



**Evidence-Based Clinical Practice Guideline**

# **Comprehensive Adult Eye and Vision Examination**



**AMERICAN OPTOMETRIC ASSOCIATION**

# OPTOMETRY: THE PRIMARY EYE CARE PROFESSION

The American Optometric Association represents approximately 39,000 doctors of optometry, optometry students and paraoptometric assistants and technicians. Optometrists serve individuals in nearly 6,500 communities across the country, and in 3,500 of those communities are the only eye doctors. Doctors of optometry provide two-thirds of all primary eye care in the United States.

Doctors of optometry are on the frontline of eye and vision care. They examine, diagnose, treat, and manage diseases and disorders of the eye. In addition to providing eye and vision care, optometrists play a major role in an individual's overall health and well-being by detecting systemic diseases such as diabetes and hypertension.

The mission of the profession of optometry is to fulfill the vision and eye care needs of the public through clinical care, research, and education, all of which enhance the quality of life.

## **Disclosure Statement**

This Clinical Practice Guideline was funded by the American Optometric Association (AOA) without financial support from any commercial sources. All Committee, Guideline Development Group, and other guideline participants provided full written disclosure of conflicts of interest prior to each meeting and prior to voting on the strength of evidence or clinical recommendations contained within the guideline.

## **Disclaimer**

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

The information in this guideline is current to the extent possible as of the date of publication.

# **COMPREHENSIVE ADULT EYE AND VISION EXAMINATION**

**Developed by the AOA Evidence-Based Optometry Guideline Development Group**

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## EVIDENCE-BASED CLINICAL GUIDELINES

### A. WHAT IS THE EVIDENCE-BASED PROCESS?

As a result of the Medicare Improvement for Patients and Providers Act of 2008, Congress commissioned the U.S. Secretary of Health and Human Services to create a public-private program to develop and promote a common set of standards for the development of clinical practice guidelines (CPGs). These standards address the structure, process, reporting, and final products of systematic reviews of comparative effectiveness research and Evidence-Based clinical practice guidelines.

The National Academy of Medicine (NAM) formerly known as the Institute of Medicine, through the Agency for Healthcare Research and Quality (AHRQ), issued two reports in March 2011: *Clinical Practice Guidelines We Can Trust* and *Finding What Works in Health Care: Standards for Systematic Reviews*.

In *Clinical Practice Guidelines We Can Trust*,<sup>1</sup> the NAM redefined CPGs as follows:

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

The report states that to be trustworthy, guidelines should:

- Be based on a systematic review of existing evidence.
- Be developed by a knowledgeable, multidisciplinary panel of experts and key stakeholders.
- Consider important patient subgroups and preferences as appropriate.
- Be based on a transparent process that minimizes conflicts of interest and biases.
- Provide a clear explanation of the logical relationships between alternative care options and health outcomes.
- Provide a grading of both the strength of the quality of evidence and the strength of the clinical recommendation.
- Be revised as appropriate when new evidence warrants modifications of recommendations.

Based on the NAM reports, the American Optometric Association (AOA) Evidence-Based Optometry (EBO) Committee developed a 14-step process to meet the new Evidence-Based recommendations for trustworthy guidelines.

## AOA's 14 Steps to Evidence-Based Clinical Practice Guideline Development

1. Guideline Development Group: Evidence-Based Optometry (EBO) Committee selects a multidisciplinary panel of experts, including patient and public representatives, for Guideline Development Group (GDG).
2. Transparency and COI: AOA Staff manages conflict of interest (COI).
3. Clinical Questions\*\*: GDG to explore and define all clinical questions through a Question Formulation Meeting and define search criteria.
4. Search for Evidence: AOA Staff to send clinical questions for query (outside researchers) and provide all papers to the Guideline Development Reading Group (GDRG). There should be no inclusion of Systematic Review (SR) writers on the GDRG.
5. Grade Evidence and Clinical Recommendations: Two clinicians from the GDRG to read and grade papers, randomly selected, according to pre-designed evidence quality values. Make clinical recommendation(s) from each paper and grade the strength of each.
6. Articulate Clinical Recommendations\*\*: GDRG to review all clinical recommendations and articulate each for inclusion in the guideline during an "Articulation of Recommendations" meeting and document identified gaps in medical research.
7. Write Draft: AOA Staff to send Articulation results to writer for development of draft 1.
8. Draft Review and Edits\*\*: GDG to read draft 1, discuss and edit.
9. Rewrite/Final Drafts: AOA Staff to send draft results to writer for writing/revisions for draft 2, then send to medical editor for copy editing, then final review as necessary.
10. Approval for Peer Review: AOA Staff to send to AOA Board of Trustees for approval to post for peer and public review. Post on the AOA website, announce the review period, and solicit comments.
11. Final Document Produced: AOA Staff to review and revise final document (include peer review comments or identify issues for review when preparing next edition).
12. Final Approval and Legal Review: AOA Staff to send to the AOA Board of Trustees and AOA Legal Counsel for approval that the GDG followed the evidence-based process as outlined by the IOM and AOA EBO Committee (same management of COI).
13. Post Guideline: AOA Staff to post to the AOA website. Submit to the National Guideline Clearinghouse and website for public use, accompanied by our written process and documents.
14. Schedule Reviews: AOA Staff to review all previously identified gaps in medical research and any new evidence, and revise guideline every 2 to 5 years.

*\*\*Denotes face-to-face meeting*

## B. HOW TO USE THIS GUIDELINE

The following table provides the grading system used in this guideline for rating Evidence-Based clinical statements. Grades are provided for both strength of the evidence and clinical recommendations.

Key to Strength of Evidence and Clinical Recommendation Grading	
Grade	Strength of Evidence
A	Data derived from well-designed, randomized clinical trials (RCTs); systematic reviews; meta-analyses; or diagnostic studies (Grade A) of relevant populations with a validated reference standard. Grade A diagnostic studies do not have a narrow population or use a poor reference standard and are not case control studies of diseases or conditions.
B	Randomized clinical trials (RCTs) with weaker designs; cohort studies (retrospective or prospective); or diagnostic studies (Grade B). Grade B diagnostic studies have only one of the following: a narrow population or the sample used does not reflect the population to whom the test would apply or uses a poor reference standard or the comparison between the test and reference standard is not blinded or are case control studies of diseases or conditions.
C	Studies of strong design, but with substantial uncertainty about conclusions or serious doubts about generalizations, bias, research design, or sample size. Nonrandomized trials; case control studies (retrospective or prospective); or diagnostic studies (Grade C). Grade C diagnostic studies have at least 2 or more of the following: a narrow population or the sample used does not reflect the population to whom the test would apply or uses a poor reference standard or the comparison between the test and reference standard is not blinded or are case control studies of diseases or conditions.
D	Cross sectional studies; case reports/series; reviews; position papers; expert opinion; or reasoning from principal.
Clinical Recommendation Levels	
<b>Strong Recommendation:</b> Eye doctors should follow this recommendation unless clear and compelling rationale for an alternative approach is present. The quality of evidence provides a clear reason to make a recommendation.	
<b>Recommendation:</b> Eye doctors should generally follow this recommendation, but should remain alert for new information. The quality of evidence is not as strong, but the benefits exceed the harms or vice versa.	
<b>Consensus Recommendation:</b> Eye doctors should be aware of this recommendation, but be flexible in their clinical decision-making and remain alert for new information. No clear advantage has been demonstrated for one approach versus another. There is lack of pertinent evidence and an unclear balance between benefit and harm.	

## Clinical Notes and Statements

Strength of evidence grades and the level of clinical recommendations are listed throughout the guideline for clinical notes and statements.

Grades are displayed with the evidence strength listed first, followed by the strength of the clinical recommendation. A statement with a strength of evidence of “B” and a strong clinical recommendation would be shown as B/Strong Recommendation.

**Evidence-Based Clinician Action Statements** will be highlighted in an “Action” box, with the strength of evidence and clinical recommendation grades listed. For example:

<b>EVIDENCE-BASED ACTION STATEMENT:</b> Individuals 60 years of age and older with central and/or peripheral vision loss should be counseled by their eye doctor about the potential for an increased risk of falls. <sup>100,102,103</sup>	
<b>Evidence Quality:</b> GRADE B, Cohort studies. No randomized controlled trials or systematic reviews were identified regarding the loss of visual field and the potential for an increased risk of falls in older adults.	
<b>Clinical Recommendation Level:</b> Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.	
<b>Evidence Statements:</b> Visual field defects, as measured by full field testing of at least 60 degrees, are a risk factor for falls. However, reduced visual acuity, contrast sensitivity or stereoacuity were not found to be associated with falls. <sup>100</sup> Evidence Quality: Grade B	
Binocular depth perception, and good visual acuity and contrast sensitivity are associated with a decreased risk for falls. Older individuals should be tested for these vision functions in an effort to decrease their risk of falls. <sup>102</sup> Evidence Quality: Grade B	
Central and peripheral visual impairment increases the risk for falls and falls with injury. Peripheral vision impairment is associated with increased risk of tripping over obstacles and the use of bifocals and being obese are also significant risk factors for falls. <sup>103</sup> Evidence Quality: Grade B	
<b>Potential Benefits:</b> Counseling and educating patients on current conditions and preventive care in order to maintain ocular and systemic health and visual function.	<b>Potential Risks/Harms:</b> None.
<b>Benefit and Harm Assessment:</b> Benefits significantly outweigh harms.	
<b>Potential Costs:</b> Direct cost of counseling as part of a comprehensive eye and vision examination.	
<b>Value Judgments:</b> Patients with central and/ or peripheral vision loss may benefit from falls prevention counseling and intervention when initially diagnosed.	
<b>Role of Patient Preferences:</b> Moderate.	
<b>Intentional Vagueness:</b> Specific type/form of counseling is not stated, as it is patient specific.	
<b>Gaps in Evidence:</b> Research is needed to evaluate the relationship between vision loss and falls.	

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



**Evidence Quality** – The strength of evidence grade (A, B, C, or D) or the aggregate strength of evidence grade (if multiple studies were reviewed) and the type of research study or studies reviewed.

**Clinical Recommendation Level** – The level (Strong Recommendation, Recommendation, Consensus Recommendation) assigned to the implementation of the clinical recommendation made in the Action Statement.

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

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

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

**Potential Costs** – Direct and indirect costs may include costs of the examination, procedure, test, or medication; time spent by the eye doctor counseling the patient; administrative time; etc.

