

“Eye” Identifying Vision Impairment in the Geriatric Patient

Melissa A. Kalinowski, RN, BSN

Vision impairment is highly prevalent yet undetected in the elderly population. Without screening and early detection age-related vision loss can lead to various adverse effects. The purpose of this review is to assess the methods of screening geriatric patients for visual impairment that can be employed by nurse practitioners in the primary care setting. A series of databases were searched utilizing the key words aged, geriatric, vision, vision tests, and screening. The Snellen chart, Pinhole assessment, Ophthalmoscope, Cardiff acuity test, Amsler grid, and subjective measures are discussed. All must be utilized cautiously because research has shown that these screening methods are limited in their sensitivity and specificity in detecting ocular disease. No combination of tools is ideal for identifying age-related vision loss although implications for practice are implied. (*Geriatr Nurs* 2008;29:125-132)

Vision is an important component of sensory perception. It allows us to enjoy reading a book, watching a sunset, cooking a meal, or driving a car. As we age, we experience natural changes in the structure of our eyes known as presbyopia. Examples of these changes include drooping eye lids, changes in color perception, and difficulty adjusting to light.¹ The prevalence of ocular diseases such as glaucoma, cataracts, diabetic retinopathy, and macular degeneration also increase with age.¹⁻⁴ According to the Eye Disease Prevalence Group, approximately 1 in 28 Americans aged 40^{4,5} and older are affected by low vision or blindness, and it is estimated that by 2020 the number of individuals with blindness will double as the population ages.^{2,5}

Vision impairment is often undiagnosed and untreated despite being highly prevalent among older adults.⁶ This is concerning given adverse effects such as increased mortality risk,⁷ falls,⁸ medication noncompliance,⁹ automobile accidents,¹⁰ hip fractures,¹¹ and decreased quality of life¹² have all been attributed to vision impairment. Thus it is imperative that the aging population is screened to detect age-related eye

diseases in a timely fashion before obvious symptoms develop, vision is lost, and adverse effects occur.²

Geriatric nurse practitioners (GNPs) can be instrumental in their role as primary care providers to screen for visual impairments during routine physical examinations and refer patients for annual ophthalmologic evaluations.^{13,14} Knowledge of what assessments deliver the highest standard of care to patients often relies on the implementation of recommendations listed within clinical practice guidelines.¹⁵ A search of the National Guideline Clearinghouse using the keyword “vision” elicits 3 guidelines on assessment of vision.¹⁶⁻¹⁸ Although these documents consist of important information that can be beneficial to older adults, such as the recommendation for those over age 61 to have annual eye examinations,¹⁸ all 3 of the guidelines are aimed at guiding the practice of optometrists and list detailed assessments that are not applicable to nurse practitioners. Moreover, none of the guidelines recommends specific aspects of vision that should be assessed in primary care during a comprehensive physical examination or recommend screening tools that are evidence-based.

Evaluating the evidence regarding screening tools is important in understanding its utility. A tool must have adequate sensitivity and specificity, or false-positive or false-negative results may occur. Methods of screening that create high numbers of false-negative results are especially concerning if an individual has a disease such as glaucoma, diabetic retinopathy, or macular degeneration that can cause progressive loss of vision if not treated.¹⁹

The objective of this review is to assess the methods of screening geriatric patients for visual impairment that can be employed by GNPs in the primary care setting (Table 1). Ovid, CINAHL, and MEDLINE databases were searched using the keywords “aged,” “vision,” “geriatric,” “vision tests,” and “screening.” The reference lists of identified articles were also scanned for further relevant peer-reviewed articles. Only articles written in English and pub-

Table 1.
Tools for Screening Geriatric Patients in the Primary Care Setting

Tool	Vision Component Tested	Information Provided
Snellen chart	Visual acuity	Normal vision, vision impaired, or legally blind Equated with function
Pinhole assessment	Visual acuity	Refractive error—patient needs glasses
Cardiff Acuity Test	Visual acuity	Vision impairment in those who may be dysphasic, cognitively impaired, or illiterate
Amsler grid	Central visual fields	Macular degeneration
Ophthalmoscope	Fundoscopy examination	Cataracts, diabetic retinopathy, macular degeneration
“Do you have a problem with vision that affects your daily life?”	Vision-related function	Problem severity and likelihood of seeking treatment
NEI-VFQ	Vision-related function	Impaired visual acuity, contrast sensitivity and its impact on vision-related functions (e.g., driving a car)
	Quality-of-life symptoms	Quality of life

lished after 1992 were included. This article is an organized discussion of the literature pertaining to each particular tool that is used or could be used in primary practice.

