visual field testing is low when performed as a stand-alone
818 test.¹³⁴ (Evidence Grade: B) The sensitivity of confrontation testing can be improved by using
819 additional test procedures. Testing of the central 20 degrees of the visual field with a small red
820 target and the red color comparison test¹³⁷ (Evidence Grade: C) or testing with a 5mm red target
821 along with the static finger wiggle test (using two index fingers) have been shown to increase
822 testing sensitivity and specificity. However, formal perimetry should be conducted if there is a
823 strong clinical suspicion of a visual field defect.¹³⁴ (Evidence Grade: B)
- 824 • Systemic health assessment (e.g., blood pressure measurement; carotid artery assessment,
825 laboratory testing, imaging, cranial nerve assessment).
826

EVIDENCE-BASED ACTION STATEMENT: Eye doctors should not rely on a single, normal confrontation visual field test result as proof that a field loss is not present, and should conduct formal perimetry on patients if there is a clinical suspicion of a visual field defect.¹³⁴⁻¹³⁷

Evidence Quality: Grade B, Cohort-Retrospective Study, Cohort-Prospective Studies.

Level of Confidence: Medium.

Clinical Recommendation Level: Recommendation. This recommendation should generally be followed but remain alert for new information.

Evidence Statements: When a defect is detected with confrontation visual fields, it is almost always real; however, confrontation fields have a relatively low sensitivity for detecting visual field defects (63 percent) due to poor sensitivity to arcuate and superior defects. Confrontation visual fields can find large peripheral and dense defects and should be a part of the adult eye examination when a field defect is suspected.¹³⁶ (Evidence Grade: B)

Normal visual fields on automated perimetry were often normal on confrontation testing, with a high specificity of 93.4 percent.¹³⁵ (Evidence Grade: B)

Testing of the central 20 degrees of the visual field with a small red target and the red color comparison test¹³⁷ (Evidence Grade: C) or testing with a 5mm red target along with the static finger wiggle test (using two index fingers) have been shown to increase testing sensitivity and specificity. However, formal visual field testing should be conducted if there is a strong clinical suspicion of a visual field defect.¹³⁴ (Evidence Grade: B)

Confrontation visual field testing may be used as a screening test, if the clinician understands its limitations.¹³⁴ (Evidence Grade: B)

Potential Benefits: Decreased likelihood that a visual field defect will be missed.	Potential Risks/Harms: Potential patient discomfort as a result of testing.
Benefits and Harms Assessment: Benefits significantly outweigh harms.	
Potential Costs: Direct cost of testing as a component of a comprehensive eye and vision examination.	
Value Judgments: The sensitivity of confrontation visual field testing can vary depending on the type and location of field loss and the method used to perform the testing.	
Role of Patient Preferences: Small.	
Intentional Vagueness: Specific types of confrontation visual field testing are not stated as they are considered practice of medicine decisions.	
Gaps in Evidence: None identified.	

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f. Ancillary Testing

During an eye and vision examination, the eye doctor continually assesses information obtained from the patient along with the clinical findings gathered. The interpretation of subjective and objective data may reveal the need for additional testing, either performed or ordered by the eye care provider. Ancillary procedures may be performed at the initial examination or during subsequent examinations. If ancillary tests are performed, an interpretation and report may be required.

Additional testing may be indicated to confirm or rule out differential diagnoses, enable more in-depth assessment or provide alternative means of evaluating patients who may not be fully cooperative or who may not comprehend testing procedures. Testing may include, but is not limited to:

- Color vision testing – used to diagnose and differentiate congenital and acquired color vision deficiency.

Clinical note: *Some pseudoisochromatic plate tests only detect protan and deutan color vision deficiency, while other color vision tests provide the added advantage of detection of tritan defects and may be able to identify mild defects. Additional tests (e.g., Farnsworth D-15, anomaloscope) may be needed to properly categorize moderate or severe color vision deficiency.*¹³⁸ (Evidence Grade: B)

- Contrast sensitivity testing – measures the ability to detect low contrast images and subtle changes in vision not measured by visual acuity and may be used to evaluate patients with macular degeneration, cataract or glaucoma.
- Dark adaptometry – measures the ability of the eyes to adapt from bright light to darkness and may be used to evaluate complaints of poor night vision and the presence of retinal diseases (e.g., age-related macular degeneration, cone dysfunction syndrome).
- Dry eye assessment – evaluates the quantity and quality of tears and may include measurement of tear production, evaluation of ocular surface staining, tear-film break-up time, and blink rate.
- Fundus photography – used to document the status of the retina and to evaluate the progression of retinal disease.

- 862 • Glare testing – evaluates any reduction in the retinal image caused by intraocular light scattering.
863 (e.g., the effects of cataracts or an ocular media opacity on vision).
864
- 865 • Gonioscopy – used to visualize and evaluate the anterior chamber angle to determine if it is open,
866 narrowed, or the possibility of it becoming closed.
867
- 868 • Keratometry/corneal topography/corneal tomography – measure the curvature of the surface of the
869 cornea to determine the extent of corneal astigmatism for the fitting of contact lenses, for identifying
870 keratoconus, and for monitoring corneal pathology.
871
- 872 • Optical coherence tomography – provides in vivo, cross-sectional high-resolution images of the
873 anterior chamber, retina, optic nerve head and retinal nerve fiber layer.
874
- 875 • Pachymetry – used to measure corneal thickness and diagnose and/or monitor glaucoma,
876 keratoconus and other corneal dystrophies, and post-surgical edema.
877
- 878 • Threshold visual field testing – identifies defects in peripheral vision (e.g., for the diagnosis of
879 glaucoma and other diseases) and is used to monitor treatment to determine if the disease is under
880 control or if vision loss is progressing.
881
882

883 **CONSENSUS-BASED ACTION STATEMENT:** A comprehensive adult eye and vision examination
884 should include, but is not limited to:

- 885 • Patient and family history, including visual, ocular and general health, medication usage, and
886 vocational and avocational visual requirements
887 • Measurement of visual acuity
888 • Determination of refractive status
889 • Assessment of ocular motility, binocular vision, and accommodation, as appropriate, based on
890 patient's age, visual signs and symptoms
891 • Ocular health examination, including evaluation of the anterior and posterior segments,
892 measurement of intraocular pressure, and visual field testing
893 • Systemic health assessment, as indicated
894 • Ancillary testing, as needed.
895

896 **(See Appendix 1: Comprehensive Adult Eye and Vision Examination: A Flowchart)**
897

898 **Evidence Quality:** There is a lack of published research to support or refute the use of this
899 recommendation.
900

901 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to result in more
902 effective diagnosis of eye and vision problems in adults. The benefits of this recommendation were
903 established by expert consensus opinion.
904

905 3. Assessment and Diagnosis

906

907 At the completion of the examination, the eye doctor should assess and evaluate the data to establish a
908 diagnosis (or diagnoses) and formulate a treatment and management plan. The nature and severity of the
909 problem(s) diagnosed determine the need for an optical prescription (e.g., eyeglasses or contact lenses)
910 or other treatment (e.g., prescription of ocular pharmaceuticals, vision rehabilitation services, vision
911 therapy). A prescription for correction of any refractive error is provided at the conclusion of the
912 examination. For some patients, further assessment and/or treatment by another eye doctor, the patient's
913 primary care physician, or another health care provider may be indicated.
914

915 **4. Potential Benefits and Harms of Testing**

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The potential benefits of a comprehensive adult eye and vision examination may include:

- Optimizing visual function through diagnosis, treatment and management of refractive, ocular motor, accommodative and binocular vision problems.
- Improving quality of life by preventing and/or minimizing vision loss through early diagnosis, treatment, and management of ocular health conditions.
- Detecting systemic disease and referral for appropriate care.
- Counseling and educating patients on current conditions and preventive care to maintain ocular and systemic health and visual function.