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

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

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

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

**Consensus-Based Clinician Action Statements**, based on consensus by the Guideline Development Reading Group (GDRG), will be highlighted in an “Action” box, without any strength of evidence or clinical recommendation grading information listed. For example:

**CONSENSUS-BASED ACTION STATEMENT:** At the conclusion of an eye and vision examination, the eye doctor should explain the diagnosis to the patient, relate it to the patient’s symptoms, and discuss a treatment plan and prognosis.

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

**Benefit and Harm Assessment:** Implementing this recommendation is likely to increase patient understanding of any diagnosed eye or vision problems and improve compliance with any recommended treatment. The benefits of this recommendation were established by expert consensus opinion.

## I. INTRODUCTION

Eye and vision care serves as an important point of entry into the health care system because:

- During the lifetime of any individual, eye and vision care services are normally needed
- Eye and vision care provide for the evaluation, management, and coordination of a broad spectrum of health care needs
- Persons who may be reluctant to seek preventive or general medical care may feel more comfortable receiving eye and vision care.

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

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

### A. GUIDELINE OBJECTIVES

This Guideline will assist eye care providers in achieving the following objectives:

- Recommend an appropriate timetable for eye and vision examinations for adults (age 18 or older)
  - Select appropriate examination procedures for adults
  - Effectively examine the eye health, vision status, and ocular manifestations of systemic disease of adults
- Minimize or avoid the adverse effects of eye and vision problems in adults through prevention, early detection, education, treatment, and management
  - Inform and educate individuals and other health care practitioners about the importance of good vision and the need for, and frequency of, comprehensive adult eye and vision examinations.

## II. BACKGROUND

Eye and vision disorders have broad implications in health care because of their potential for negatively impacting activities of daily living resulting in decreased quality of life. They are associated with loss of independence and difficulty maintaining employment. Many eye and vision disorders are chronic conditions that can affect individuals for their entire lives. The burden of these conditions is projected to continue to increase as the aging population expands.<sup>2</sup>

More than 3.4 million Americans 40 years and older are either legally blind (visual acuity of 20/200 or worse or a visual field of less than 20 degrees) or have vision impairment (visual acuity of 20/40 or worse) and millions more are at risk of developing visual impairment or blindness.<sup>3</sup> In the next 30 years, the number of adults with visual impairment and/or age-related eye disease is expected to double due to the aging of the United States population and the increase in diabetes and other chronic diseases.<sup>4</sup>

It is estimated that at least 40 percent of vision loss in the United States is either preventable or treatable with timely intervention, yet many people are undiagnosed and untreated.<sup>5</sup> The diagnosis and treatment of eye diseases and vision problems can result in improved visual function and health-related quality of life for adults of all ages.<sup>6-9</sup>

## A. ADULT VISION CHANGES

Adulthood involves a wide range of activities in which good visual function and eye health are of great value. Changes in visual function can affect an individual's ability to perform many activities of daily living. Since these changes often develop gradually, their effect on performance may not be readily apparent.<sup>10</sup>

Normal age-related changes in visual function and ocular structures, and increases in the prevalence and incidence of ocular and systemic disease with age, combine to make comprehensive eye and vision care services particularly important for older adults.<sup>11</sup> The leading causes of vision impairment and blindness in the United States, in addition to refractive errors, are primarily age-related diseases such as cataracts, glaucoma, and age-related macular degeneration.<sup>3,4,12</sup> In addition, diabetic retinopathy, the most common microvascular complication of diabetes, is the leading cause of new cases of blindness and low vision among Americans 20 to 74 years of age.<sup>13</sup>

Refractive errors, cataracts, age-related macular degeneration, and diabetic retinopathy usually reduce central vision. Glaucoma characteristically affects peripheral vision, which may alter balance and walking. Untreated, these conditions lead to problems with taking medications, keeping track of personal information, walking, watching television, driving, and reading, and often create social isolation.<sup>14</sup> Early detection and treatment of these conditions are likely to translate into substantial economic savings and result in improved quality of life.<sup>15</sup>

## B. OCULAR MANIFESTATIONS OF SYSTEMIC DISEASE

The eye is the only part of the human body where blood vessels and nerve tissue can be viewed directly in their natural state. Alterations in retinal blood vessels allow the clinician to draw conclusions about the status of blood vessels in the entire body.<sup>16</sup> Changes in the eye often precede or occur concurrently with various systemic conditions and can

represent important prognostic indications of disease progression.<sup>17</sup> A comprehensive eye examination presents a unique opportunity to observe and evaluate the impact systemic health problems such as diabetes, hypertension and hyperlipidemia have on the body and the eyes.

For some individuals, signs of an undetected systemic disease may initially be found during an eye examination. Earlier detection of systemic diseases through a comprehensive eye and vision examination can lead to earlier treatment resulting in better patient care, avoidance of complications, and reduced health care costs.<sup>18,19</sup>

## C. FAILURE TO SEEK CARE

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.<sup>20</sup> The cost of eye care or lack of insurance, and 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.<sup>21</sup> A lack of transportation and difficulty trusting and communicating with the doctor have also been reported as barriers to care.<sup>22,23</sup> In addition, many individuals may be unaware they have a sight-threatening eye condition due to a lack of early symptoms.<sup>24,25</sup> Some people don't seek care because they wrongly assume nothing can be done to improve their vision.<sup>26</sup> 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 eye care may not be conveyed to them by the media or their primary care provider.<sup>27</sup>

Also, there may be confusion regarding the terminology of "eye examination." Individual tests, such as a visual acuity test given during a general physical examination, by the state Department of Motor Vehicles, using an on line acuity test or refraction, and other forms of screenings are not substitutes for a comprehensive eye examination.

Some individuals may choose to compensate for blurred vision by purchasing over-the-counter 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.

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

## **D. EPIDEMIOLOGY OF EYE AND VISION DISORDERS IN ADULTS**

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:

- **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 errors are the most common cause of reduced vision.<sup>28-31</sup> Blurred vision due to uncorrected refractive errors can have immediate and long-term consequences such as lost educational and employment opportunities, reduced productivity, impaired safety and decreased health-related quality of life.<sup>30,32</sup> Correction of refractive errors can lead to improvement in visual acuity in the majority of patients over a wide range of ages.<sup>33</sup>

Clinically significant refractive errors affect more than half of the United States population age 20 years or older. Estimates based on the 1999-2004 National Health and Nutrition Examination Survey (NHANES) found that 33.1 percent of people 20 years of age or older had myopia equal to or less than 1.00D; 6.5 percent had myopia between 1.00D and 5.00D; 3.6 percent had hyperopia equal to or greater than

3.00D; and 36.2 percent had astigmatism equal to or greater than 1.00D. The prevalence of myopia is approximately equal in 20 to 39 and 40 to 59 year age groups (36.2 percent compared to 37.7 percent), but is markedly lower for the 60 year or older age group (20.5 percent). Hyperopia increased from 1.0 percent in the 20 to 29 year olds to 2.4 percent in 40 to 59 year olds to 10 percent in persons 60 years of age or older.<sup>34</sup>

Although most refractive errors first develop in childhood, the eye continues to undergo refractive changes throughout adult life. The Beaver Dam Eye Study, involving persons older than 40 years of age, reported changes in refractive error occurring over ten years. Adults (43 to 59 years of age) became more hyperopic, while older adults (70+ years of age) became more myopic. The reported 10-year change in refraction was +0.48, +0.03 and -0.19D for persons 43 to 59, 60 to 69, and 70+ years of age at baseline, respectively.<sup>35</sup>

Click to view the AOA Clinical Practice Guidelines on [Care of the Patient with Myopia](#) and [Care of the Patient with Hyperopia](#).

- **Presbyopia**

Presbyopia, which results from the loss of eye focusing ability with age, can affect the quality of vision and activities of daily living. Because presbyopia is the result of aging changes to the eye's accommodative mechanism,<sup>36</sup> its prevalence is directly related to the proportion of the aging population. Most individuals first begin experiencing the effects of presbyopia around ages 40 to 45.<sup>37</sup> When presbyopia is defined as a visual condition of everyone over the age of 45, using figures from the 2010 United States Census Bureau would suggest that about 121 million Americans have presbyopia.

Click to view the [AOA Clinical Practice Guideline on Care of the Patient with Presbyopia](#).

- **Cataracts**

Cataract development is a leading cause of vision loss in adults.<sup>12</sup> Advancing age is the major risk

factor for the development of cataracts. A cataract, however, may be present at, or develop shortly after, birth or occur later as a result of a metabolic condition, medications, exposure to radiation, electric shock, trauma, and ocular or systemic diseases. Approximately 17.2 percent (20.5 million) of Americans age 40 years and older have developed cataracts in one or both eyes. By age 80, more than half are affected. The total number of adults with cataracts is expected to increase to 30.1 million by the year 2020.<sup>38</sup>

Click to view the [AOA Clinical Practice Guideline on Care of the Adult Patient with Cataract.](#)

- **Glaucoma**

An estimated 2.9 million Americans, a prevalence of 2.11 percent, have primary open-angle glaucoma (POAG);<sup>39</sup> however, at least half of all cases may remain undiagnosed.<sup>4,39</sup> The disease process can begin at any age, but the risk of development of glaucoma increases greatly after age 40.