Snellen Chart

Assessment of visual acuity is the gold standard of an ocular diagnostic evaluation²⁰ and is defined as a clinical measure of an individual’s ability to perform specific visual tasks.²¹ The most common tool used to assess vision acuity is the Snellen chart.²² The chart consists of a white background with rows of black letters.²³ The data gathered using this tool have historically been equated to visual function in the world.²⁴ It reflects the ability of the eye to detect letters displayed at maximum contrast and extending over the central 1 to 2 degrees of visual field.²⁴ Normal vision is a score of 20/40 or better. A Snellen score of 20/40 can be interpreted as the smallest letter a patient can read clearly at 20 feet is that which a person with normal vision can read at

40 feet.⁴ A score of 20/50 or worse in the better-seeing eye is considered visual impairment.²⁵ Blindness is considered a Snellen score of 20/200 or worse.⁴ The quick and effortless interpretation of visual acuity is a positive feature of the Snellen chart.

The Snellen chart, despite its ubiquitous use in clinical and laboratory settings, is not without its weaknesses. This assessment tool is not applicable for the visual assessment of all geriatric patients because it requires one to be able to see, recognize, and read a letter. For many who are dysphasic, deaf, illiterate, or confused, the Snellen assessment could be challenging.²²

The sensitivity of the Snellen chart has been called into question²³ because the tool assesses vision under the most optimal circumstances with good lighting and high contrast. However, visual impairment that compromises daily functions often occurs within less optimal conditions of reduced lighting and contrast.²³ Various authors show that the Snellen test for visual acuity often greatly underestimates the actual level of

visual impairment in adults.^{11,26,27,28} West and colleagues²³ performed a cross-sectional study exploring vision in older community-dwelling residents and found that assessment with the Snellen chart greatly underestimated vision impairment. In this study, assessing with more sophisticated methods identified 60% of the subjects with visual impairment, whereas only 20% of those in the same cohort failed the Snellen visual acuity test.

The limited sensitivity of the Snellen chart to detect vision impairment can be attributed to the loss of multiple visual functions with aging. The Salisbury Eye Evaluation Project,²⁶ a longitudinal study of risk factors for age-related eye disease and the impact of visual impairment on physical disability, was one of the first population-based studies to assess multiple aspects of visual function. This study specifically assessed mobility limitations and found that many individual vision functions were significantly associated with individual measures of physical performance such as walking, rising from a chair, and tandem balance. One important finding in this study was that similar to acuity, multiple visual components decrease with age; contrast sensitivity, glare sensitivity, stereoacuity (depth perception), and visual fields also decline with age and have an impact on the performance of everyday tasks. Haegerstrom-Portnoy and colleagues²⁸ also tested a large group of geriatric patients using a battery of visual function tests and concluded that many visual functions in addition to visual acuity decline with age. Thus practitioners must be aware that the Snellen chart only measures visual acuity, and a favorable score does not necessarily equate with optimal vision function.

