Annals of Internal Medicine | Clinical Guideline

Screening for Glaucoma: U.S. Preventive Services Task Force Recommendation Statement

Virginia A. Moyer, MD, MPH, on behalf of the U.S. Preventive Services Task Force*

Description: Update of the 2004 U.S. Preventive Services Task Force (USPSTF) recommendation on screening for glaucoma.

Methods: The USPSTF reviewed evidence on the benefits and harms of screening for glaucoma and of medical and surgical treatment of early glaucoma. Beneficial outcomes of interest included improved vision-related quality of life and reduced progression of early asymptomatic glaucoma to vision-related impairment. The USPSTF also considered evidence on the accuracy of glaucoma screening tests.

Population: This recommendation applies to adults who do not have vision symptoms and are seen in a primary care setting.

Recommendation: The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for primary open-angle glaucoma in adults. (I statement)

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For author affiliation, see end of text.

* For a list of the members of the USPSTF, see the Appendix (available at www.annals.org).

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The U.S. Preventive Services Task Force (USPSTF) makes recommendations about the effectiveness of specific preventive care services for patients without related signs or symptoms.

It bases its recommendations on the evidence of both the benefits and harms of the service and an assessment of the balance. The USPSTF does not consider the costs of providing a service in this assessment.

The USPSTF recognizes that clinical decisions involve more considerations than evidence alone. Clinicians should understand the evidence but individualize decision making to the specific patient or situation. Similarly, the USPSTF notes that policy and coverage decisions involve considerations in addition to the evidence of clinical benefits and harms.

Summary of Recommendation and Evidence

The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for primary open-angle glaucoma (POAG) in adults. (I statement)

See the Suggestions for Practice Regarding the I Statement in the Clinical Considerations section for more information.

See the **Figure** for a summary of the recommendation and suggestions for clinical practice.

Appendix Table 1 describes the USPSTF grades, and **Appendix Table 2** describes the USPSTF classification of levels of certainty about net benefit (both tables are available at www.annals.org).

Rationale

Importance

Open-angle glaucoma affects approximately 2.5 million Americans and is a leading cause of impaired vision (loss of peripheral vision) and blindness.

Detection

The USPSTF found inadequate evidence on the accuracy of screening for POAG in adults. Evidence is limited by the lack of an established gold standard against which individual screening tests can be compared.

Benefits of Detection and Early Treatment

The USPSTF found no direct evidence on the benefits of screening.

The USPSTF found convincing evidence that treatment of increased intraocular pressure (IOP) and early glaucoma reduces the number of persons who develop small, clinically unnoticeable visual field defects and that treatment of early asymptomatic POAG decreases the number of persons whose visual field defects worsen.

However, the USPSTF found inadequate evidence that screening for or treatment of increased IOP or early asymptomatic POAG reduces the number of persons who will develop impaired vision or quality of life.

Harms of Detection and Early Treatment

The USPSTF found no direct evidence on the harms of screening. It found convincing evidence that treatment results in numerous harms, including local eye irritation from medications and risk for complications from surgery, such as early formation of cataracts. The magnitude of these harms for most persons is small. Screening is associ-

Figure. **Screening for glaucoma: clinical summary of U.S. Preventive Services Task Force recommendation.**

Annals of Internal Medicine

U.S. Preventive Services TASK FORCE
www.USPreventiveServicesTaskForce.org

SCREENING FOR GLAUCOMA
CLINICAL SUMMARY OF U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATION

Population	Adults without vision symptoms who are seen in primary care
Recommendation	No recommendation. Grade: I statement

Risk Assessment	Important risk factors for open-angle glaucoma are increased intraocular pressure, older age, family history of glaucoma, and African American race.
Screening Tests	Diagnosis of glaucoma is usually made on the basis of several tests that, when combined, evaluate the biological structure and function of the optic nerve and intraocular pressure. Most tests that are available in a primary care setting do not have acceptable accuracy to detect glaucoma.
Treatment	The immediate physiologic goal and measure of effect of primary treatment of glaucoma is reduction in intraocular pressure. Treatments that are effective in reducing intraocular pressure include medications, laser therapy, and surgery. However, these treatments have potential harms, and their effectiveness in reducing patient-perceived impairments in vision-related function is uncertain.
Balance of Benefits and Harms	Evidence on the accuracy of screening tests, especially in primary care settings, and the benefits of screening or treatment to delay or prevent visual impairment or improve quality of life is inadequate. Therefore, the overall certainty of the evidence is low, and the USPSTF is unable to determine the balance of benefits and harms of screening for glaucoma in asymptomatic adults.
Other Relevant USPSTF Recommendations	The USPSTF has made recommendations on screening for impaired visual acuity in older adults. These recommendations are available at www.uspreventiveservicestaskforce.org.