The prevalence of open-angle glaucoma increased from 0.9 percent in people 43 to 54 years of age to 4.75 percent in people 75 years of age or older in the Beaver Dam Eye Study.<sup>40</sup> The prevalence of POAG in persons over age 40 was 1.7 percent for white Americans and 5.6 percent for African Americans in the Baltimore Eye Survey.<sup>41</sup>

The greatest number of people with POAG are aged 70 to 79 years and are non-Hispanic whites. By 2050, an estimated 7.32 million persons will have POAG. During the next few decades, the largest demographic group with POAG will shift from older non-Hispanic white women to Hispanic men.<sup>42</sup>

Click to view the [AOA Clinical Practice Guideline on Care of the Patient with Open Angle Glaucoma.](#)

- **Diabetic retinopathy**

Diabetic retinopathy (DR), one of the most common microvascular complications of diabetes, is the leading cause of new cases of blindness and low vision among adults 20 to 74 years of age in the

United States. The duration of diabetes is one of the strongest predictors for development and progression of DR.<sup>43</sup> However, vision loss from DR can be reduced or delayed with early diagnosis and prompt intervention.<sup>44</sup>

In 2005 to 2008, an estimated 4.2 million, or 28.5 percent of people with diabetes ages 40 years and over, had DR and of these 655,000, or 4.4 percent had advanced diabetic retinopathy that could lead to severe vision loss.<sup>45</sup> The number of Americans 40 years or older with DR and vision-threatening DR is projected to triple by 2050, from 5.5 million (in 2005) to 16 million for DR and from 1.2 million (in 2005) to 3.4 million for vision-threatening DR.<sup>46</sup>

Click to view the [AOA Evidence-Based Clinical Practice Guideline on Eye Care of the Patient with Diabetes Mellitus.](#)

- **Age-related macular degeneration**

Age-related macular degeneration (AMD) is a major cause of vision loss in persons age 65 years or older.<sup>47,48</sup> Among the United States population age 40 years and older, an estimated 1.47 percent (1.75 million people) have AMD. This number is expected to nearly double to almost 3 million individuals by the year 2020.<sup>49</sup>

Age is the greatest risk factor for AMD. Around 25 percent of people between the ages of 65 and 74 years and 33 percent of those above 75 years of age in the United States are likely to develop AMD. The disease is far more prevalent among white Americans than African Americans.<sup>49</sup>

Click to view the [AOA Clinical Practice Guideline on Care of the Patient with Age-Related Macular Degeneration.](#)

- **Dry eye disease**

Dry eye disease, a form of ocular surface disease, is one of the most common ocular problems in the United States, particularly among older women.<sup>50</sup> It is a multifactorial disease of the tears and ocular surface resulting in symptoms of discomfort, visual

disturbance, and tear film instability, with potential damage to the ocular surface.<sup>51</sup>

Dry eye disease is more prevalent in persons with autoimmune diseases, in postmenopausal women, and in the elderly. The prevalence of dry eye disease is estimated to be between 7.4 percent and 33.7 percent in various populations.<sup>52</sup> The Beaver Dam Eye Study found a dry eye disease prevalence rate of 14.4 percent in adults 48 to 91 years of age.<sup>53</sup>

Click to view the [AOA Clinical Practice Guideline on Care of the Patient with Ocular Surface Disorders](#).

## E. COST OF EYE AND VISION DISORDERS

Eye disorders and vision loss are generally chronic conditions that continue for the duration of an individual's life resulting in ongoing expenses for treatment and the related social costs of vision loss. The total economic costs of eye disorders and vision loss for all adults 18 years of age or older in the United States in 2011 was estimated to be \$133.2 billion.<sup>2</sup> This includes both the direct costs for eye care services and vision aids, as well as the indirect costs for reduced productivity, decreased quality of life and loss of independence. The majority of these costs (55 percent) occur in persons age 65 years and older and is likely to increase due to the aging population. Adults younger than 40 years of age may incur as much as \$21.6 billion of the total cost of vision loss and eye disorders. When the costs of lost productivity are included, adults younger than 40 years may account for more than a third of the total cost.<sup>54</sup>

The most costly eye and vision condition for adults is refractive error (\$14.2 billion). Cataracts are the second costliest disorder (\$10.6 billion), followed by blindness and low vision (\$9.9 billion). Costs for retinal disorders and glaucoma total \$8.6 billion and \$5.7 billion, respectively. Although correction of refractive error is the most costly disorder due to the high prevalence of this condition in the adult population, per-person vision correction costs are lower than all other eye and vision disorders at an estimated \$81 per person, per year.<sup>2</sup>

## III. CARE PROCESS

### A. COMPREHENSIVE ADULT EYE AND VISION EXAMINATION

The comprehensive adult eye and vision examination provides the means to evaluate the structure, function, and health of the eyes and visual system. During the examination, information is obtained to explain symptoms reported by the patient and diagnose the cause of signs noted by the eye doctor. It also provides the means to identify the presence of other ocular or systemic conditions that may exist without symptoms. The examination is a dynamic and interactive process. It involves collecting subjective data directly from the patient and obtaining objective data by observation, examination, and testing. ([Appendix Figure 1](#))

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

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

- Evaluate the functional status of the eyes and visual system, taking into account special vision demands and needs
- Assess ocular health and related systemic health conditions
- Establish a diagnosis (or diagnoses)
- Formulate a treatment and management plan
- Counsel and educate the patient regarding his or her visual, ocular, and related systemic health care status, including recommendations



for prevention, treatment, management, or future care.

## 1. General Considerations

This Guideline describes the optometric examination for patients 18 years of age or older. The individual components are described in general terms because the order and methods of testing vary from practitioner to practitioner, and change as new technology is developed and is made available in the clinical setting.

The examination components described are not intended to be all-inclusive. Professional judgment and individual patient symptoms and findings may significantly influence the nature and course of the examination. The examination process may also vary from that delineated in this Guideline according to patient cooperation and comprehension, and the examination setting. For example, professional judgment may dictate modification of the examination for the developmentally delayed or frail adult, or for the adult in an institutional setting such as an extended care facility.

## 2. Examination Procedures\*

### CONSENSUS-BASED ACTION STATEMENT:

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

- Patient, family, and social history, including visual, ocular and general health, medication usage, and vocational and avocational visual requirements
- Measurement of visual acuity
- Preliminary examination regarding aspects of visual function and ocular health
- Determination of refractive status

- Assessment of ocular motility, binocular vision, and accommodation, as appropriate, based on patient's age, visual signs and symptoms, and visual requirements
- Ocular health assessment, including evaluation of the anterior and posterior segment, peripheral retina, measurement of intraocular pressure, and visual field testing
- Systemic health assessment, as indicated.

[\(See Appendix Table 1\)](#)

*Refer to A. Comprehensive Adult Eye and Vision Examination, Section 4 for a listing of potential benefits and harms of testing*

**Evidence Quality:** There is a lack of published research to support or refute the use of all of the tests and/or assessments included in this recommendation.

**Benefit and Harm Assessment:** Implementation of this recommendation is likely to result in the enhanced ability to effectively diagnose any eye or vision problem in adults. The benefits of this recommendation were established by expert consensus opinion.

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

### a. Patient History

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

- Nature and history of the presenting problem, including chief complaint
- Visual and ocular history
- General health history, including a social history and review of systems
- Family ocular and health histories
- Medication usage, including prescription and nonprescription drugs; use of mineral, herbal, and other vitamin supplements; documentation of medication allergies; and utilization of other complementary and alternative medicines
- Vocational and avocational visual requirements
- Names of and contact information for the patient's other health care providers.

**CONSENSUS-BASED ACTION STATEMENT:**

Any systemic medication or supplement used by patients should be investigated by their eye doctor for ocular risk factors or side effects.

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

**Benefit and Harm Assessment:** Implementation of this recommendation is likely to assist eye doctors in determining the potential risks or side effects any medication or supplement may have on a patient's eye health or vision. The benefits of this recommendation were established by an expert consensus opinion.

**b. Visual Acuity**

Visual acuity may 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 (DVA)
- Near visual acuity (NVA)
- 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.<sup>55</sup>(B/Recommendation)*

**c. Preliminary Examination**

The preliminary examination includes an initial evaluation of aspects of the patient's visual function, ocular health, and related systemic health status. The procedures, instrumentation utilized, and order in which these assessments are performed may vary. The following areas may be assessed, when appropriate:

- General observation of the patient, including orientation to person, place and time, and assessment of mood and affect
- Pupil size and pupillary responses
- Eye movements
- Near point of convergence (NPC)
- Ocular alignment

*Clinical note: The estimated cover test, prism neutralized objective cover test, and the prism neutralized subjective cover test are equally reliable for determining heterophoria.<sup>56</sup>(C/Recommendation)*

- Stereopsis
- Color vision

*Clinical note: Although effective when used with standard illuminant C, some pseudoisochromatic plate tests only detect protan and deutan color vision deficiency,<sup>57</sup>(C/Recommendation) while other color vision tests provide the added advantage of detection of tritan defects and the ability to categorize defects as mild, moderate, or severe.<sup>58</sup>(C/Recommendation)*

**d. 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 measurement should be analyzed with other testing data and an assessment of the patient's visual needs obtained during the 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 optical correction
- Objective measurement of refractive status, including cycloplegic refraction, if needed

*Clinical note: Autorefraction may be used as a starting point, but not necessarily as a substitute, for subjective refraction. Retinoscopy, however, when performed by an experienced clinician, is more accurate than automated refraction for determining a starting point for non-cycloplegic refraction.*<sup>59</sup>(C/Recommendation)

- Subjective measurement of refractive status.

#### **e. Ocular Motility, Binocular Vision, and Accommodation**

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

- Evaluation of ocular motility
- Assessment of heterophorias, vergence ranges and facility

*Clinical note: Measurement of lateral heterophoria may be performed using the prism neutralized cover test, von Graefe test, or Modified Thorington test. The Modified Thorington test has been shown to have the highest interexaminer correlation and provides*

*the most repeatable method of evaluating heterophoria.*<sup>60</sup>(C/Recommendation)

*Clinical note: Diagnosis of binocular vision dysfunctions for the symptomatic patient can be improved through the use of vergence facility testing at near.*<sup>61</sup>(C/Recommendation)

- Testing for suppression
- Measurement of accommodative amplitude and facility.

*Clinical note: Testing of vergence facility, binocular accommodative ability and vertical associated phoria can provide a minimum database for the evaluation of binocular vision dysfunction in patients having a normal distance phoria and AC/A ratio. Patients failing one or more of these tests can be provided a more extensive examination battery.*<sup>61</sup>(C/Recommendation)

Click to view the [AOA Clinical Practice Guideline on Care of the Patient with Accommodative and Vergence Dysfunction](#).