Potential harms associated with a comprehensive adult eye and vision examination may include:

- Patient anxiety about testing procedures or resulting diagnosis.
- Adverse ocular and/or systemic reactions.
- Temporary visual disturbances resulting from testing, or allergic responses to diagnostic pharmaceutical agents or materials used.
- Missed or misdiagnosis of eye health or vision problems.
- Unnecessary referral or treatment.

5. Clinical Record Keeping

Clinical record keeping is an integral part of patient care. Regardless of the form of the records (e.g., paper or electronic), good record keeping provides a legally binding account of the care provided, supports clinical decision-making and helps to direct ongoing care. Record keeping in the United States health care system, including optometric practices, has undergone significant transition from paper-based records to electronic health records (EHRs).

The 21st Century Cures Act is intended to set a foundation for sharing of electronic health information to support patient care.¹³⁹ The rule is designed to provide patients and health care providers with secure access to electronic health information and support the easy exchange of that information. Information in the EHR that must be shared with patients includes consultation, history, physical examination notes, laboratory reports, and progress notes.

The EHR's impact on patient-doctor communications remains unclear. Despite objective evidence that EHR use may negatively impact patient-doctor communication,¹⁴⁰ (Evidence Grade: D) a study examining patient perceptions of EHR use found no change in patient satisfaction or patient-doctor interaction.¹⁴¹ (Evidence Grade: A) It is important for clinicians to remain patient-centered while effectively using EHRs.¹⁴²

Patients' access to their clinical records has increased with the implementation of EHRs. A study of eye care patients found that most were strongly in favor of having online access to their clinical record and were optimistic this access would improve their understanding and self-care, although over 40 percent had concerns about privacy issues. Providing online access to patients' clinical notes may enhance doctor-patient communications and improve clinical outcomes.¹⁴³ (Evidence Grade D)

969 When comparing traditional paper to EHRs, generally paper records are found to be significantly more
970 complete. Therefore, additional training in data collection and improving the design of EHRs may be
971 needed to enhance the usability and completeness of EHRs in clinical settings.¹⁴⁴ (Evidence Grade: D)
972

973 **B. Management**

974 975 **1. Patient Counseling and Communication**

976
977 Counseling of the patient at the conclusion of a comprehensive adult eye and vision examination should
978 include a review and discussion of examination findings and anticipated outcomes based upon the results
979 of the assessment. Patients expect to receive information about their diagnosis, recommended treatment
980 and prognosis explained in understandable language.¹⁴⁵
981

982 Patient counseling may include:

- 983
984 • Review of the patient's visual and ocular health status in relation to their visual symptoms and
985 complaints.
- 986
987 • Discussion of any refractive correction that provides improved visual efficiency and/or appropriate
988 eye protection.
- 989
990 • Explanation of available treatment options for diagnosed eye or vision conditions, including risks,
991 benefits, and expected outcomes.
- 992
993 • Recommendation of a course of treatment with the reasons for its selection and the prognosis.
- 994
995 • Discussion of the importance of patient compliance with the treatment prescribed.
- 996
997 • Recommendation for follow-up care, re-examination, or referral.
- 998

999 When appropriate, patients should also be counseled about the need for referral. When referral for ocular
1000 surgery or other specialty care is indicated, patients need to receive information about the purpose of the
1001 referral and the potential benefits and harms of the procedure or service.
1002

1003 **CONSENSUS-BASED ACTION STATEMENT:** At the conclusion of an eye and vision examination,
1004 diagnosis of any eye or vision problems should be explained to the patient and related to the patient's
1005 symptoms, along with a discussion of treatment plans and prognosis.

1006
1007 **Evidence Quality:** There is a lack of published research to support or refute the use of this
1008 recommendation.

1009 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to increase patient
1010 understanding of any diagnosed eye or vision problems and improve compliance with any recommended
1011 treatment. The benefits of this recommendation were established by expert consensus opinion.

1012 Doctor-patient communication plays an important role in the delivery of high-quality health care.¹⁴⁶ It is
1013 one of the most essential dynamics in health care, affecting the course of patient care and patient
1014 compliance with recommendations for care. Optimal doctor-patient communications involve a balance of
1015 talk and interruptions, everyday discourse rather than scripted communication, active listening, and
1016 proper nonverbal communication.¹⁴⁷ (Evidence Grade: D)
1017

1018 When communicating with patients, it is important to take their level of health literacy into consideration.
1019 Health literacy is “the degree to which individuals have the capacity to obtain, process, and understand

1020 basic health information and services needed to make appropriate decisions regarding their health.”¹⁴⁸
1021 Poor health literacy is associated with worse health-related outcomes in many chronic conditions.
1022

1023 Clinicians should tailor their communication styles to match patients' educational backgrounds and
1024 language ability.¹⁴⁹ (Evidence Grade: B) Language and cultural differences or misunderstandings may
1025 prevent individuals from accepting a doctor's recommendations. For example, many individuals with
1026 vision impairment do not understand what vision rehabilitation entails and how they could benefit. A
1027 heightened awareness of low vision rehabilitation may be achieved with better communication by eye
1028 care professionals.¹⁵⁰ (Evidence Grade: D)
1029

1030 In addition, anxiety reduces the effectiveness of patient-practitioner communications and results in
1031 reduced attention, recall of information, and compliance with treatment. The use of patient-centered
1032 communications and active listening can help reduce anxiety and improve patient satisfaction and
1033 outcomes.¹⁵¹
1034

1035 The use of mobile phone technology, particularly text messaging, is a low cost and easy method for
1036 communicating with patients. It can provide information effectively and concisely and may improve patient
1037 attendance at appointments and medication adherence.¹⁵² (Evidence Grade: A) Mobile phone text
1038 messaging reminders may increase attendance at healthcare appointments compared to either no
1039 reminders or postal reminders. Text messaging reminders are similar to telephone reminders in terms of
1040 their effect on attendance rates, but cost less than telephone reminders.¹⁵³ (Evidence Grade: A)
1041

1042 In compliance with the Americans with Disabilities Act (ADA), eye care providers need to make
1043 reasonable accommodations to ensure that whatever is written or spoken is clear and understandable to
1044 individuals with disabilities. Appropriate auxiliary aids and services must be made available, when
1045 needed, to enable effective communications when evaluating, treating, or counseling persons with
1046 hearing, vision or speech impairments. According to the ADA, auxiliary aids and services for individuals
1047 who are hearing impaired include qualified interpreters, note takers, computer-aided transcription
1048 services, written materials, telephone handset amplifiers, assistive listening systems, telephones
1049 compatible with hearing aids, closed caption decoders, open and closed captioning, telecommunications
1050 devices for the deaf (TDDs), videotext displays and exchange of written notes. For individuals with vision
1051 impairments, auxiliary aids and services include qualified readers, taped texts, audio recordings,
1052 magnification software, optical readers, Braille materials and large print materials. Examples for
1053 individuals with speech impairments include TDDs, computer terminals, speech synthesizers and
1054 communication boards.¹⁵⁴
1055

1056 2. Patient Education

1057

1058 Effective patient education often requires frequent repetition of instructions and reinforcement of benefits
1059 of proposed treatment. A high rate of concordance can be achieved through intensive patient education. It
1060 is very important for clinicians to repeat and continue repeating instructions to patients.¹⁵⁵ (Evidence
1061 Grade: B)
1062

1063 The use of video-based media appears to be effective in improving patient understanding and in certain
1064 cases may ameliorate overall outcome.¹⁵⁶ (Evidence Grade: B) Also, the use of educational videos may
1065 enhance patient techniques (e.g., eye drop installation) at little cost or time burden to the clinician.¹⁵⁷
1066 (Evidence Grade: C) In one study, education about how to administer drops for glaucoma was associated
1067 positively with percentage of the correct number of doses taken each day and percentage of the
1068 prescribed doses taken on time.¹⁵⁸ (Evidence Grade: C)
1069

1070 **Clinical note:** While clinicians should make efforts to assist patients in adhering to medication use,
1071 no specific strategies have been shown to be more effective than others in improving patient
1072 adherence to the prescribed treatment regimen.¹⁵⁹ (Evidence Grade: A)
1073