Despite the aforementioned weaknesses, the Snellen chart remains a valued asset for the evaluation of vision. This is alluded to in a study that explored alternative aspects of vision function and found that visual acuity played a vital role in performance of a variety of functional tasks.²³ Ariyasu and colleagues²⁹ also found measures of visual acuity to have the best correlation with ocular disease. The quick and easy use of the chart is appealing to both patients and nurse practitioners working in the demanding health care setting. Thus the Snellen visual acuity test in many aspects can be deemed a useful tool for assessing vision in elderly patients.¹¹

Pinhole Assessment

Many geriatric patients who earn a low score with the Snellen assessment of visual acuity may have vision impairment due to refraction. Refractive error has often been considered the most common cause of visual impairment.^{4,6,25} Refractive error, or problems focusing, is corrected with glasses. Thus, assessing patients for refractive error and the provision of corrective lenses is an important public health endeavor in improving the health of the aging population.²⁵

The tool for screening for refractive error is a pinhole assessment.^{11,30} This tool involves the use of a Snellen chart to assess distance visual acuity. The pinhole differentiates between decreased visual acuity from refractive errors and decreased visual acuity caused by an ocular disease.²⁰ The patient holds a pinhole device and is instructed to read the letters on the Snellen chart. The pinholes only allow light to pass perpendicularly to the lens onto the retina. Thus, the eye does not need to bend any light rays to focus on the retina, eliminating refractive error. If visual acuity improves with this device, the patient has decreased visual acuity due to refractive error, which can be corrected with the provision of glasses.³¹ The problem proposed to practice is that many geriatric patients have difficulty using a pinhole assessment technique.³⁰ Moreover, the sensitivity and specificity of this tool is 20%–53% and 67%–92%, respectively.³² Wang et al.²⁷ in their evaluation of a battery of screening tools that could be used in the primary care setting found the pinhole device to be a reasonable method to estimate those with poor distance acuity due to refractive error. However, it detected only half of those with eye disease. A method of testing for refractive error that is tailored to the geriatric patient is needed.

Cardiff Acuity Test

Many of the tools used to gather data about visual impairment rely on the patient to be cognitively intact. Assessing vision function in patients with cognitive impairment, aphasia, or deafness can be challenging.²² Tools that effectively screen for visual impairment in older adults who are cognitively impaired are needed because current evidence suggests that Mini-Mental Status Exam scores may be correlated with visual acuity impairment, thus rendering

assessments of vision impairment suspect.²⁶ Similarly, true visual acuity impairment must be differentiated from differences due to the cognitive demands of vision testing.³⁰ The Cardiff acuity test is a unique tool that has been developed to assess patients with cognitive impairment, aphasia, and deafness to separate true impairment from measurements confounded by the cognitive demands of testing.²²

The Cardiff acuity test was originally developed to assess vision in toddlers and young children with intellectual impairment.³³ It includes 11 cards with a grey background and picture created from a white and black line drawing. When beyond the range of vision, the picture becomes invisible. The width of the lines decreases in succession, creating increased difficulty for identifying the target image. The cards are labeled A through K with the G card considered the threshold for significant impairment.⁴ The practitioner watches the subject's eye movements to determine whether he or she can see the image. If the patient is unable to see the picture, his or her eyes will move randomly trying to locate the image. This test is practical for the elderly patient with cognitive impairment or the aphasic patient because it does not require any understanding or speech. It does not require the patient to recognize the image; an automatic response from the patient indicates awareness of its presence.²²

Johansen, White, and Waraisch²² used the Cardiff acuity test to screen rehabilitation patients ranged in age from 47 to 99 years. They also assessed the participants' vision with the Snellen acuity test for comparison. Correlation coefficients were able to confirm that the Cardiff acuity test was a valid, reliable, and highly acceptable tool to assess vision in the elderly patient. Adoh and colleagues³³ also stated that comparison studies with established acuity tests—Snellen, Cambridge, and Teller cards—demonstrate that the Cardiff test provides a realistic acuity measure. Although these studies suggest that the Cardiff acuity test may accurately measure visual acuity, the practitioner should be cautious in interpreting these results. There are several studies that highlight weaknesses of this screening tool. The research that has elucidated these weaknesses is taken from the work performed with pediatrics. Weaknesses that have been found in this literature include its potential to overestimate acuity and miss small interocular

differences,³⁴ its inability to detect mild amounts of amblyopia,³⁵ and its underdiagnosis of reduced acuity caused by refractive error.³⁶ Moreover, the detection of an automatic response from the patient could be hindered by medications or neurological conditions, which may be mistaken by the geriatric nurse for a visual acuity deficit.