#### **f. Ocular and Systemic Health Assessment**

Thorough assessment of the health of the eyes and associated structures is an important and integral component of the comprehensive adult eye and vision examination. The eyes and associated structures are not only sites for primary ocular diseases, but they are also subject to systemic disease processes that affect the body as a whole (e.g., disorders of neurologic, vascular, endocrine, immune, or neoplastic origin). This part of the examination contributes to the diagnosis of diseases and disorders that have ocular manifestations and helps determine the impact of any systemic disease on the eye and associated structures. ([Appendix Table 2](#))

<p><b>CONSENSUS-BASED ACTION STATEMENT:</b> Pharmacologic dilation of the pupil is generally required for thorough stereoscopic evaluation of the ocular media, retinal vasculature, macula, optic nerve, and the peripheral retina.</p>
<p><b>Evidence Quality:</b> There is a lack of published research to support or refute the use of this recommendation.</p>
<p><b>Benefit and Harm Assessment:</b> Implementation of this recommendation would enhance the ability to diagnose ocular disease. Potential harms involve adverse reactions to drugs used for dilation.</p>

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

- Evaluation of the ocular anterior segment and adnexa
- Measurement of the intraocular pressure (IOP)

*Clinical note: The Goldmann applanation tonometer is considered the reference standard for the measurement of intraocular pressure (IOP). Non-contact and handheld applanation tonometers, however, can provide IOP measurements close to that of the Goldmann.<sup>62</sup>(A/Strong Recommendation) Consistent use of the same tonometer during clinical follow-up testing may be as important as the choice of tonometer.*

*Clinical note: Measurement of a patient's IOP should include recording of the type of instrument used and time of day.<sup>64</sup>*

<p><b>EVIDENCE-BASED ACTION STATEMENT:</b> Because of possible variations in measurements obtained when using various intraocular pressure (IOP) testing instruments/techniques, eye doctors should consider taking more than one reading with the same instrument to reduce measurement error.<sup>63</sup></p>
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<p><b>Evidence Quality:</b> GRADE C, Observational Study. No randomized controlled trials or systematic reviews were identified regarding the variability of IOP measurements.</p>	
<p><b>Clinical Recommendation Level:</b> Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.</p>	
<p><b>Evidence Statement:</b> There can be significant differences in the measurements obtained using different IOP testing methods. The clinician needs to be aware of these differences when using any particular instrument or technique.<sup>63</sup> Evidence Quality: Grade C</p>	
<p><b>Potential Benefits:</b> Preventing and/or minimizing vision loss through early diagnosis, treatment, and management of ocular health conditions.</p>	<p><b>Potential Risks/Harms:</b> Allergic responses to diagnostic pharmaceutical agents or other adverse effects.</p>
<p><b>Benefit and Harm Assessment:</b> Benefits significantly outweigh harms.</p>	
<p><b>Potential Costs:</b> Direct cost of testing as a component of a comprehensive eye and vision examination.</p>	
<p><b>Value Judgments:</b> Repeat measurement of IOP using the same instrument/technique can reduce the chances of measurement error and help ensure appropriate patient diagnosis and management.</p>	
<p><b>Role of Patient Preferences:</b> Small</p>	
<p><b>Intentional Vagueness:</b> Specific type of IOP instruments/techniques are not specified as they are considered practice of medicine decisions.</p>	
<p><b>Gaps in Evidence:</b> Research is needed to support the validity, reliability and repeatability of IOP tests/instruments currently used to diagnose glaucoma in adult patients.</p>	
<p>Research is needed to support the validity, reliability and repeatability of new or emerging technologies/instrumentation in the diagnosis of glaucoma.</p>	

- Evaluation of the ocular media
- Evaluation of the ocular posterior segment
- Visual field testing

*Clinical note: Confrontation visual field (CVF) testing is a simple and inexpensive method of identifying visual field loss. Subjective description of the examiners face and quadrant finger counting are not very sensitive, but might quickly identify a substantial loss in visual field.<sup>65</sup>(B/Recommendation) This type of testing may not detect significant disease such as glaucoma, compressive optic neuropathies and tumors.<sup>66</sup>(C/Recommendation)*

*The diagnostic accuracy of confrontation visual field testing is low for mild to moderate visual field defects and when performed as a stand-alone test,<sup>67</sup>(B/Recommendation) however, it has high positive predictive value when a field loss is demonstrated.<sup>68</sup>(C/Recommendation) The sensitivity of confrontation testing can be improved by using two testing procedures (e.g., kinetic testing with a 5mm red target along with static finger wiggle testing).<sup>67</sup>(B/Recommendation)*

**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 threshold visual field testing on patients if there is a clinical suspicion of a visual field defect.<sup>67,68</sup>

**Evidence Quality:** GRADE B<sup>67</sup>, Cohort study and GRADE C<sup>68</sup>, Diagnostic study. No randomized controlled trials or systematic reviews were identified regarding the sensitivity of confrontation visual field testing.

**Clinical Recommendation Level:** Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.

**Evidence Statements:** The diagnostic accuracy of confrontation visual field testing is low for mild to moderate visual field defects and when performed as a standalone test. The sensitivity of confrontation testing can be improved by using two testing procedures (e.g., kinetic testing with a 5mm red target along with static finger wiggle testing). Formal perimetry should be conducted if there is a suspicion of a visual field defect.<sup>67</sup> Evidence Quality: Grade B

When only an individual test is performed, confrontation visual field testing is sensitive for only very dense visual field defects. However, there is high positive predictive value when a confrontation visual field loss is demonstrated. Therefore confrontation visual field testing is not without value. Clinicians should not rely on a negative confrontation result as proof that a field loss is not present.<sup>68</sup> Evidence Quality: Grade C

**Potential Benefits:**

Decreased likelihood that a visual field defect will be missed.

**Potential Risks/**

**Harms:** No adverse effects of testing.

**Benefit and Harm 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:** Research is needed to support the validity, reliability and repeatability of confrontation visual field testing in adult patients.

Research is needed to support the validity, reliability and repeatability of new or emerging technologies in visual field testing.

- Systemic health assessment (e.g., blood pressure measurement, carotid artery

assessment, laboratory testing, imaging, cranial nerve assessment).

#### **g. Supplemental 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 indicate the need for additional testing, either performed or ordered by the eye care provider. Supplemental procedures (e.g., optical coherence tomography [OCT], threshold visual field testing, gonioscopy, fundus photography, keratometry, pachymetry, glare testing, contrast sensitivity testing, dry eye assessment) may be performed at the initial examination or during subsequent examinations. If supplemental 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
- Provide alternative means of evaluating patients who may not be fully cooperative or who may not comprehend testing procedures

### **3. Assessment and Diagnosis**

At the completion of the examination, the eye doctor assesses and evaluates all the data obtained to establish a diagnosis (or diagnoses) and formulates a treatment and management plan. The nature and severity of the problem(s) diagnosed determine the need for an optical prescription (e.g., eyeglasses or contact lenses) or other treatment (e.g., vision rehabilitation or vision therapy services). A prescription for correction of any refractive error is provided at the conclusion of the examination.<sup>69</sup>

For some patients, further assessment and/or treatment by another eye doctor, the patient's primary care physician, or another health care provider may be indicated.

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

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 or allergic responses to diagnostic pharmaceutical agents or materials used
- Missed or misdiagnosis of eye health or vision problems
- Unnecessary referral or treatment.

## **B. MANAGEMENT**

### **1. Patient Counseling and Education**

Communication with the patient at the conclusion of a comprehensive adult eye and vision examination should include a review and discussion of examination findings and anticipated outcomes based upon the results of the assessment. Patients expect to receive information about their diagnosis, recommended treatment, and prognosis explained in understandable language.<sup>70</sup>

Language and cultural differences or misunderstandings may prevent some individuals from accepting a doctor’s recommendation. In addition, anxiety reduces the effectiveness of patient-practitioner communications and results in reduced attention, recall of information, and compliance with treatment. The use of “patient-centered” communications and “active listening” can help reduce anxiety and improve patient satisfaction and outcomes.<sup>71</sup> Improved doctor-patient communications and higher levels of patient involvement in care are linked to better clinical outcomes.<sup>70</sup>

When communicating with patients, it is important to take their level of “health literacy” into consideration. Health literacy is “the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate decisions regarding their health.”<sup>72</sup> Poor health literacy is associated with worse health-related outcomes in many chronic conditions. Eye models, diagrams and written materials can be used to aid in patient understanding. The patient’s involvement in the decision-making process can also increase commitment to the treatment plan.

In compliance with the Americans with Disabilities Act (ADA), eye care providers need to make reasonable accommodations to ensure that whatever is written or spoken is clear and understandable to individuals with disabilities. Appropriate auxiliary aids and services must be made available, when needed, to enable effective communications when evaluating, treating, or counseling persons with hearing, vision, or speech impairments. According to the ADA, auxiliary aids and services for individuals who are hearing impaired include qualified interpreters, note takers, computer-aided transcription services, written materials, telephone handset amplifiers, assistive listening systems, telephones compatible with hearing aids, closed caption decoders, open and closed captioning, telecommunications devices for the deaf (TDD’s), videotext displays and exchange of written notes. For individuals with vision impairments, auxiliary aids and services include qualified readers, taped texts, audio recordings, magnification software, optical

readers, Braille materials, and large print materials. Examples for individuals with speech impairments include TDD’s, computer terminals, speech synthesizers, and communication boards.<sup>73</sup>

<p><b>CONSENSUS-BASED ACTION STATEMENT:</b> At the conclusion of an eye and vision examination, the eye doctor should explain the diagnosis to the patient, relate it to the patient’s symptoms, and discuss a treatment plan and prognosis.</p>
<p><b>Evidence Quality:</b> There is a lack of published research to support or refute the use of this recommendation.</p>
<p><b>Benefit and Harm Assessment:</b> Implementing this recommendation is likely to increase patient understanding of any diagnosed eye or vision problems and improve compliance with any recommended treatment. The benefits of this recommendation were established by expert consensus opinion.</p>

Patient counseling and education may include:

- Review of the patient’s visual and ocular health status in relation to his/her visual symptoms and complaints
- Discussion of any refractive correction that provides improved visual efficiency and/or appropriate eye protection
- Explanation of available treatment options for diagnosed eye or vision conditions, including risks, benefits, alternatives, and expected outcomes
- Recommendation of a course of treatment with the reasons for its selection and the prognosis
- Discussion of the importance of patient compliance with the treatment prescribed
- Recommendation for follow-up care and re-examination.

When appropriate, patients should also be counseled regarding:



- Referral - When referral for ocular surgery or other specialty care is indicated, patients need to receive information about the purpose of the referral and the potential benefits and harms of the procedure or service.

**CONSENSUS-BASED ACTION STATEMENT:**

Persons who will undergo or have undergone ocular surgery or other specialty care should be counseled by their eye doctor regarding their ongoing need for periodic comprehensive eye and vision examinations.