1074 Showing and explaining personal retinal images as part of patient education may be a practical strategy
 1075 for clinicians to improve motivational and health outcomes in patients with diabetes.¹⁶⁰ (Evidence Grade:
 1076 B) Patient education and patient reminders also may play a positive role in encouraging individuals with
 1077 chronic medical conditions such as diabetes to seek an annual eye examination.¹⁶¹ (Evidence Grade:
 1078 A),¹⁶² (Evidence Grade: B)

1079
 1080 Unfortunately, many patient education materials may not be written at a readability level for patients with
 1081 low health literacy. Patient education can be improved by selecting materials that are in the range of
 1082 sixth- to eighth-grade reading levels, which can help to improve patient understanding.¹⁶³ (Evidence
 1083 Grade: B) In addition, there is a need to lower the difficulty of online educational materials on eye and
 1084 vision care so they are easier to understand. The average difficulty of materials on the internet is
 1085 significantly higher than United States Department of Health and Human Services recommendations that
 1086 materials be written at or below the sixth-grade reading level to optimize comprehension.¹⁶⁴ (Evidence
 1087 Grade: B)
 1088

EVIDENCE-BASED ACTION STATEMENT: Eye doctors should advise patients on appropriate and trustworthy sources of eye and vision care information, including providing educational materials and counseling about eye health and vision care topics, as needed.^{155,156,160,163,164}

Evidence Quality: Grade B, Randomized Clinical Trial, Systematic Review, Cohort-Pro prospective Studies, Case Series.

Level of Confidence: Medium.

Clinical Recommendation Level: Recommendation. This recommendation should generally be followed but remain alert for new information.

Evidence Statements: There is a need to lower the difficulty of online educational materials on eye and vision care so they are easier to understand. The average difficulty of materials on the internet is significantly higher than United States Department of Health and Human Services recommendations that materials be written at or below the sixth-grade reading level to optimize comprehension.¹⁶⁴ (Evidence Grade: B)

Many patient education materials may not be written at a readability level for patients with low health literacy. Patient education can be improved by selecting materials that are in the range of sixth- to eighth-grade reading levels, which can help to improve patient understanding.¹⁶³ (Evidence Grade: B)

A high rate of concordance can be achieved through intensive patient education, which by necessity involves frequent repetition of instructions and re-enforcement of benefits. It is very important for clinicians to repeat and continue repeating instructions to patients.¹⁵⁵ (Evidence Grade: B)

Showing and explaining personal retinal images as part of patient education may be a practical strategy for clinicians to improve motivational and health outcomes in patients with diabetes.¹⁶⁰ (Evidence Grade: B)

The use of video-based media appears to be effective in improving patient understanding and in certain cases may ameliorate overall outcomes.¹⁵⁶ (Evidence Grade: B)

Potential Benefits: Counseling and educating patients about eye and vision care topics may provide them with a better understanding of diagnosed eye and vision conditions and enhance compliance with treatment and management recommendations.

Potential Risks/Harms: None.

Benefits and Harms Assessment: Benefits significantly outweigh harms.

Potential Costs: Direct cost of counseling as part of a comprehensive eye and vision examination.

Value Judgments: None.

Role of Patient Preferences: Large.

Intentional Vagueness: Specific type/form of counseling/educational materials is not stated as it is patient specific.

Gaps in Evidence: Research is needed to identify the most effective methods of patient education.

1089
1090 Areas of patient education may include:

1091
1092 **a. Healthy Lifestyle**

1093
1094 A healthy diet and regular exercise are important to good eye health. Maintaining a healthy lifestyle may
1095 help to prevent or slow the progression of glaucoma, cataracts, diabetic retinopathy and age-related
1096 macular degeneration in certain individuals¹⁶⁵⁻¹⁷⁰ and may be a factor in lowering blood pressure and
1097 preventing cardiovascular disease.¹⁷¹⁻¹⁷⁴

1098
1099 **CONSENSUS-BASED ACTION STATEMENT:** Eye doctors should counsel their patients on the benefits
1100 of a healthy lifestyle and remain alert for new research that demonstrates the effects of diet and exercise
1101 on ocular and general health.

1102
1103 **Evidence Quality:** An evaluation of published research to support or refute the use of this
1104 recommendation was not conducted for this guideline.

1105
1106 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to increase patient
1107 awareness of the value of a healthy diet and exercise on their eye and general health. The benefits of this
recommendation were established by expert consensus opinion.

1108
1109 **b. Smoking Cessation**

1110 Smoking can play a significant role in general and ocular health. Individuals who smoke are at increased
1111 risk for the development of cardiovascular disease, cancer and diabetes.¹⁷⁵ In addition, cigarette smoking
1112 places them at risk for a number of eye diseases, including cataracts,^{176,177} age-related macular
1113 degeneration,^{178,179} glaucoma,¹⁸⁰ ocular surface disorders¹⁸¹ and the development of visual impairment.¹⁸²

1114
1115 Smoking cessation, along with an active lifestyle, may be important in preserving visual function and
1116 reducing visual impairment. Therefore, behavioral modifications may play a role in preventing visual
1117 impairment in adults.¹⁸³ (Evidence Grade: B) Smoking cessation is associated with a reduced risk of
1118 cataract formation, and some early lens damage may be reversible. The reduction in risk appears
1119 strongest for those who have quit smoking within the past decade, but is not so robust in those who quit
1120 longer than ten years ago.¹⁷⁶ (Evidence Grade: B)

1121
1122 Although they are aware of the impact of smoking on ocular health, doctors of optometry don't always talk
1123 to their patients about smoking or encourage smoking cessation. They should discuss the use of tobacco
1124 products and advise cessation treatment, if appropriate.¹⁸⁴ (Evidence Grade: D)

1125
1126 **Clinical note:** Smoking plays a significant role in ocular disease. Assessing a patient's smoking
1127 status, as well as addressing smoking cessation, are important topics for discussion with patients.¹⁸⁵
1128 (Evidence Grade D)

1129

EVIDENCE-BASED ACTION STATEMENT: Eye doctors should counsel their patients on smoking cessation. They should document discussions with their patients about their smoking status and inform them about the benefits to their eyes, vision and overall health through smoking cessation. ^{176,183}	
Evidence Quality: Grade B, Cohort-Prospective Studies Level of Confidence: Medium. Clinical Recommendation Level: Recommendation. This recommendation should generally be followed but remain alert for new information.	
Evidence Statements: Smoking cessation, along with an active lifestyle, is important in preserving visual function and reducing visual impairment. Therefore, behavioral modifications may play a role in preventing visual impairment in adults. ¹⁸³ (Evidence Grade: B) Smoking cessation is associated with a reduced risk of cataract formation, and some early lens damage may be reversible. The reduction in risk appears strongest for those who have quit smoking within the past decade, but is not so robust in those who quit longer than ten years ago. ¹⁷⁶ (Evidence Grade: B)	
Potential Benefits: Counseling and educating patients about the potential impact of smoking may help promote general and ocular health, as well as visual function.	Potential Risks/Harms: Patient may be sensitive to discussing the topic.
Benefits and Harms Assessment: Benefits significantly outweigh harms.	
Potential Costs: Direct cost of counseling as part of a comprehensive eye and vision examination.	
Value Judgments: Persons who smoke may benefit from counseling to reduce the risk of general and ocular health problems.	
Role of Patient Preferences: Large.	
Intentional Vagueness: Specific type/form of counseling is not stated as it is patient specific.	
Gaps in Evidence: None identified.	