For a summary of the evidence systematically reviewed in making this recommendation, the full recommendation statement, and supporting documents, please go to www.uspreventiveservicestaskforce.org.

ated with a risk for false-positive and false-negative results, but the magnitude of this risk is unknown, given the considerable variability in reported test sensitivity and specificity. Screening and treatment are associated with risk for overdiagnosis and overtreatment because some evidence shows that many persons with increased IOP or early POAG have an indolent long-term course yet still receive treatment.

USPSTF Assessment

The USPSTF concludes that the evidence of effectiveness of screening for glaucoma on clinical outcomes is lacking and that the balance of benefits and harms therefore cannot be determined.

Clinical Considerations

Patient Population Under Consideration

This recommendation applies to adults who do not have vision symptoms and are seen in a primary care setting.

Assessment of Risk

Increased IOP, family history of glaucoma, older age, and African American race increase a person's risk for open-angle glaucoma (1, 2). Recent evidence shows that glaucoma may be increased in Hispanics (3). Older African Americans have a higher prevalence of glaucoma and perhaps a more rapid disease progression; if screening reduces vision impairment, then African Americans would probably have greater absolute benefit than whites.

Screening Tests

Diagnosis of POAG is based on a combination of tests showing characteristic degenerative changes in the optic disc and defects in visual fields (often loss in peripheral vision). Although increased IOP was previously considered an important part of the definition of this condition, it is now known that many persons with POAG do not have increased IOP and not all persons with increased IOP have or will develop glaucoma. Therefore, screening with tonometry alone may be inadequate to detect all cases of POAG.

Measurement of visual fields can be difficult. The reliability of a single measurement may be low; several consistent measurements are needed to establish the presence of defects. Specialists use dilated ophthalmoscopy or slit lamp examination to evaluate changes in the optic disc; however, even experts have varying ability to detect glaucomatous progression of the optic disc. In addition, no single standard exists to define and measure progression of visual field defects. Most tests that are available in a pri-

mary care setting do not have acceptable accuracy to detect glaucoma.

Treatment

The initial aim and efficacy assessment of primary treatments of POAG are reduction of IOP. Treatments include medication, laser therapy, and surgery. These treatments also effectively reduce the longer-term development and progression of small visual field defects as assessed by clinical examination. However, the magnitude of the effectiveness in reducing impairments in patient-reported, vision-related function, including development of blindness, is uncertain.

Suggestions for Practice Regarding the I Statement

Potential Preventable Burden

Approximately 2.5 million persons in the United States have glaucoma, and approximately 1.9% of adults older than 40 years have open-angle glaucoma (4). Most persons with glaucoma have POAG. This condition is defined as optic neuropathy with a visibly open anterior chamber angle (between the iris and the anterior sclera or peripheral cornea) that is associated with progressive death of retinal ganglion cells and axons and visual field loss (1, 2, 5).

The goal of screening programs is to identify and treat POAG before visual impairment develops. The proportion of persons who are currently unidentified and who will develop vision problems as a result of a diagnosis obtained through screening is not known. The natural history of glaucoma is heterogeneous and poorly defined.

In some persons, POAG does not progress or progression is so slow that it never has an important effect on vision. The size of this subgroup is uncertain and may depend on the ethnicity and age of the population and initial findings of ophthalmologic testing. Screening in asymptomatic persons is likely to increase the size of this subgroup. Other patients have more rapid progression, as determined by optic nerve damage, visual field defects, and development of visual impairment.

Whether early glaucoma will progress to visual impairment cannot be precisely predicted. Whether the rate of progression of visual field defects remains uniform throughout the course of glaucoma is also not known. Older adults and African Americans seem to be at increased risk and have more rapid progression. Persons with a short life expectancy probably have little to gain from glaucoma screening.

Potential Harms

Harms caused by treatment of glaucoma include formation of cataracts and those resulting from surgery and from topical medications. Overdiagnosis and overtreatment are possible because not all persons who are diagnosed with and treated for glaucoma progress to visual impairment; the magnitude of overdiagnosis and overtreatment is unknown.