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

**Benefit and Harm Assessment:** Implementing this recommendation is likely to increase patient understanding of the need for ongoing primary eye and vision care services after eye surgery or other specialized care. The benefits of this recommendation were established by expert consensus opinion.

- Smoking cessation - Individuals who smoke are at increased risk for the development of cardiovascular disease, cancer and diabetes.<sup>74</sup> In addition, cigarette smoking places them at risk for a number of eye diseases, including cataracts,<sup>75</sup>(B/Recommendation) age-related macular degeneration,<sup>76,77</sup> and ocular surface disorders<sup>78,79</sup> and the development of visual impairment.<sup>80</sup>(B/Recommendation). Given the effect of smoking on overall health, and especially on vision, counseling to reduce or eliminate tobacco use is needed.

**EVIDENCE-BASED ACTION STATEMENT:** Eye doctors should ask about and document their patients' smoking status and inform them about the benefits to their eyes, vision, and overall health, through smoking cessation.<sup>75, 80</sup>

**Evidence Quality:** GRADE B, Cohort studies. No randomized controlled trials or systematic reviews were identified regarding the effects of smoking on eye health and vision.

**Clinical Recommendation Level:**

Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.

**Evidence Statements:** Cigarette smoking is a major modifiable risk factor for cataract and age-related macular degeneration. Given the effect of smoking on overall health, and especially on vision, counseling to reduce or eliminate tobacco use is needed.<sup>75</sup> Evidence Quality: Grade B

A physically active lifestyle, occasional drinking, and not smoking are modifiable behaviors associated with a reduced risk for developing visual impairment. Patients should be counseled about these modifiable risk factors to help prevent or decrease future vision loss.<sup>80</sup> Evidence Quality: Grade B

**Potential Benefits:** Counseling and educating patients about the potential impact of smoking may help maintain ocular and systemic health, and visual function.

**Potential Risks/Harms:** None.

**Benefit and Harm Assessment:** Benefits significantly outweigh harms.

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

**Value Judgments:** Patients who smoke may benefit from counseling on smoking cessation to reduce the risk of cataracts, age-related macular degeneration, and ocular surface disorders.

**Role of Patient Preferences:** Large

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

**Gaps in Evidence:** Research is needed to evaluate the relationship between vision loss and smoking.

- Eye protection - Eye injury is a leading cause of monocular blindness in the United States and a common reason for eye-related emergency department visits. The majority of injuries occur in the home and workplace. Rates of eye injury treated in emergency rooms are reported to be highest among males in their 20s and 30s and among American Indians and African Americans.<sup>81</sup>

Many individuals are unaware of the ocular hazards they face, particularly at home or while playing sports.<sup>82</sup> Most eye injuries are preventable with appropriate use of protective eyewear.<sup>81,83</sup> It is, therefore, important to discuss eye safety issues with patients, including eye hazards at work, school, or home and during recreational activities.<sup>84</sup>

**CONSENSUS-BASED ACTION STATEMENT:**

Individuals performing high-risk activities, monocular persons, and those with previous eye trauma or eye surgery should be strongly advised by their eye doctor to wear appropriate eye protection with impact resistant properties.

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

**Benefit and Harm Assessment:** Implementing this recommendation is likely to increase patients' use of eye protection based on their personal risk factors. The benefits of this recommendation were established by expert consensus opinion.

- Ultraviolet protection - Patients should be advised about the need to protect their eyes from exposure to ultraviolet (UVA and UVB) radiation. Exposure to high levels of UV radiation can cause photokeratitis and photoconjunctivitis. Chronic exposure to even low levels of UV radiation is a risk factor for developing cataracts, pterygium, squamous cell carcinoma of the cornea and conjunctiva, and skin cancer.<sup>85</sup>

**CONSENSUS-BASED ACTION STATEMENT:**

Exposure to UV radiation is a risk factor for disorders of the eye. Eye doctors should advise their adult patients about the benefits of the regular use of sunglasses that effectively block at least 99 percent of UVA and UVB radiation and the use of hats with brims when outdoors.

**Evidence Quality:** There is a lack of sufficient evidence to define the specific effects of UV on the eyes.

**Benefit and Harm Assessment:** Implementing this recommendation is likely to decrease patient risk of eye health problems from chronic exposure to UV radiation. The benefits of this recommendation were established by expert consensus opinion.

- Eye health and nutrition - Maintaining a healthy lifestyle and diet may, for example, help to prevent or slow the progression of age-related macular degeneration (AMD) in certain individuals.<sup>86</sup> Eye doctors should remain alert for new research that demonstrates the effects of diet and nutrition on ocular health and the prevention of various eye diseases and conditions.

**CONSENSUS-BASED ACTION STATEMENT:**

Eye doctors should be aware of their patients' dietary and supplementation practices and counsel them on good nutrition for eye health.

**Evidence Quality:** Available research confirms the importance of good nutrition for specific aspects of eye health, but it does not support or refute the use of a broader evidence-based approach to dietary and supplemental practices.

**Benefit and Harm Assessment:** Implementing this recommendation is likely to help patients understand the benefits to their eyes and vision by improving their nutritional habits. The benefits of this recommendation were established by expert consensus opinion.

**2. Coordination and Frequency of Care**

The diagnosis of a wide array of eye and vision anomalies, diseases, disorders, and related systemic conditions may result from a comprehensive adult eye and vision examination. The nature and severity of the problem(s) diagnosed determine the need for:

- Optical correction
- Prescription or nonprescription medications
- Surgery
- Referral for consultation with or treatment by another eye doctor, the patient's primary care physician, or other health care provider

- Follow-up for additional evaluation and/or treatment.

#### **a. Coordination of Care**

On the basis of the examination, it may be determined that the patient needs additional services. Intraprofessional consultation may be needed for optometric services such as treatment and management of ocular disease, vision 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 reveal non-ophthalmic conditions for which the eye doctor may coordinate needed care. The patient may be referred to his or her 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.

Ocular telehealth programs may be a component of care for some patients, particularly in areas where access to specialized eye care services is limited. These programs rely on the digital capture and transmission of standardized ocular images and patient health information for interpretation and evaluation by trained observers who can recommend a treatment and care plan. To date, telehealth programs have been most widely used for the evaluation of patients with diabetic retinopathy<sup>87</sup> and in some cases age-related macular degeneration.<sup>88</sup> The use of ocular telehealth-based programs has the potential to expand access to eye care services; however, telehealth-based retinal evaluations are not a substitute for a comprehensive eye examination by an eye doctor.

#### **b. Frequency of Care**

Individuals should receive periodic eye and vision examinations to detect and treat any eye disease in

its early stages in order 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.

Many eye diseases can be asymptomatic in their earliest and most treatable stages. Detection of any eye disease in this early phase can be very beneficial to the patient for treatment options and treatment success.

Since the prevalence of ocular diseases and vision disorders tends to increase with age, the need for patient re-examination is potentially age dependent (Table 1). In addition, the recommended frequency of a comprehensive eye and vision examination varies with an individual's ocular and medical history, occupation, and other related risk factors.

- **18 through 39 years of age**

Vision problems in people under 40 years of age are largely due to refractive errors and eye injury.<sup>4</sup> More than half of all individuals treated for eye injuries are between 18 and 45 years of age and nearly 30 percent of those are 30 to 40 years old.<sup>89</sup> Lifestyle changes adopted during this period may adversely affect vision and eye health in later years.<sup>37</sup> Maintaining a physically active lifestyle, limiting alcohol use, and not smoking are behaviors associated with a reduced risk of developing visual impairment.<sup>80</sup>(B/ Recommendation)

The educational, vocational and avocational visual requirements for individuals in this age group are substantial. Visual demands of the workplace bring about the need for regular eye care. The most frequent health complaints among workers who use computers are vision related. Studies indicate that a large percentage of people working at a computer have visual symptoms.<sup>90-92</sup> Other workers whose jobs involve extensive near viewing tasks also experience similar problems.



The prevalence of ocular disease is relatively low for young adults; however, many eye diseases can initially develop without signs or symptoms. Therefore, having good visual acuity does not rule out their presence.<sup>24</sup> Glaucoma may begin to appear in this age group, particularly among African Americans. In addition, diabetes increasingly affects young adults and is a leading cause of blindness among working age Americans. To ensure early detection of potentially sight-threatening disorders and for young adults to maintain their visual efficiency and productivity, periodic examinations are needed.

**CONSENSUS-BASED ACTION STATEMENT:**

Comprehensive eye and vision examinations are recommended at least every two years for asymptomatic, low-risk persons ages 18 through 39 years to evaluate changes in eye and visual function, and provide for early detection of sight-threatening eye and systemic health problems.

*Refer to A. Comprehensive Adult Eye and Vision Examination, Section 4 for a listing of potential benefits and harms of testing.*

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

**Benefit and Harm Assessment:** Implementing 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.

• **40 through 64 years of age**

The prevalence of refractive errors is related to age and varies with gender and race/ethnicity.<sup>28</sup> Changes in refractive error are not uncommon in persons 40 years of age or older.<sup>35</sup> 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.<sup>32</sup> Many adults may have visually significant undiagnosed refractive errors, the detection of which can be a significant benefit in their personal and work lives.<sup>93</sup>

(B/Recommendation) Near vision problems due to refractive errors are also significant causes of reduced vision among people of working age.<sup>94</sup>(B/Recommendation)

The onset of presbyopia in this age group results in reduced ability to focus at near working 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.