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c. Protection from Eye Injury

Eye injury is an important contributor to the burden of vision impairment and blindness in the United States. Many individuals are unaware of the ocular hazards they face, particularly at home or while playing sports.¹⁸⁶ Most eye injuries are preventable with appropriate use of protective eyewear.^{187, 188} It is, therefore, important to discuss eye safety issues with patients, including eye hazards at work, school, or home and during recreational activities.¹⁸⁹

Eye trauma occurs more frequently during the spring and summer months. Prevention efforts would likely be most effective if implemented in this timeframe and if targeted to men and those under age 60.¹⁹⁰ (Evidence Grade: D) In persons ≥ 65 years of age, most eye injuries from consumer products occur in men, at home and involve chemical injuries. The most preventable injuries were those that occurred during construction and resulted in contusions and abrasions. Many of these injuries can be prevented through the use of safety glasses.¹⁹¹ (Evidence Grade: B)

- Sports and recreation

1147
1148 Approximately 30,000 individuals present annually to emergency departments in the United States
1149 with sports-related eye injuries. Injuries occur most commonly in males and happen most frequently
1150 as a result of playing basketball, baseball or softball and shooting an air gun.¹⁹² Although contact
1151 sports have not been shown to result in a higher prevalence of severe ocular injury, evaluation of
1152 athletes should occur prior to their commencing contact sports and on an ongoing basis, as eye
1153 and vision problems may increase with age and duration of activity.¹⁹³ (Evidence Grade: B)
1154

1155 • Workplace injuries

1156
1157 As a group, individuals aged between 18 and 64 years are at high-risk for chemical injuries in the
1158 workplace. Continued efforts by the Occupational Safety and Health Administration to strengthen
1159 and enforce regulations associated with protective eyewear in the workplace are important to
1160 preventing chemical eye injuries.¹⁹⁴ (Evidence Grade: D)
1161

1162 • Laser eye protection

1163
1164 The effect of lasers on the eye depends on various factors, including pupil size, pigmentation, laser
1165 pulse duration and repetition, and wavelength. Different wavelengths will penetrate the eyes to
1166 different levels and may cause damage to the cornea, lens or retina. Laser eyewear can be used to
1167 attenuate the laser radiation for eye protection. Laser safety glasses must meet very specific
1168 requirements and should be labeled per the American National Standards Institute (ANSI) Z136.1
1169 Standard for the Safe Use of Lasers.¹⁹⁵
1170

1171 High-powered recreational lasers with the potential to cause severe ocular injuries are becoming
1172 increasingly available to the general public. The expanding use of lasers in everyday life increases
1173 the risk of injuries associated with laser exposure.¹⁹⁶ (Evidence Grade: D) Natural protective
1174 responses such as the blink reflex, pupillary constriction, and aversive head-turn response typically
1175 minimize sustained ocular exposure, but do not prevent accidental laser eye injuries from occurring.
1176 Most reported cases of laser injuries occur in occupational environments.¹⁹⁷
1177

1178 ***Clinical note:*** Clinicians should be aware of the signs and symptoms of ocular laser injuries.
1179 *Vision loss usually occurs immediately after laser exposure. The primary mode of prevention is*
1180 *with appropriate eye protection using goggles specifically matched to the laser's wavelength.*¹⁹⁷
1181

1182 • Use of protective eyewear

1183
1184 Dress prescription eyeglasses are not an adequate substitute for protective eyewear meeting the
1185 ANSI Z-87.1 Standard for Occupational and Educational Eye and Face Protection Devices.
1186 Spectacle wearers need to be made aware of the potential risks associated with wearing dress
1187 prescription eyeglasses during medium- to high-risk activities. The protective ability of eyewear is
1188 dependent upon the frame and lens as a complete unit.¹⁹⁸ (Evidence Grade: D)
1189

1190 The 2016 National Health Interview Survey found that use of protective eyewear has been
1191 increasing in the United States and individuals who are older, male, white and who wear corrective
1192 lenses are more likely to use protective eyewear during recreational activities. Also, a recent visit
1193 with an eye care practitioner appears to increase the likelihood of an individual using protective
1194 eyewear.¹⁹⁹ (Evidence Grade: D)
1195

1196 Monocular patients are often not informed of the necessity of eye protection to improve the long-
1197 term visual prognosis of the remaining functional eye. Clinicians should make a point of
1198 recommending eye protection to all monocular patients.²⁰⁰ (Evidence Grade: D)
1199
1200

1201 **CONSENSUS-BASED ACTION STATEMENT:** Individuals performing medium- to high-risk activities,
1202 monocular persons and those with previous eye trauma or eye surgery should be strongly advised by their
1203 eye doctor to wear appropriate eye protection with impact resistant properties.

1204
1205 **Evidence Quality:** An evaluation of published research to support or refute the use of this
1206 recommendation was not conducted for this guideline.

1207 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to increase patient's
1208 use of eye protection based on their personal risk factors. The benefits of this recommendation were
1209 established by expert consensus opinion.

1210
1211 • Ultraviolet radiation protection

1212
1213 Patients should be advised about the need to protect their eyes from exposure to ultraviolet (UVA
1214 and UVB) radiation. Exposure to high levels of UV radiation can cause photokeratitis and
1215 photoconjunctivitis. Chronic exposure to even low levels of UV radiation is a risk factor for
1216 developing cataracts, pterygium, squamous cell carcinoma of the cornea and conjunctiva, and skin
1217 cancer.²⁰¹

1218
1219 **CONSENSUS-BASED ACTION STATEMENT:** Since exposure to ultraviolet radiation (UV) is a risk factor
1220 for disorders of the eye, eye doctors should advise their adult patients about the benefits of the regular use
1221 of sunglasses that effectively block at least 99 percent of UVA and UVB radiation and the use of hats with
1222 brims when outdoors.

1223
1224 **Evidence Quality:** An evaluation of published research to support or refute the use of this
1225 recommendation was not conducted for this guideline.

1226 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to decrease patient
1227 risk of eye health problems from chronic exposure to UV radiation. The benefits of this recommendation
1228 were established by expert consensus opinion.

1229 **d. Fall Prevention**

1230
1231 Maintaining good vision may play a role in preventing falls.²⁰² Falls are a common occurrence in older
1232 adults and can have serious consequences.²⁰³ A national survey (2014 Behavioral Risk Factor
1233 Surveillance System) of adults aged ≥65 found 46.7 percent of persons with, compared with nearly 28
1234 percent without, self-reported severe visual impairment reported at least one fall in the previous year.²⁰⁴

1235
1236 In the Salisbury Eye Evaluation Study, visual field loss was reported to be the primary vision component
1237 that increases the risk of falls. For each 10 percent loss in visual field, individuals experienced 8 percent
1238 higher odds of falling, after adjustment for other factors. Peripheral visual field loss, in particular, was
1239 statistically significant. Visual field reduction is most likely related to the risk of falls through its effects on
1240 postural stability, the ability to maneuver around objects and decreased ability to detect steps or changes
1241 in surfaces. Although visual field loss cannot be reversed, persons with such deficits may benefit from
1242 mobility training to navigate the environment more safely and reduce the risk of falling.²⁰⁵ (Evidence
1243 Grade: B)

1244
1245 Impaired vision is an important and independent risk factor for falls. Strong association exists between
1246 depth perception and falls, and distance edge contrast sensitivity and visual acuity have also been linked
1247 to the risk of falls. Good visual acuity and distance edge contrast sensitivity have been shown to be
1248 important for detecting and avoiding hazards in the environment, especially when walking. The strong
1249 association between depth perception and falls suggests intact stereoacuity may be important for fall
1250 prevention.²⁰⁶ (Evidence Grade: C)

1251
1252 The Los Angeles Latino Eye Study found that both central and peripheral visual impairment were
1253 associated with increased risk of falls and falls with injury, independent of age, gender and co-morbidities.
1254 Impairment in central vision increased the risk of falls by 2.4 times and falls with injury by 2.8 times.
1255 Peripheral vision loss increased falls risk 1.4-fold for both outcomes. Patients may benefit from being
1256 counseled about the impact of central and peripheral vision loss on the increased risk of falls.²⁰⁷
1257 (Evidence Grade: B)

1258
1259 **Clinical note:** Because medications can contribute to falls by inducing changes in vision and vision
1260 loss, it is important for clinicians to take a detailed medication history in patients who report subjective
1261 changes in vision or who have decreased visual acuity.¹²³
1262

1263 A combination of interventions, including exercise, and vision assessment and treatment, may help
1264 prevent injurious falls.²⁰⁸ (Evidence Grade: B) Cost-effective measures such as ensuring their spectacle
1265 correction is current, or the use of cataract surgery when indicated, may also maximize vision and have
1266 an impact on preventing falls in older people.²⁰⁶ (Evidence Grade: C) One study, however, found that
1267 correction of vision problems did not reduce the frequency of falls, although the reason was unclear.²⁰⁹
1268

EVIDENCE-BASED ACTION STATEMENT: Older individuals (≥ 60 years of age) with central and/or peripheral vision loss should be counseled by their eye doctor about the potential for an increased risk of falls.²⁰⁵⁻²⁰⁸

Evidence Quality: Grade B, Systematic Review, Cohort-Prospective Studies, Cohort-Retrospective Study.