Costs

The cost of screening varies widely depending on the tests used. Testing with hand-held tonometers and ophthalmoscopes can be done quickly and inexpensively. However, the diagnostic accuracy of these inexpensive tests is not known. According to the National Business Group on Health, the average screening eye examination costs $71 (6). Screening with specialized tests for glaucoma and with newer computerized instruments is more expensive.

Current Practice

Approximately 62% of Medicare patients enrolled in an HMO were screened for glaucoma in 2009 (7). In 2008, approximately 53% of whites, 47% of African Americans, and 37% of Hispanics reported an annual eye care visit (8).

Other Considerations

Research Needs and Gaps

The natural history of glaucoma, particularly the role of IOP and its relationship to optic nerve damage, visual field defects, visual impairment, and blindness, is poorly understood. More evidence is needed on the link between the intermediate glaucoma outcomes of optic nerve damage and visual field loss and the final health outcomes of visual disability and patient-reported outcomes. Evidence for screening would ideally come from a randomized, controlled trial of routine (or targeted) screening versus standard care with long-term follow-up. More studies on treatment that are of adequate duration and size to assess important clinical outcomes (such as visual impairment and vision-related quality of life), or at least greater changes in visual fields, are needed.

Discussion

Burden of Disease

Glaucoma is characterized as primary (idiopathic) or secondary (resulting from a known cause, such as trauma or inflammation) and as closed- or open-angle. Closed-angle glaucoma may present with acute symptoms, such as eye pain and blurred vision, and is considered an emergency. Primary open-angle glaucoma is the most prevalent type of glaucoma in the United States and the focus of this recommendation. It is defined as optic neuropathy with a visibly open anterior chamber angle (between the iris and the anterior sclera or peripheral cornea) that is associated with progressive death of retinal ganglion cells and axons and visual field loss (1, 2, 5). In most cases, damage to the optic nerve is the result of increased pressure in the eye, also known as IOP.

Approximately 2.5 million persons in the United States have glaucoma, and many are unaware that they have it. Important risk factors include older age, family history of the condition, and African American race (8).

The overall estimated prevalence of glaucoma in the United States is 1.9%. Age-adjusted estimates are approximately 3 times higher in African Americans than in whites (4). A recent study reported a prevalence of 4.7% in Hispanics older than 40 years (3).

Scope of Review

To update its 2004 recommendation on screening for glaucoma, the USPSTF reviewed evidence on the benefits and harms of screening and of medical and surgical treatment of early glaucoma. Beneficial outcomes of interest for the USPSTF included improved vision-related quality of life and reduced progression of early asymptomatic glaucoma to vision-related impairment. The USPSTF also considered evidence on the accuracy of screening tests for glaucoma.

Accuracy of Screening Tests

The USPSTF considered evidence on the accuracy of direct and indirect ophthalmoscopy, photography and computerized imaging of the fundus, measurement of corneal thickness combined with another test for glaucoma, perimetry, and tonometry. The USPSTF did not consider evidence on tests that are experimental or no longer commonly used in the screening for or diagnosis of glaucoma.

Evaluating the evidence on screening tests is complicated by the lack of an established standard for the diagnosis of glaucoma and a consequent lack of an established gold standard to evaluate accuracy. The USPSTF reviewed more than 100 studies on the accuracy of various tests for glaucoma (1). Instead of an established gold standard, many investigators used confirmation of POAG at follow-up examination, diagnosis of POAG requiring treatment, and other individual tests or combinations of tests as the reference against which to evaluate accuracy.

Tests with the most published studies on accuracy include optical coherence tomography, scanning laser polarimetry, confocal scanning laser tomography, frequency-doubling technology, and the Humphrey visual field analyzer. Studies varied appreciably in the devices, variables, thresholds for diagnosis, and measurement of outcomes used. Many studies had several methodological limitations, including enrollment of participants who were not representative of persons who would be tested in practice.

Most studies did not blind personnel who interpreted test results to the findings of the reference standard and vice versa. Many studies used a reference test that included 1 or more tests comprising the candidate test, resulting in a significant concern about bias. Because of the methodological limitations, variability in study designs, and lack of a diagnostic standard, the USPSTF was not able to make conclusions about the overall accuracy of screening for glaucoma.