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.<sup>95</sup>

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, periodic eye examinations are an important means to prevent vision loss.<sup>37</sup> Persons 40 to 65 years of age, with or without visual impairment, who had an eye exam in the prior year, were found to generally have better vision, as indicated by their ability to recognize friends across the street and to read a newspaper or magazine.<sup>96</sup>(B/Recommendation)

<p><b>EVIDENCE-BASED ACTION STATEMENT:</b> Comprehensive eye and vision examinations are recommended at least every two years for asymptomatic, low-risk persons 40 through 64 years of age to evaluate changes in eye and visual function, and provide for the early detection of eye diseases, which may lead to significant vision loss, and systemic conditions that may affect health or vision.<sup>93,94,96</sup></p>
<p><b>Evidence Quality:</b> GRADE B, Cohort studies. No randomized controlled trials or systematic reviews were identified regarding the recommended frequency of examination.</p>
<p><b>Clinical Recommendation Level:</b> Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.</p>
<p><b>Evidence Statements:</b> A significant portion of working age adults have visually significant undiagnosed refractive errors. Detection of refractive errors in working age adults could benefit their working lives.<sup>93</sup> Evidence Quality: Grade B</p> <p>Near vision problems due to refractive errors are a significant cause of reduced vision among people of working age.<sup>94</sup> Evidence Quality: Grade B</p> <p>Periodic eye examinations are recommended for the timely detection and treatment of glaucoma, age-related macular degeneration (AMD), cataracts and many other eye conditions to prevent irreversible vision loss in person 40 to 65 years of age. Persons 40 to 65 years of age, with and without visual impairment, who had an eye exam in the prior year generally had better vision.<sup>96</sup> Evidence Quality: Grade B</p>

<p><b>Potential Benefits:</b> Optimizing visual function through diagnosis, treatment, and management of refractive, ocular motor, accommodative and binocular vision problems.</p> <p>Preventing and/or minimizing vision loss through early diagnosis, treatment, and management of ocular health conditions.</p>	<p><b>Potential Risks/Harms:</b> Temporary visual disturbances resulting from dilation, allergic responses to diagnostic pharmaceutical agents, or other adverse effects.</p>
<p><b>Benefit and Harm Assessment:</b> Benefits significantly outweigh harms.</p>	
<p><b>Potential Costs:</b> Direct cost of testing.</p>	
<p><b>Value Judgments:</b> Periodic eye and vision examinations are an important means to prevent vision loss and maintain and improve health-related quality of life.</p>	
<p><b>Role of Patient Preferences:</b> Moderate.</p>	
<p><b>Intentional Vagueness:</b> None.</p>	
<p><b>Gaps in Evidence:</b> Research is needed to determine the optimum frequency of eye examinations to prevent vision loss and maintain visual function and eye health.</p>	

- **65 years of age and older**

The prevalence of visual impairment increases rapidly with age among all racial and ethnic groups.<sup>97</sup> The portion of adults reporting some form of visual impairment rises dramatically after age 65. Seventeen percent of Americans age 65 to 74 years and 26 percent of those 75 years of age or older self-report some form of vision loss.<sup>98</sup> Vision loss in older adults can adversely affect their activities of daily living, which allow them to live independently in their community.

Studies have found that persons age 65 years and older who have regular eye examinations experience less decline in vision and improved functional status.<sup>11</sup>(B/Recommendation) In addition, correction of refractive error improves vision - specific quality

of life in persons over age 65.<sup>6</sup>(B/Recommendation) Those who have an annual eye examination also have a lower probability of reduction in reading ability and of developing legal blindness or chronic vision impairment.<sup>99</sup>(B/Recommendation)

Maintaining good vision may also play a role in preventing falls. Falls are a common occurrence in older adults and can have serious consequences. Vision problems, including visual field defects (as measured by full field testing of at least 60 degrees)<sup>100</sup>(B/Recommendation), and impaired visual acuity<sup>101,102</sup>(B/Recommendation), contrast sensitivity<sup>101,102</sup>(B/Recommendation), and depth perception<sup>102</sup>(B/Recommendation) have been linked to the risk of falls. The use of bifocals and being obese have also been found to be risk factors for falls.<sup>103</sup>(B/Recommendation)

Vision evaluation that addresses both central and peripheral visual impairment, including visual acuity, depth perception and contrast sensitivity, may be needed to reduce the rates of falls and injury related to vision loss in older individuals.<sup>103</sup>(B/Recommendation) Cost-effective measures such as ensuring their spectacle correction is current, or the use of cataract surgery, when indicated, may also have an impact on preventing falls in older people.<sup>101,102</sup>(B/Recommendation) One study, however, found that correction of vision problems did not reduce the frequency of falls, but actually increased them. Major changes in individuals' eyeglass prescriptions may have contributed to the increase in falls.<sup>104</sup>

Failure to diagnose and treat vision problems in the elderly may contribute to cognitive decline and dementia.<sup>105-107</sup> Visual disturbances, including problems with contrast sensitivity, color perception, visuospatial orientation and pupillary reaction can be among the first symptoms in persons with Alzheimer's disease.<sup>107</sup> Early vision correction may reduce the severity of dementia and its associated functional decline.<sup>106</sup>

<b>EVIDENCE-BASED ACTION STATEMENT:</b> Individuals 60 years of age and older with central and/or peripheral vision loss should be counseled by their eye doctor about the potential for an increased risk of falls. <sup>100,102,103</sup>	
<b>Evidence Quality:</b> GRADE B, Cohort studies. No randomized controlled trials or systematic reviews were identified regarding the loss of visual field and the potential for an increased risk of falls in older adults.	
<b>Clinical Recommendation Level:</b> Recommendation. Eye doctors should generally follow this recommendation, but should remain alert for new information.	
<b>Evidence Statements:</b> Visual field defects, as measured by full field testing of at least 60 degrees, are a risk factor for falls. However, reduced visual acuity, contrast sensitivity or stereoacuity were not found to be associated with falls. <sup>100</sup> Evidence Quality: Grade B  Binocular depth perception, and good visual acuity and contrast sensitivity are associated with a decreased risk for falls. Older individuals should be tested for these vision functions in an effort to decrease their risk of falls. <sup>102</sup> Evidence Quality: Grade B  Central and peripheral visual impairment increases the risk for falls and falls with injury. Peripheral vision impairment is associated with increased risk of tripping over obstacles and the use of bifocals and being obese are also significant risk factors for falls. <sup>103</sup> Evidence Quality: Grade B	
<b>Potential Benefits:</b> Counseling and educating patients on current conditions and preventive care in order to maintain ocular and systemic health and visual function.	<b>Potential Risks/Harms:</b> None.
<b>Benefit and Harm Assessment:</b> Benefits significantly outweigh harms.	
<b>Potential Costs:</b> Direct cost of counseling as part of a comprehensive eye and vision examination.	

<b>Value Judgments:</b> Patients with central and/or peripheral vision loss may benefit from falls prevention counseling and intervention when initially diagnosed.
<b>Role of Patient Preferences:</b> Moderate.
<b>Intentional Vagueness:</b> Specific type/form of counseling is not stated, as it is patient specific.
<b>Gaps in Evidence:</b> Research is needed to evaluate the relationship between vision loss and falls.

<b>EVIDENCE-BASED ACTION STATEMENT:</b> Annual comprehensive eye and vision examinations are recommended for persons 65 years of age or older for the diagnosis and treatment of sight-threatening eye conditions and the timely correction of refractive errors. <sup>6,11,99,102</sup>
<b>Evidence Quality:</b> GRADE B, Randomized Controlled Trial and Cohort studies.
<b>Clinical Recommendation Level:</b> Strong Recommendation. Eye doctors should follow this recommendation unless clear and compelling rationale for an alternative approach is present. The quality of evidence provides a clear reason to make a recommendation
<b>Evidence Statements:</b> Correction of refractive error improves vision specific quality of life in persons over age 65. <sup>6</sup> Evidence Quality: Grade B  Persons ≥ 65 years of age who have regular eye examinations experience less decline in vision and improved functional status. <sup>11</sup> Evidence Quality: Grade B  Individuals ≥ 65 years of age who have annual eye examinations have a lower probability of a reduction in reading ability and of developing legal blindness or low vision. <sup>99</sup> Evidence Quality: Grade B  Binocular depth perception, and good visual acuity and contrast sensitivity are associated with a decreased risk for falls. Older individuals should be tested for these vision functions in an effort to decrease their risk of falls. <sup>102</sup> Evidence Quality: Grade B

<b>Potential Benefits:</b> Optimizing visual function through diagnosis, treatment, and management of refractive, ocular motor, accommodative, and binocular vision problems.  Preventing and/or minimizing vision loss through early diagnosis, treatment, and management of ocular health conditions.	<b>Potential Risks/Harms:</b> Temporary visual disturbances resulting from dilation, allergic responses to diagnostic pharmaceutical agents, or other adverse effects.
<b>Benefit and Harm Assessment:</b> Benefits significantly outweigh harms.	
<b>Potential Costs:</b> Direct costs of testing.	
<b>Value Judgments:</b> Annual eye and vision examinations can help maintain visual function and reduce the likelihood of vision loss from eye disease.	
<b>Role of Patient Preferences:</b> Moderate.	
<b>Intentional Vagueness:</b> None.	
<b>Gaps in Evidence:</b> Research is needed to determine the optimum frequency of eye examinations in persons 65 years of age or older to prevent vision loss and maintain visual function and eye health.	

### c. At-risk Patients

Persons who notice vision changes, those at higher risk for the development of eye and vision problems, and individuals with a family history of eye disease need to have an eye examination more frequently than asymptomatic persons with no history of ocular or general health problems.<sup>108</sup>(B/Recommendation) The eye doctor may recommend more frequent re-examinations of certain patients at risk for vision loss, regardless of their age. Factors that put persons at risk include:

- A personal or family history of ocular disease
- Belonging to certain racial and ethnic groups

- Systemic health conditions with potential ocular manifestations ([Appendix Table 2](#))
- 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 ([Appendix Table 3](#))
- Having functional vision in only one eye
- Wearing contact lenses (See [Care of the Contact Lens Patient Guideline](#))
- Eye surgery or previous eye injury
- High or progressive refractive error
- Other eye-related health concerns or conditions.

Table 1 provides a summary of recommended frequency of eye examinations for “Asymptomatic/Low Risk” patients and for those who are considered to have any factors listed above which puts them “At Risk” for the development of eye or vision problems.

**TABLE 1:**

Recommended Eye Examination Frequency for Adult Patients\*\*

Examination Interval

Patient Age (Years)	Asymptomatic/Low-Risk	At-Risk
18 through 39	At least every two years	At least annually, or as recommended
40 through 64	At least every two years	At least annually, or as recommended
65 and older	Annually	At least annually, or as recommended

**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 (Table 1) if new ocular, visual, or systemic health problems develop.