Level of Confidence: Medium.

Clinical Recommendation Level: Recommendation. This recommendation should generally be followed but remain alert for new information.

Evidence Statements: In the Salisbury Eye Evaluation Study, visual field loss was reported to be the primary vision component that increases the risk of falls. For each 10 percent loss in visual field, individuals experienced 8 percent higher odds of falling, after adjustment for other factors. Peripheral visual field loss, in particular, was statistically significant. Visual field reduction is most likely related to the risk of falls through its effects on postural stability, the ability to maneuver around objects and decreased ability to detect steps or changes in surfaces. Although visual field loss cannot be reversed, persons with such deficits may benefit from mobility training to navigate the environment more safely and reduce the risk of falling.²⁰⁵ (Evidence Grade: B)

The Los Angeles Latino Eye Study found that both central and peripheral visual impairment were associated with increased risk of falls and falls with injury, independent of age, gender and co-morbidities. Impairment in central vision increased the risk of falls by 2.4 times and falls with injury by 2.8 times. Peripheral vision loss increased falls risk 1.4-fold for both outcomes. Patients may benefit from being counseled about the impact of impaired vision on the increased risk of falls.²⁰⁷ (Evidence Grade: B)

A combination of interventions, including exercise and vision assessment and treatment, may help prevent injurious falls.²⁰⁸ (Evidence Grade: B)

Impaired vision is an important and independent risk factor for falls. Strong association exists between depth perception and falls, and distance edge contrast sensitivity and visual acuity have also been linked to the risk of falls. Good visual acuity and distance edge contrast sensitivity have been shown to be important for detecting and avoiding hazards in the environment, especially when walking. The strong association between depth perception and falls suggests intact stereoacuity may be important for fall prevention.²⁰⁶ (Evidence Grade: C)

Cost-effective measures such as ensuring patient’s spectacle correction is current, or the use of cataract surgery, when indicated, may also maximize vision and have an impact on preventing falls in older people. ²⁰⁶ (Evidence Grade: C)	
Potential Benefits: Patients with central and/or peripheral vision loss may benefit from fall prevention counseling and intervention when initially diagnosed.	Potential Risks/Harms: None.
Benefits and Harms Assessment: Benefits significantly outweigh harms.	
Potential Costs: Direct cost of counseling as part of a comprehensive eye and vision examination.	
Value Judgments: None.	
Role of Patient Preferences: Moderate.	
Intentional Vagueness: Specific type/form of counseling is not stated, as it is patient specific.	
Gaps in Evidence: Research is needed to further evaluate the relationship between different forms of vision loss/impairment and falls.	

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3. Coordination and Frequency of Care

Eye and vision care provide for the evaluation, management and coordination of a broad spectrum of integrated health care needs resulting in the diagnosis of a wide array of eye and vision anomalies, diseases, disorders and related systemic conditions. The nature and severity of the problem(s) diagnosed determine the need for and frequency of additional services.

a. Professional Collaboration and Communication

Intraprofessional consultation may be needed for optometric services such as treatment and management of ocular disease, low vision or neurovision rehabilitation, vision therapy and/or specialty contact lenses. Interprofessional consultation with an ophthalmologist may be necessary for ophthalmic surgery or other aspects of secondary or tertiary eye care.

The comprehensive adult eye and vision examination may also reveal systemic medical conditions or diseases for which the doctor of optometry may coordinate needed care. An interprofessional consultation can be implemented with the patient’s primary care physician or another health care provider for further evaluation and treatment of systemic conditions or related health problems. Information shared with other health care providers offers a unique and important perspective, resulting in improved interdisciplinary care of the patient.

b. Frequency of Care

Individuals should receive periodic eye and vision examinations to detect and treat any eye disease in its early stages to prevent or minimize vision loss. These evaluations can also identify problems that may be affecting visual function and productivity at work, at home, and in sports or leisure activities. In addition, the early signs and symptoms of systemic medical conditions, such as diabetes, hypertension and hyperlipidemia, may be revealed during a comprehensive eye and vision examination. Annual eye health and vision examinations are an important part of overall preventive healthcare and wellness practices.

1300 The cost/benefit ratio of routine eye examinations may vary for those persons found to have normal eye
1301 examination results on initial examination; however, regular examinations are recommended for
1302 individuals who notice a change in vision, have systemic health problems with ocular complications (e.g.,
1303 diabetes) and who have a family history of eye disease.²¹⁰ (Evidence Grade: B)

1304
1305 In patients with chronic eye conditions (e.g., glaucoma, retinal eye disease) nonadherence with
1306 scheduled follow-up visits can be prevalent. Factors such as incomplete understanding of the
1307 pathogenesis and treatment of the disease, difficulty getting time off from work and having significant
1308 visual impairment may limit compliance with follow-up care. Interventions to improve patient education
1309 and office efficiency and to increase networking opportunities among patients with chronic eye conditions
1310 could help improve compliance with follow-up.²¹¹ (Evidence Grade: D)

1311
1312 Many eye diseases can be asymptomatic in their earliest and most treatable stages. Detection of any eye
1313 disease in this early phase can be very beneficial to the patient for treatment options and treatment
1314 success. Some individuals believe, that if they had an eye problem, they would have symptoms. If this
1315 misconception results in fewer eye examinations, it potentially may contribute to increased risk of vision
1316 loss due to later stage detection.²¹² (Evidence Grade: D). Therefore, annual eye health and vision
1317 examinations can aid in the early detection and treatment of potentially vision-threatening conditions,
1318 such as diabetes. The American Public Health Association supports annual in-person comprehensive eye
1319 examinations for all individuals, regardless of diabetes status.²¹³

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1321 **CONSENSUS-BASED ACTION STATEMENT:** Patients who will undergo or have undergone ocular
1322 surgery or other specialty care should be counseled by their eye doctor regarding their ongoing need for
1323 periodic comprehensive eye and vision examinations.

1324 **Evidence Quality:** There is a lack of published research to support or refute the use of this
1325 recommendation.

1326 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to increase patient
1327 understanding of any diagnosed eye or vision problems and improve compliance with any recommended
1328 treatment. The benefits of this recommendation were established by expert consensus opinion.

1329 Since the prevalence of ocular diseases and vision disorders tends to increase with age, the need for
1330 patient re-examination is potentially age dependent. In addition, the recommended frequency of a
1331 comprehensive eye and vision examination varies with an individual's ocular and medical history,
1332 occupation and other related risk factors.

- 1333
1334 • 18 through 39 years of age
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1336 Vision problems in people under 40 years of age are largely due to refractive errors and eye injury.²¹⁴
1337 More than half of all individuals treated for eye injuries are between 18 and 45 years of age and nearly 30
1338 percent of those are 30 to 40 years old.²¹⁵ Lifestyle changes adopted during this period may adversely
1339 affect vision and eye health in later years.