Effectiveness of Early Detection and Treatment

No studies directly evaluated whether screening prevents visual field loss, visual impairment, or worsening quality of life. Whereas evidence shows that medical and surgical treatment of early asymptomatic POAG reduce the number of patients whose visual field defects progress, no studies evaluated whether they reduce progression to visual impairment or improve quality of life.

The USPSTF assessed 1 systematic review (of 10 studies) and 19 additional randomized, controlled trials that evaluated whether medical treatment slows the progression of visual field loss (2). A systematic review of 10 studies published in 2007 concluded that medical treatment had a significant protective effect on incident worsening of visual field measurements compared with placebo or no treatment (odds ratio, 0.62 [95% CI, 0.47 to 0.81]) (2, 9). Nineteen additional primary studies reported mixed results with treatment; a few reported improvements in visual field measurements with medical treatment, 7 reported no change, and 9 reported worsening of visual field measurements.

Most of these studies were not large or long enough to detect differences in the rates of visual field loss or clinically relevant outcomes related to glaucoma, given the slowly progressive nature of the disease. Three large studies of long duration reported mixed results; 2 studies concluded that medical treatment reduced glaucoma progression, and 1 found no difference between medical treatment and placebo (2, 10–12). A 2005 systematic review of 5 randomized, controlled trials that assigned participants to medical and/or surgical treatment or to no treatment reported that those receiving medical and/or surgical treatment were less likely to have progression of visual field loss and optic disc damage (hazard ratio for topical medications vs. no treatment, 0.56 [CI, 0.39 to 0.81]) (13).

Potential Harms of Screening or Treatment

No studies addressed the harms of screening. Several assessed the harms of treatment (2, 5). Eye redness was the most commonly reported adverse effect of topical medical treatments for glaucoma. In observational studies, the percentage of patients reporting eye redness ranged from 2% to 21%, depending on dose, length of use, and type of medication. Eye pain and burning were also commonly reported with topical medications, occurring in 1% to 3% of participants in observational studies. Other reported adverse effects of topical medications included eye irritation, eye dryness, increased iris pigmentation, and cystoid macular edema.

Surgical treatments of glaucoma were associated with hypotony, hyphema, shallow anterior chambers, cataract, and choroidal detachment. Penetrating surgical interventions (trabeculectomy) were associated with more frequent adverse effects than nonpenetrating procedures. Studies of surgical procedures more commonly reported cataracts, infection, bleeding, and synechiae than did studies of medications.

Estimate of Magnitude of Net Benefit

Evidence on the accuracy of screening tests and the benefits of screening or treatment in delaying or preventing

visual impairment or improving quality of life is inadequate. Therefore, the overall certainty of the evidence is low, and the USPSTF is unable to determine the balance of benefits and harms of screening for glaucoma in asymptomatic adults.

How Does Evidence Fit With Biological Understanding?

The exact cause of POAG is not known. Diagnosis of glaucoma is usually based on several tests that, when combined, evaluate the biological structure and function of the optic nerve and the IOP. Persons with POAG may not have increased IOP, and increased IOP may not result in nerve damage and eventual visual impairment. This finding limits the development of a single gold standard to evaluate the accuracy of screening tests.

Most persons with glaucoma do not have symptoms. Once vision loss occurs—usually slow loss of side or peripheral vision—the optic nerve is already damaged. When damage is severe enough, loss of vision impairs function and quality of life. Advanced glaucoma can lead to blindness.

Treatments that reduce IOP prevent the decline in the biological structure and function of the optic nerve caused by glaucoma, thus slowing the worsening of visual field loss. However, the slowly progressive nature of glaucoma makes it difficult to evaluate the effectiveness of treatments, especially in preventing or slowing clinically noticeable loss of vision, and screening may lead to detection and treatment of many persons who will remain asymptomatic throughout their life (known as overdiagnosis and overtreatment).

Response to Public Comments

A draft version of this recommendation statement was posted for public comment on the USPSTF Web site from 19 February to 18 March 2013. A few comments noted that important population subgroups are at increased risk for glaucoma. The USPSTF updated the section on risk with new information on Hispanics. A few comments disagreed that there is no accepted gold standard for screening for glaucoma. None of the comments came to a consensus on an accepted standard for screening, and no change was made to the recommendation statement.

A few comments cited studies to provide evidence on the link between visual field loss and quality of life. The USPSTF reviewed these studies and determined that they did not provide the necessary evidence to change its conclusions. The USPSTF made several minor revisions to the recommendation statement in response to requests for corrections and clarifications.