*Refer to A. Comprehensive Adult Eye and Vision Examination, Section 4 for a listing of potential benefits and harms of testing.*

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

**Benefit and Harm Assessment:** Implementing 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.

\*\*The following American Optometric Association Clinical Practice Guidelines provide more information on the recommended frequency of examinations for persons with or at risk for specific eye and vision disorders:

- Eye Care of the Patient with Diabetes Mellitus
- Care of the Patient with Amblyopia
- Care of the Patient with Primary Angle Closure Glaucoma
- Care of the Patient with Age-Related Macular Degeneration
- Care of the Patient with Anterior Uveitis
- Care of the Adult Patient with Cataract
- Care of the Patient with Open Angle Glaucoma
- Care of the Patient with Ocular Surface Disorders
- Care of the Patient with Conjunctivitis
- Care of the Patient with Strabismus: Esotropia and Exotropia
- Care of the Patient with Retinal Detachment and Peripheral Vitreoretinal Disease

- Care of the Patient with Visual Impairment (Low Vision Rehabilitation)
- Care of the Patient with Myopia
- Care of the Patient with Hyperopia
- Care of the Patient with Presbyopia
- Care of the Patient with Accommodative and Vergence Dysfunction
- Care of the Contact Lens Patient
- Care of the Patient with Learning Related Vision Problems

## **C. CONCLUSION**

Eye and vision disorders have broad implications in health care because of their potential for causing disability, suffering, and loss of productivity. Early diagnosis 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.

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.

Periodic 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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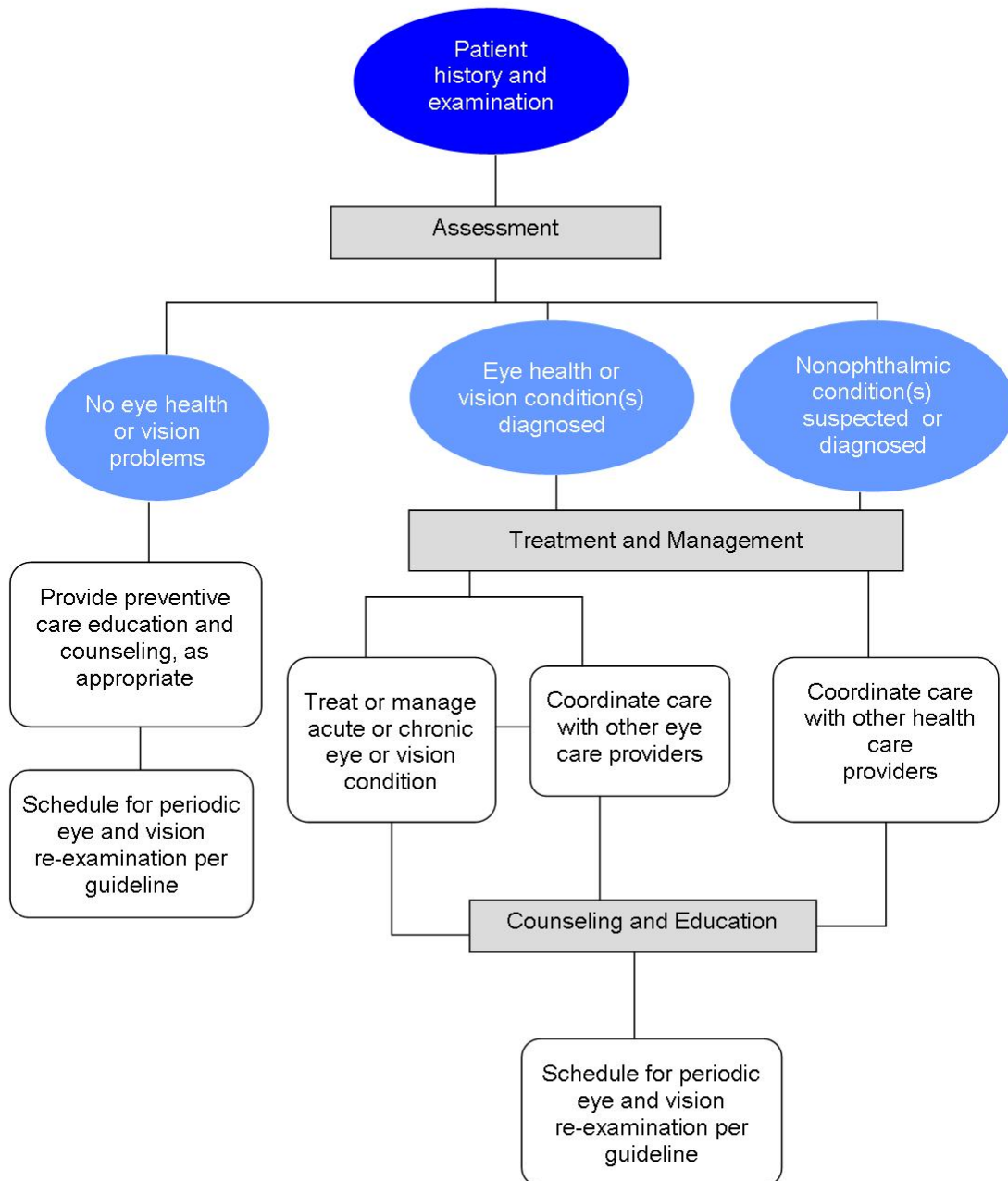
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## V. APPENDIX

### A. Appendix Figure 1:

Comprehensive Adult Eye and Vision Examination: A Flowchart



## **B. Appendix Table 1:**

### Potential Components of the Comprehensive Adult Eye and Vision Examination

#### **A. Patient History**

1. Nature and history of presenting problem, including chief complaint
2. Visual and ocular history
3. General health history, including social history and review of systems
4. Family ocular and health histories
5. Medication and supplement usage and medication allergies
6. Vocational and avocational visual requirements
7. Name of, and contact information for, the patient's other health care providers

#### **B. Visual Acuity**

1. Distance visual acuity testing
2. Near visual acuity testing
3. Pinhole testing, when indicated
4. Visual acuity at identified vocational or avocational working distances

#### **C. Preliminary Examination**

1. General observation of patient
2. Pupil size and pupillary responses
3. Near point of convergence
4. Ocular alignment
5. Stereopsis
6. Color vision

#### **D. Refraction**

1. Measurement of patient's most recent optical correction
2. Objective measurement of refractive status
3. Subjective measurement of refractive status



## **E. Ocular Motility, Binocular Vision, and Accommodation**

1. Evaluation of ocular motility
2. Assessment of heterophorias, vergence ranges and facility
3. Testing for suppression
4. Measurement of accommodative amplitude and facility

## **F. Ocular and Systemic Health Assessment**

1. Evaluation of the ocular anterior segment and adnexa
2. Measurement of intraocular pressure
3. Evaluation of the ocular media
4. Evaluation of the ocular posterior segment and peripheral retina
5. Visual field testing
6. Systemic health assessment



## C. Appendix Table 2:

### Systemic Diseases with Ocular Manifestations

The following is a partial listing of systemic diseases whose ocular signs or symptoms may be reported or diagnosed during a comprehensive eye and vision examination. A more comprehensive listing is available at [aoa.org/systemicdiseases](http://aoa.org/systemicdiseases).

Albinism	Myasthenia Gravis
Anemias	Nerve Diseases and Palsies
Ankylosing Spondylitis	Neurofibromatosis
Arteriosclerosis <sup>17</sup>	Pituitary Tumors
Behcet's Disease <sup>109,110</sup>	Psoriasis <sup>120</sup>
Chlamydia <sup>111</sup>	Reiter's Syndrome
Cogan's Syndrome	Rheumatoid Arthritis <sup>110,121</sup>
Crohn's Disease	Rosacea <sup>122,123</sup>
Diabetes Mellitus <sup>17</sup>	Rubella
Fabry Disease <sup>112</sup>	Sarcoidosis
Gonorrhea	Scleroderma
Hepatitis	Sickle Cell Disease <sup>124</sup>
Herpes Simplex	Sinusitis
Herpes Zoster <sup>113</sup>	Sjorgen's Syndrome <sup>110</sup>
Histoplasmosis	Stevens-Johnson Syndrome <sup>125</sup>
HIV/AIDS <sup>114,115</sup>	Sturge-Weber Syndrome
Hypertension <sup>17,116,117</sup>	Syphillis <sup>111</sup>
Influenza	Systemic Lupus <sup>110</sup>
Kawasaki Disease <sup>110</sup>	Thyroid Dysfunction (Graves' Disease) <sup>17</sup>
Leukemia	Toxocariasis (Dog Round Worm)
Marfan's Syndrome	Toxoplasmosis <sup>126</sup>
Measles	Tuberculosis
Meningitis	Usher's Syndrome
Migraine	Vessel Occlusive Disease
Multiple Sclerosis <sup>118,119</sup>	Vitamin A Deficiency

### D. Appendix Table 3:

#### Partial Listing of Systemic Medications with Potential Ocular Side Effects

*Clinicians should consult other sources for current information on these and other systemic medications with potential ocular side effects.*

Drug Category	Example
ACE inhibitor	Quinapril (Accupril) Benazepril (Lotensin) Captopril (Capoten)
Alpha1 adrenoceptor antagonist	Tamsulosin (Flomax)
Antiarrhythmic	Amiodarone (Cordarone)
Antiangina	Nitroglycerine
Antidepressant	Sertraline (Zoloft) Fluoxetine (Prozac)
Anti-estrogen	Tamoxifen
Antihistamine	Cetirizine (Zyrtec) Diphenhydramine (Benadryl)
Antibacterial	Minocycline (Minocin) Tetracycline Doxycycline Chloramphenicol Sulfonamides
Anticoagulant	Acetyl salicylic acid (Aspirin) Warfarin (Coumadin)
Antimalarial	Hydroxychloroquine (Plaquenil) Chloroquine (Aralen)
Antimanic	Lithium
Antipsychotic	Chlorpromazine (Thorazine) Thioridazine (Mellaril)
Antituberculosis	Ethambutol (Myambutol) Rifampin (Rifadin) Isoniazid
Beta blockers	Metoprolol (Lopressor) Propranolol (Inderal) Atenolol (Tenormin)

Drug Category	Example
Bisphosphonates	Alendronate (Fosamax) Risedronate (Actonel)
Carbonic Anhydrase Inhibitor	Acetazolamide (Diamox) Methazolamide (Neptazane)
Cardiac Glycosides	Digoxin (Lanoxin)
Gastrointestinal	Ranitidine (Zantac)
Hormone Replacement	Estradiol Estrogen (Premarin)
Immune modulator	Methotrexate
Immunosuppressant	Cyclosporine (Sandimmune)
Nonsteroidal Anti-inflammatory	Indomethacin (Indocin) Ibuprofen Naproxen
Phosphodiesterase-5 Inhibitor	Sildenafil citrate (Viagra) Tadalafil (Cialis)
Retinoid	Isotretinoin (Accutane)
Rheumatologic	Gold salts
Statin	Atorvastatin calcium (Lipitor) Lovastatin (Mevacor) Rosuvastatin (Crestor) Simvastatin (Zocor)
Steroid	Prednisone (Sterapred)
Sulfa-based drugs	Topiramate (Topamax)
Vitamins	Niacin (Nicotinic acid, Vitamin A, Vitamin B3)