1340
1341 The educational, vocational and avocational visual requirements for individuals in this age group are
1342 substantial. Visual demands of the workplace bring about the need for regular eye care. The most
1343 frequent health complaints among workers who use computers are vision related. Studies indicate that a
1344 large percentage of people working at a computer have visual symptoms.²¹⁶⁻²¹⁹ Other workers whose jobs
1345 involve extensive near viewing tasks may also experience similar problems.

1346
1347 The prevalence of ocular disease is relatively low for young adults; however, many eye diseases can
1348 initially develop without signs or symptoms. Therefore, having good visual acuity does not rule out their
1349 presence.²⁷ Glaucoma may begin to appear in this age group, particularly among African Americans. In
1350 addition, diabetes increasingly affects young adults and is a leading cause of blindness among working
1351 age Americans. To ensure early detection of potentially sight-threatening vision disorders, and for young
1352 adults to maintain their visual efficiency and productivity, periodic examinations are needed.

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CONSENSUS-BASED ACTION STATEMENT: Comprehensive eye and vision examinations are recommended annually for persons 18 through 39 years of age to optimize visual function, evaluate eye changes and provide for the early detection of sight-threatening eye and systemic health conditions. Risk factors present may result in recommendations for more frequent evaluations.

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Evidence Quality: There is a lack of published research to support or refute the use of this recommendation.

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Benefits and Harms Assessment: Implementation of this recommendation is likely to result in earlier diagnosis of eye and vision problems and the prevention or reduction in vision loss in this age group. The benefits of this recommendation were established by expert consensus opinion.

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- 40 through 64 years of age

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The prevalence of refractive errors is related to age and varies with gender and race/ethnicity.⁹⁸ Changes in refractive error are not uncommon in persons 40 years or older.¹⁰⁵ Even low amounts of refractive error can cause significantly reduced vision, and if uncorrected, affect a person's independence, health-related quality of life and well-being. A substantial portion of working age adults may have visually-significant undiagnosed refractive errors, and detection can be a major benefit in their personal and work lives and help to improve vision in later life.²²⁰ (Evidence Grade: D) Near vision problems due to refractive errors are also significant causes of reduced vision among people of working age.²²¹

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The onset of presbyopia in this age group results in reduced ability to focus at near and intermediate distances. Uncorrected presbyopia can cause significant visual disability and have a negative impact on a person's quality of life. In most cases, presbyopia progresses gradually until individuals are unable to focus clearly at near for reading or other close activities without the aid of an optical correction. This progression continues in a predictable manner in this age group, necessitating periodic changes in the power of their near optical correction.

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Uncorrected presbyopia has been poorly recognized as a cause for reduction in a person's health-related quality of life. This may be due to the perception that it affects individuals less significantly than eye disease or other eye conditions; however, reduced near vision due to uncorrected presbyopia matters just as much to quality of life as reduced distance visual acuity.²²²

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Individuals in this age group are also at greater risk for eye diseases, including age-related macular degeneration, cataracts, diabetic retinopathy and glaucoma. Since these diseases are often asymptomatic in the early treatable stages, regular eye examinations are an important means to prevent vision loss.²²³ (Evidence Grade: D)

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Having insurance for eye care services increases the chances of having better vision outcomes. A study of adults in eight states found that persons 40 to 65 years of age, with or without visual impairment, who had an eye exam in the prior year, generally had better vision, as indicated by their ability to recognize friends across the street and to read a newspaper or magazine.²²⁴ (Evidence Grade: D) Early diagnosis and treatment of eye and vision problems may also reduce the cost burden of providing future care. These findings reinforce the benefits of an annual eye health and vision examination.

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CONSENSUS-BASED ACTION STATEMENT: Comprehensive eye and vision examinations are recommended annually for persons 40 through 64 years of age to optimize visual function, evaluate eye changes and provide for the early detection of sight-threatening eye and systemic health conditions. Risk factors present may result in recommendations for more frequent evaluations.

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1403 **Evidence Quality:** There is a lack of published research to support or refute the use of this
1404 recommendation.
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1406 **Benefits and Harms Assessment:** Implementation of this recommendation is likely to result in earlier
1407 diagnosis of eye and vision problems and the prevention or reduction in vision loss in this age group. The
1408 benefits of this recommendation were established by expert consensus opinion.

1409
1410 • 65 years of age and older
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1412 The prevalence of visual impairment increases rapidly with age among all racial and ethnic groups.²²⁵ The
1413 portion of adults reporting some form of visual impairment rises dramatically after age 65. In 2014, an
1414 estimated 28 million people aged ≥65 years in the United States reported some vision impairment defined
1415 as being blind or having severe difficulty with seeing, even with eyeglasses.²⁰⁴ Vision loss in older adults
1416 can adversely affect their activities of daily living and hinder their ability to live independently in their
1417 community.
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1419 Persons aged 65 years and older who have regular eye examinations were found to experience less
1420 decline in vision and improved functional status.³⁰ (Evidence Grade: D) In addition, correction of refractive
1421 error improves vision-specific quality of life and aids in preserving independence in activities of daily living
1422 in persons over age 65.¹⁸ (Evidence Grade: B) Those who have regular eye examinations may also have
1423 a lower probability of reduction in reading ability and of developing legal blindness or chronic vision
1424 impairment.²²⁶
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1426 In asymptomatic patients, routine comprehensive optometric eye examinations detect a significant
1427 number of new eye conditions and/or result in management changes. The number detected increases
1428 with age and assessment interval. As the assessment interval increases, the odds of having a significant
1429 change increase, especially in older individuals.²²³ (Evidence Grade: D)
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1431 Failure to diagnose and treat vision problems in the elderly may contribute to cognitive decline and
1432 dementia.²²⁷⁻²²⁹ Visual disturbances, including problems with contrast sensitivity, color perception,
1433 visuospatial orientation and pupillary reaction, can be among the first symptoms in persons with
1434 Alzheimer's disease.^{39,229} Early vision correction may reduce the severity of dementia and its associated
1435 functional decline.¹⁰⁶
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EVIDENCE-BASED ACTION STATEMENT: For persons 65 years of age or older, annual comprehensive eye and vision examinations are recommended to optimize visual function, evaluate eye changes and provide for the early detection of sight-threatening eye and systemic health conditions. Risk factors present may result in recommendations for more frequent evaluation.^{18,30,223}

Evidence Quality: Grade C, Randomized Clinical Trial, Cross-Sectional Studies.

Level of Confidence: Medium.

Clinical Recommendation Strength: Recommendation. This recommendation should generally be followed but remain alert for new information.

Evidence Statements: Correction of refractive errors improves vision-specific quality of life and aids in preserving independence in activities of daily living in persons over age 65.¹⁸ (Evidence Grade: B)

Persons aged 65 years and older who have regular eye examinations were found to experience less decline in vision and improved functional status.³⁰ (Evidence Grade: D)

In asymptomatic patients, routine comprehensive optometric eye examinations detect a significant number of new eye conditions and/or result in management changes. The number detected increases with age and assessment interval. As the assessment interval increases, the odds of having a significant change increase, especially in older individuals.²²³ (Evidence Grade: D)

Potential Benefits: Optimizing visual function and preventing and/or minimizing vision loss through early diagnosis, treatment and management of ocular health conditions.	Potential Risks/Harms: Temporary discomfort and visual disturbances resulting from dilation, allergic responses to diagnostic pharmaceutical agents or other adverse effects.
Benefits and Harms Assessment: Benefits significantly outweigh harms.	
Potential Costs: Direct cost of testing.	
Value Judgments: None.	
Role of Patient Preferences: Moderate.	
Intentional Vagueness: None.	
Gaps in Evidence: Research is needed to determine the optimum frequency of eye examinations in persons 65 years or older to prevent vision loss and maintain visual function and eye health.	

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1438 **c. At-risk Patients**

1439 More frequent re-examinations may be recommended for certain patients at risk for vision loss,
 1440 regardless of their age. Persons who notice vision changes, those at higher risk for the development of
 1441 eye and vision problems and individuals with a family history of eye disease need to have an eye
 1442 examination more frequently than asymptomatic persons with no history of ocular or general health
 1443 problems.²¹⁰ (Evidence Grade: B) Table 2 lists, in no particular order, factors that put persons at risk for
 1444 the development of eye and vision problems.