Recommendations of Others

The American Academy of Ophthalmology recommends a comprehensive adult medical eye evaluation, including tests for glaucoma, with frequency depending on the patient's age and other risk factors for glaucoma (14). The American Optometric Association recommends eye examinations every 1 to 2 years, with frequency depending on age and risk factors for glaucoma (15).

From the U.S. Preventive Services Task Force, Rockville, Maryland.

Disclaimer: Recommendations made by the USPSTF are independent of the U.S. government. They should not be construed as an official position of the Agency for Healthcare Research and Quality or the U.S. Department of Health and Human Services.

Financial Support: The USPSTF is an independent, voluntary body. The U.S. Congress mandates that the Agency for Healthcare Research and Quality support the operations of the USPSTF.

Potential Conflicts of Interest: None disclosed.

Requests for Single Reprints: Reprints are available from the USPSTF Web site (www.uspreventiveservicestaskforce.org).

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Appendix: U.S. Preventive Services Task Force

Members of the U.S. Preventive Services Task Force at the time this recommendation was finalized† are Virginia A. Moyer, MD, MPH, *Chair* (American Board of Pediatrics, Chapel Hill, North Carolina); Michael L. LeFevre, MD, MSPH, *Co-Vice Chair* (University of Missouri School of Medicine, Columbia, Missouri); Albert L. Siu, MD, MSPH, *Co-Vice Chair* (Mount Sinai School of Medicine, New York, and James J. Peters Veterans Affairs Medical Center, Bronx, New York); Linda Ciofu Baumann, PhD, RN (University of Wisconsin, Madison, Wisconsin); Kirsten Bibbins-Domingo, PhD, MD (University of California, San Francisco, San Francisco, California); Susan J. Curry, PhD (University of Iowa College of Public Health, Iowa City, Iowa); Mark Ebell, MD, MS (University of Georgia, Athens, Georgia); Glenn Flores, MD (University of Texas Southwestern, Dallas, Texas); Francisco A.R. García, MD, MPH (Pima County Department of Health, Tucson, Arizona); Adelita Gonzales Cantu, RN, PhD (University of Texas Health Science Center, San Antonio, Texas); David C. Grossman, MD, MPH (Group Health Cooperative, Seattle, Washington); Jessica Herzstein, MD, MPH (Air Products, Allentown, Pennsylvania); Wanda K. Nicholson, MD, MPH, MBA (University of North Carolina School of Medicine, Chapel Hill, North Carolina); Douglas K. Owens, MD, MS (Veterans Affairs Palo Alto Health Care System, Palo Alto, and Stanford University, Stanford, California); William R. Phillips, MD, MPH (University of Washington, Seattle, Washington); and Michael P. Pignone, MD, MPH (University of North Carolina, Chapel Hill, North Carolina). Former USPSTF members Rosanne Leipzig, MD, PhD; Diana Petitti, MD, MPH; and Timothy Wilt, MD, MPH, also contributed to the development of this recommendation.

† For a list of current Task Force members, go to www.uspreventiveservicestaskforce.org/members.htm.

Appendix Table 1. **What the USPSTF Grades Mean and Suggestions for Practice**

Grade	Definition	Suggestions for Practice
A	The USPSTF recommends the service. There is high certainty that the net benefit is substantial.	Offer/provide this service.
B	The USPSTF recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer/provide this service.
C	The USPSTF recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer/provide this service for selected patients depending on individual circumstances.
D	The USPSTF recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I statement	The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the Clinical Considerations section of the USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

Appendix Table 2. **USPSTF Levels of Certainty Regarding Net Benefit**

Level of Certainty*	Description
High	The available evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies.
Moderate	The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as: the number, size, or quality of individual studies; inconsistency of findings across individual studies; limited generalizability of findings to routine primary care practice; and lack of coherence in the chain of evidence. As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion.
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of: the limited number or size of studies; important flaws in study design or methods; inconsistency of findings across individual studies; gaps in the chain of evidence; findings that are not generalizable to routine primary care practice; and a lack of information on important health outcomes. More information may allow an estimation of effects on health outcomes.

* The USPSTF defines *certainty* as "likelihood that the USPSTF assessment of the net benefit of a preventive service is correct." The net benefit is defined as benefit minus harm of the preventive service as implemented in a general primary care population. The USPSTF assigns a certainty level on the basis of the nature of the overall evidence available to assess the net benefit of a preventive service.