## **E. ABBREVIATIONS**

ADA – Americans with Disabilities Act

AMD – Age-related macular degeneration

CVF – Confrontation visual field

D – Diopter

DR – Diabetic retinopathy

DVA – Distance visual acuity

ETDRS – Early Treatment Diabetic Retinopathy Study

IOP – Intraocular pressure

NPC – Near point of convergence

NVA – Near visual acuity

OCT – Optical coherence tomography

POAG – Primary open-angle glaucoma

UV – Ultraviolet radiation

## F. SUMMARY LISTING OF ACTION STATEMENTS

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

- Patient, family, and social history, including visual, ocular and general health, medication usage, and vocational and avocational visual requirements
- Measurement of visual acuity
- Preliminary examination regarding aspects of visual function and ocular health
- Determination of refractive status
- Assessment of ocular motility, binocular vision, and accommodation, as appropriate, based on patient's age, visual signs and symptoms, and visual requirements
- Ocular health assessment, including evaluation of the anterior and posterior segment, measurement of intraocular pressure, and visual field testing
- Systemic health assessment, as indicated. ([consensus](#))

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Any systemic medication or supplement used by patients should be investigated by their eye doctor for ocular risk factors or side effects. ([consensus](#))

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Pharmacologic dilation of the pupil is generally required for thorough stereoscopic evaluation of the ocular media, retinal vasculature, macula, optic nerve, and the peripheral retina. ([consensus](#))

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Because of possible variations in measurements obtained when using various intraocular pressure (IOP) testing instruments/techniques, eye doctors should consider taking more than one reading with the same instrument to reduce measurement error.<sup>63</sup>([C/Recommendation](#))

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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 threshold visual field testing on patients if there is a clinical suspicion of a visual field defect.<sup>67</sup>([B/Recommendation](#)),<sup>68</sup>([C/Recommendation](#))

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At the conclusion of an eye and vision examination, the eye doctor should explain the diagnosis to the patient, relate it to the patient's symptoms, and discuss a treatment plan and prognosis. ([consensus](#))

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Persons who will undergo or have undergone ocular surgery or other specialty care should be counseled by their eye doctor regarding their ongoing need for periodic comprehensive eye and vision examinations. ([consensus](#))

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Eye doctors should ask about and document their patients' smoking status and inform them about the benefits to their eyes, vision and overall health, if they stop smoking.<sup>75</sup>([B/Recommendation](#)),<sup>80</sup>([B/Recommendation](#))

Individuals performing high-risk activities, monocular persons, and those with previous eye trauma or eye surgery should be strongly advised by their eye doctor to wear appropriate eye protection with impact resistant properties. [\(consensus\)](#)

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Exposure to UV radiation is a risk factor for disorders of the eye. Eye doctors should advise their adult patients about the benefits of the regular use of sunglasses that effectively block at least 99 percent of UVA and UVB radiation and the use of hats with brims when outdoors. [\(consensus\)](#)

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Eye doctors should be aware of their patients' dietary and supplementation practices and counsel them on good nutrition for eye health. [\(consensus\)](#)

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Comprehensive eye and vision examinations are recommended at least every two years for asymptomatic, low-risk persons ages 18 through 39 years to evaluate changes in eye and visual function, and provide for early detection of sight-threatening eye and systemic health problems. [\(consensus\)](#)

---

Comprehensive eye and vision examinations are recommended at least every two years for asymptomatic, low-risk persons 40 through 64 years of age to evaluate changes in eye and visual function, and provide for the early detection of eye diseases, which may lead to significant vision loss, and systemic conditions that may affect health or vision. [<sup>93</sup>\(B/Recommendation\)](#), [<sup>94</sup>\(B/Recommendation\)](#), [<sup>96</sup>\(B/Recommendation\)](#)

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Individuals 60 years of age and older with central and/or peripheral vision loss should be counseled by their eye doctor about the potential for an increased risk of falls. [<sup>100</sup>\(B/Recommendation\)](#), [<sup>102</sup>\(B/Recommendation\)](#), [<sup>103</sup>\(B/Recommendation\)](#)

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Annual comprehensive eye and vision examinations are recommended for persons 65 years of age or older for the diagnosis and treatment of sight-threatening eye conditions and the timely correction of refractive errors. [<sup>6</sup>\(B/Recommendation\)](#), [<sup>11</sup>\(B/Recommendation\)](#), [<sup>99</sup>\(B/Recommendation\)](#), [<sup>102</sup>\(B/Recommendation\)](#)

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Adult patients should be advised by their eye doctor to seek eye care more frequently than the recommended re-examination interval (Table 1) if new ocular, visual, or systemic health problems develop. [\(consensus\)](#)



## **G. GAPS IN RESEARCH EVIDENCE**

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

- Research to determine the optimum frequency for comprehensive eye and vision examinations in adults to prevent vision loss and maintain visual function and eye health
- Research to support the validity, reliability and repeatability of current and new or emerging IOP tests/instruments used to diagnose glaucoma in adults
- Research to support the validity, reliability and repeatability of current and new or emerging confrontation visual field testing in adult patients
- Research to evaluate the relationship between vision loss and falls.

## VI. METHODOLOGY FOR GUIDELINE DEVELOPMENT

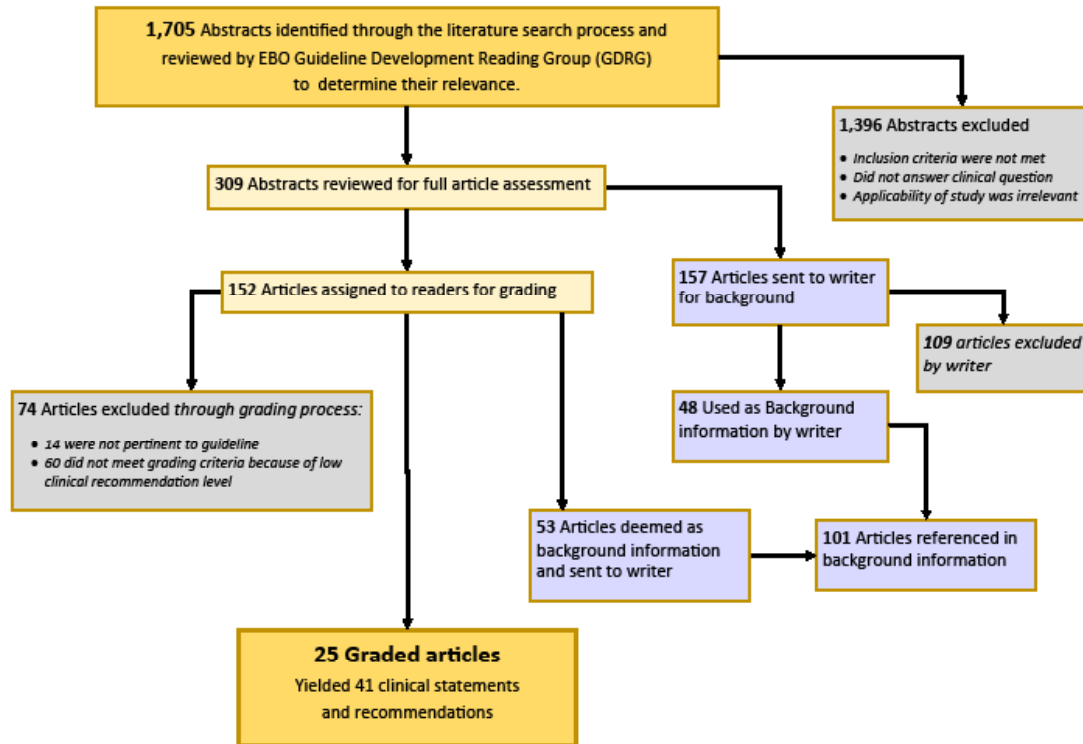
This guideline was developed by the AOA Evidence-Based Optometry Guideline Development Group (GDG). Clinical questions to be addressed in the guideline were identified and refined during an initial meeting of the GDG and served as the basis for a search of the clinical and research literature.

An English language literature search for the time period January 2005 to December 2014 was conducted by several trained researchers: [www.aoa.org/documents/EBO/APPENDIX%20G-3%20Literature%20Search%20Process.pdf](http://www.aoa.org/documents/EBO/APPENDIX%20G-3%20Literature%20Search%20Process.pdf)

If the search did not produce results, the search parameters were extended an additional 5 years, and subsequently 10 years back. In addition, a review of selected earlier research publications was conducted based on previous versions of this guideline. The literature search was conducted using the following electronic databases:

- Agency for Healthcare Research and Quality (AHRQ)
- American Academy of Ophthalmology
- American Optometric Association
- Canadian Ophthalmologic Society
- Centers for Disease Control and Prevention, National Center for Health Statistics
- Cochrane Library
- Elsevier
- Google Scholar
- Mayo Clinic
- Medical Expenditure Panel Survey (MEPS)
- Medline Plus
- National Eye Institute
- National Guideline Clearinghouse (AHRQ)
- National Institute for Clinical Effectiveness (British)
- PubMed
- Vision Health Initiative (of the CDC)
- Visionet
- VisionSite
- World Health Organization





All references meeting the criteria were reviewed to determine their relevance to the clinical questions addressed in the guideline. Each article was assigned to two clinicians who independently reviewed and graded the quality of evidence and the clinical recommendations for the article, based on a previously defined system for grading quality. If discrepancies were found in the grading results, the article was assigned to an independent third clinician for review and grading.

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

At the Draft Reading Meeting of the Evidence-Based Optometry GDG, the guideline document was reviewed and edited and the final draft was reviewed and approved by the GDG by conference call. The final draft of the guideline was then made available for peer and public review for 30 days for numerous stakeholders (individuals and organizations) to make comments. All suggested revisions were reviewed, and, if accepted by the GDG, incorporated into the guideline.

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

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