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**Table 2
 Risk Factors for the Development of Eye and Vision Problems**

Having a personal or family history of ocular disease.
Belonging to certain racial and ethnic groups.
Having systemic health conditions with potential ocular manifestations, (e.g., diabetes mellitus, hypertension, obesity, arteriosclerosis).
Participating in occupations that are highly demanding visually or have a high potential of being hazardous to the eyes.
Taking prescription or nonprescription drugs with ocular side effects.
Having functional vision in only one eye.
Wearing contact lenses.
Undergoing eye surgery or experiencing previous eye injury.

Having high or progressive refractive error.
Experiencing other progressive eye-related health concerns or conditions.

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CONSENSUS-BASED ACTION STATEMENT: Adult patients should be advised by their eye doctor to seek eye care more frequently than the recommended re-examination interval, if new ocular, visual, or systemic health problems develop.

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Evidence Quality: There is a lack of published research to support or refute the use of this recommendation.

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Benefits and Harms Assessment: Implementation of this recommendation is likely to increase patient understanding of the need for and benefits of more frequent vision examination based on personal risk factors. The benefits of this recommendation were established by expert consensus opinion.

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C. Conclusion

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Eye and vision disorders have broad implications in health care because of their potential for causing disability, suffering, and loss of productivity. Early detection and treatment of eye and vision disorders are essential to maintain full functional ability and to prevent or minimize the damage and consequent disabilities that may result from their neglect.

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Many eye and vision disorders create no obvious symptoms; therefore, individuals are often unaware that problems exist. The comprehensive adult eye and vision examination performed in-person by an eye doctor provides the means to evaluate the function and health of the eyes and visual system and any ocular manifestations of systemic disease. It is an important part of preventive health care and serves as a key component in maintaining good vision and optimal eye health in adults.

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Comprehensive eye and vision examinations provide the opportunity for early detection of eye health and visual performance problems. They also provide the opportunity for prevention of vision loss. This results in improved visual and overall function, as well as improved health-related quality of life for adults.

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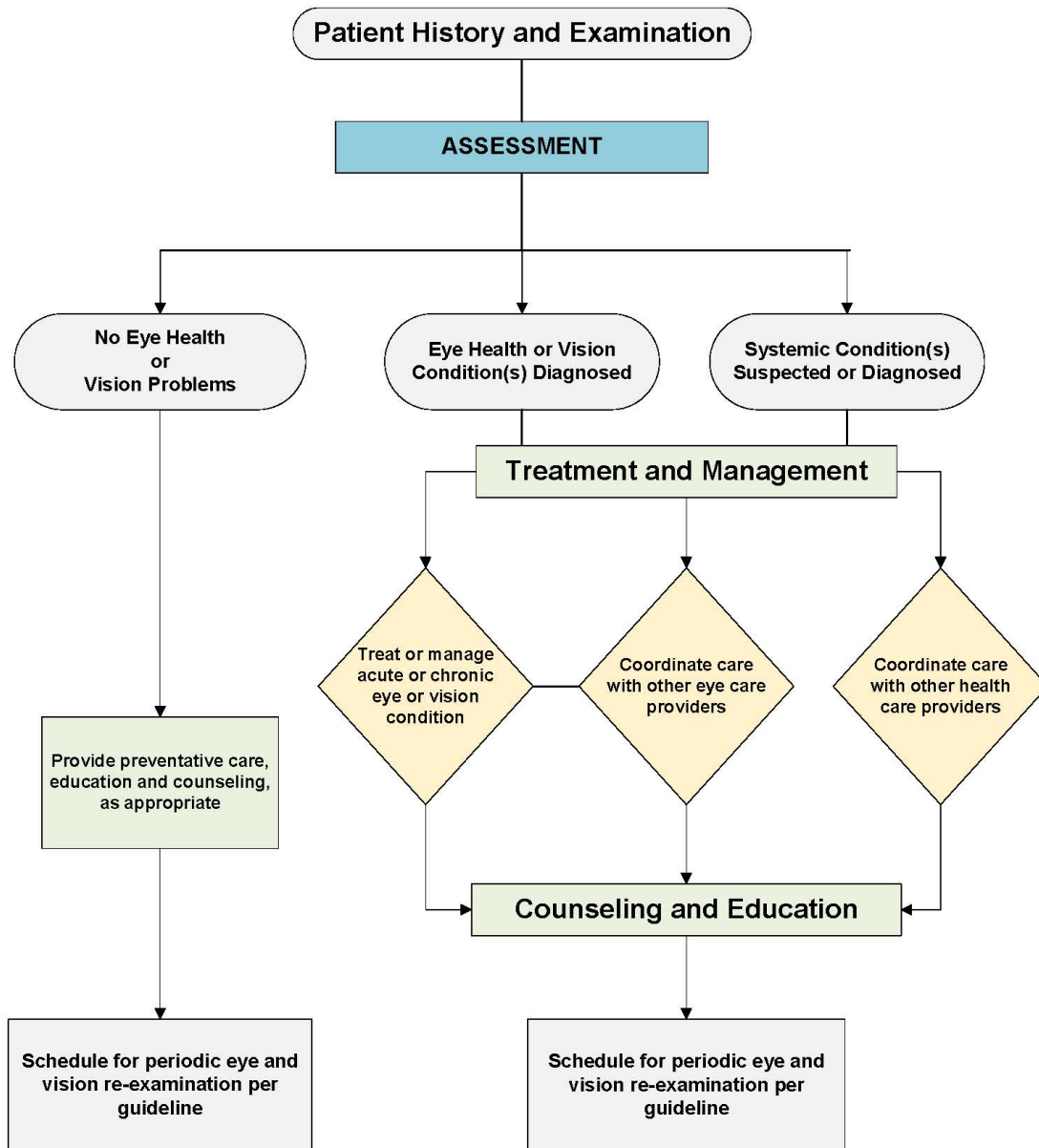
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1953
1954

1955 V. APPENDICES
1956

APPENDIX 1

Comprehensive Adult Eye and Vision
Examination: A Flowchart



1957
1958

1959 Appendix 2

1960

1961 Potential Components of the Comprehensive Adult

1962 Eye and Vision Examination

1963

1964

1965 A. Patient History

1966 1. Nature and history of presenting problem, including chief complaint

1967 2. Visual and ocular history

1968 3. General health history, which may include social history and review of systems

1969 4. Family eye and medical histories

1970 5. Medication usage and medication allergies

1971 6. Vocational and avocational visual requirements

1972 7. Name of, and contact information for, the patient's other health care providers

1973

1974 B. Visual Acuity

1975 1. Distance visual acuity testing

1976 2. Near visual acuity testing

1977 3. Pinhole acuity testing

1978 4. Visual acuity at identified vocational or avocational working distances

1979

1980 C. Refraction

1981 1. Measurement of patient's most recent or habitual optical correction

1982 2. Objective measurement of refractive status

1983 3. Subjective measurement of refractive status

1984 4. Cycloplegic refraction, if needed

1985

1986 D. Ocular Motility, Binocular Vision, and Accommodation

1987 1. Evaluation of ocular alignment and motility

1988 2. Assessment of heterophorias, vergence amplitude and facility

1989 3. Testing for suppression

1990 4. Measurement of accommodative amplitude and facility

1991

1992 E. Ocular Examination and Systemic Health Assessment

1993 1. Observation of pupil size and pupillary responses

1994 2. Evaluation of the ocular anterior segment and adnexa

1995 3. Measurement of intraocular pressure

1996 4. Evaluation of the ocular media

1997 5. Evaluation of the ocular posterior segment

1998 6. Visual field testing

1999 7. Systemic health assessment

2000

2001 F. Ancillary Testing (as needed)

2002

2003

2004

2005

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2007

2008 Appendix 3: Abbreviations/Acronyms

2009	
2010	AC/A – Accommodative convergence/accommodation
2011	
2012	ADA – Americans with Disabilities Act
2013	
2014	AHRQ – Agency for Healthcare Research and Quality
2015	
2016	AMD – Age-related macular degeneration
2017	
2018	ANSI – American National Standards Institute
2019	
2020	AOA – American Optometric Association
2021	
2022	CDC – Centers for Disease Control and Prevention
2023	
2024	COI – Conflict of interest
2025	
2026	CPG – Clinical Practice Guideline
2027	
2028	DED – Dry eye disease
2029	
2030	DR – Diabetic retinopathy
2031	
2032	EBO – Evidence-based Optometry
2033	
2034	EHR – Electronic health record
2035	
2036	ETDRS – Early Treatment Diabetic Retinopathy Study
2037	
2038	GDG – Guideline Development Group
2039	
2040	GDRG – Guideline Development Reading Group
2041	
2042	IOM – Institute of Medicine
2043	
2044	IOP – Intraocular pressure
2045	
2046	NASEM – National Academies of Sciences, Engineering and Medicine
2047	
2048	NPC – Near point of convergence
2049	
2050	TDD – Telecommunications devices for the deaf
2051	
2052	UV – Ultraviolet radiation
2053	
2054	

2055 Appendix 4: Gaps in Research Evidence

2056

2057 During the course of the development of this guideline, the Evidence-based Optometry Guideline
2058 Development Group identified the following gaps in evidence as potential areas for future research:

2059

2060 • Research to determine the optimum frequency for comprehensive eye and vision examinations in
2061 adults to prevent vision loss and maintain visual function and eye health.

2062

2063 • Research to identify the most effective methods of patient education.

2064

2065 • Research to further evaluate the relationship between different forms of vision loss/impairment
2066 and falls.

2067

2068 **VI. METHODOLOGY FOR GUIDELINE DEVELOPMENT**

2069

2070 This guideline was developed by the AOA Evidence-based Optometry Guideline Development Group
2071 (GDG). Clinical questions to be addressed in the guideline were identified and refined during an initial
2072 meeting of the GDG and served as the basis for a search of the clinical and research literature.

2073

2074 An English language literature search for the years 2013 to 2020 was conducted by a trained
2075 researcher. If the search did not produce results, the search parameters were extended an additional
2076 5 years, and subsequently 10 years back. In addition, a review of selected earlier research
2077 publications was conducted based on previous versions of this guideline. The literature search was
2078 conducted using the following electronic databases:

- 2079 • Centers for Disease Control and Prevention, National Center for Health Statistics
- 2080 • Cochrane Library
- 2081 • Google Scholar
- 2082 • Ovid MEDLINE
- 2083 • PubMed
- 2084 • VisionCite
- 2085 • Scopus

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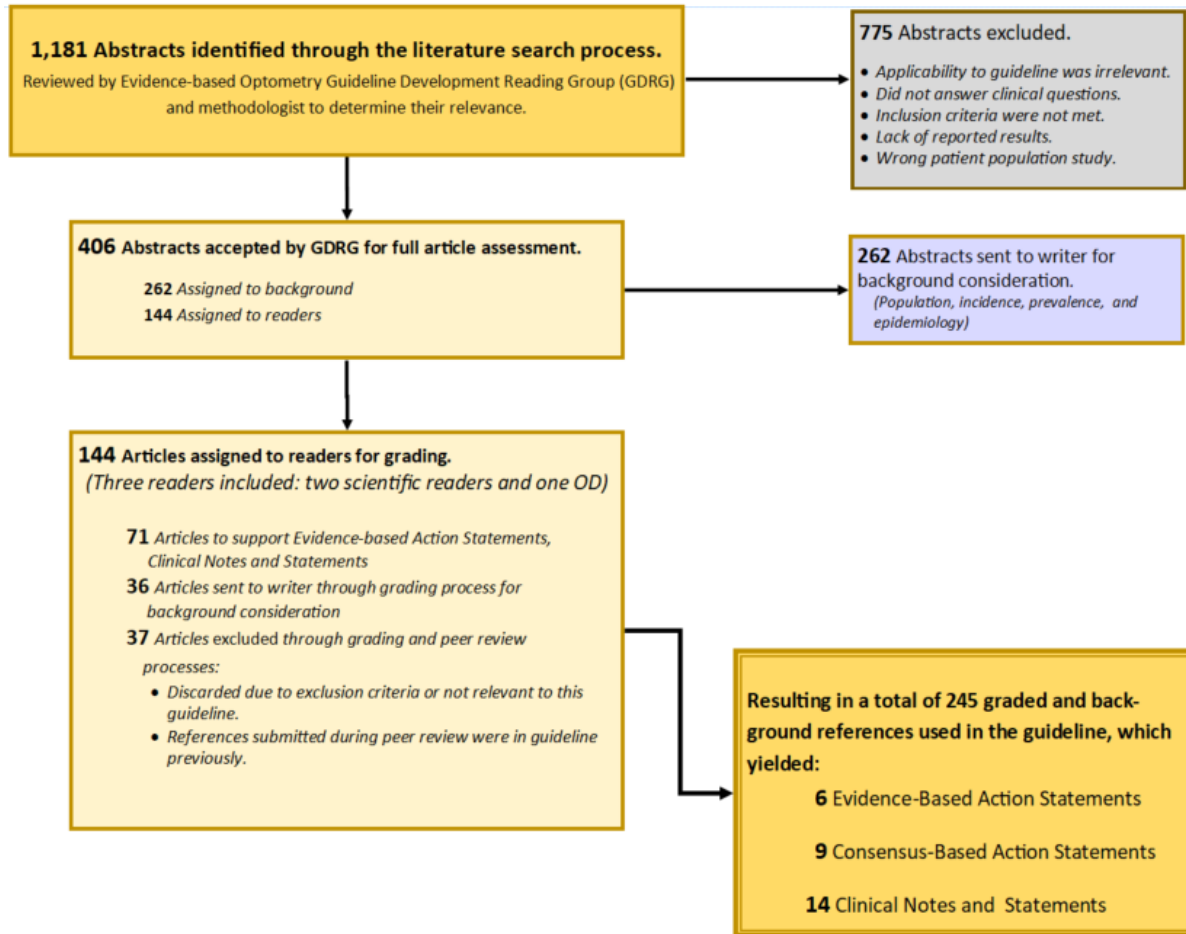
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2106 All references meeting the criteria were reviewed to determine their relevance to the clinical questions
2107 addressed in the guideline. They were assigned to three readers who independently reviewed and
2108 graded the quality of evidence and the clinical recommendations for each article, based on a previously
2109 defined system for grading quality.

2110 During six articulation meetings of the Evidence-based Optometry Guideline Development Reading
2111 Group (GDRG), all evidence was reviewed and clinical recommendations were developed. Grading for
2112 the recommendations was based on the quality of the research and the benefits and risks of the
2113 procedure or therapy recommended. Where direct scientific evidence to support a recommendation was
2114 weak or lacking, a consensus of the GDRG members was required to approve a recommendation.

2115 At the draft reading meeting of the Evidence-based Optometry Guideline Development Group (GDG), the
2116 guideline document was reviewed and edited and the completed draft was approved by the GDG by
2117 conference call. The approved draft of the guideline was then made available for peer and public review
2118 for 30 days for numerous stakeholders (individuals and organizations) to make comments. All suggested
2119 revisions were reviewed, and, if accepted by the GDG, incorporated into the final guideline.

2120 Clinical recommendations in this guideline are evidence-based statements regarding patient care that are
2121 supported by the scientific literature or consensus of professional opinion when no quality evidence was
2122 discovered. The guideline will be periodically reviewed and updated as new scientific and clinical
2123 evidence becomes available.

2124

2125 **VII. EVIDENCE-BASED OPTOMETRY GUIDELINE DEVELOPMENT GROUP**

2126

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