This review did not locate any reports on the reliability and validity of this tool for geriatric patients who are deaf, aphasic, or cognitively impaired. Thus, the Cardiff acuity may be easily applied and useful for assessment of elderly in a clinical setting such as a neurology unit with an aphasic patient,²² but it must be used with caution given the lack of research providing data to support its efficacy, reliability, and validity for assessing visual acuity.

Amsler Grid

An additional tool, the Amsler grid, is a disease-specific tool that the nurse practitioner can use to assess patients for visual changes related to macular degeneration.^{13,14} Age-related macular degeneration, the most common cause of vision loss in older adults, is a painless disease of the macula of the retina in which the cells of the macula break down or abnormal vascularization of the retina may cause loss of sight in the central part of the field of vision.²⁻⁴ The Amsler grid is advantageous because it specifically assesses central visual fields without pupil dilation. The Amsler grid is strengthened psychometrically by an established theoretical background. It is inexpensive, is easily used, and yields results that are effortlessly interpreted. The grid consists of a symmetrical pattern of squares with a central dot.³⁷ The patient is instructed to hold the grid at a distance of 12 to 16 inches and focus on the grid with each eye independently. The patient should wear his or her glasses if needed. The patient observes the vertical and horizontal lines and reports any distortions of the lines. A patient who visualizes a curved appearance of the horizontal or vertical lines, is instructed to contact his or her health care provider immediately for evaluation.¹³ The Amsler grid can detect early macular degeneration and monitor changes after treatment.³⁷ This simple tool may then be used by clinicians and patients.^{14,37}

Despite being used routinely by retina specialists,³⁷ the Amsler grid is not without its flaws.

Schuchard³⁸ in his study of 55 patients with vision loss in the macular region found the Amsler grid to have poor validity. No studies with similar results were located in this review. Zaidi and colleagues³⁹ also found the Amsler grid to be of doubtful value in retinal screening for early laser therapy of subretinal membranes. In light of these weaknesses, geriatric nurses need to be aware that no change with the grid does not validate that macular degenerative changes are not occurring. Moreover, the grid is not meant to replace routine assessment for fundoscopic changes using an ophthalmoscope.

Ophthalmoscope

The value of use of the ophthalmoscope by GNP's in the primary care setting is limited because of lack of dilation and limited skill. Crocker Houde¹³ states that most findings associated with age-related diseases can be identified with a careful office examination using an ophthalmoscope. A few studies cite nonophthalmic health care professionals successfully using an ophthalmoscope to screen patients accurately for diabetic retinopathy⁴⁰ and cataracts.⁴¹ The ophthalmoscope can also be used to assist in the identification of retinal pigment changes indicative of macular degeneration¹⁴ and optic disc changes associated with glaucoma.²⁷ If the pupil is dilated, the ophthalmoscope has been demonstrated to have a sensitivity of 70% and specificity of 67% in screening for any eye disease and 92% and 74% in screening for diabetic retinopathy and glaucoma.²⁷ Importantly, however, the pupils are *not* routinely dilated in primary care practice because dilation is within the scope of ophthalmologic care, and this limits a thorough fundoscopic examination.^{13,15,40} Thus, screening with an ophthalmoscope is not sufficiently accurate to replace routine referral of patients to an ophthalmologist when suspicions of age-related vision diseases are inherent.

Subjective Measurement

Methods of self-reported vision assessment may be beneficial given that easily managed but undetected visual impairments in older people are common, and the clinical measurement of visual acuity is unlikely to identify all impairments encountered in daily function.^{6,21,42,43} Chu-Ai The and colleagues⁶ performed a retrospective case record review of patients attend-

ing a geriatric assessment clinic to evaluate the diagnostic utility of a subjective screening question through comparison with objective data gathered with the Snellen chart. One question was asked: "Do you have a problem with vision that affects your daily life?" This study found that there was a 15% underestimation of impairment using subjective means. This suggests that some elders may lack insight or have nonperception of visual impairment as a problem. This may occur because age-related changes occur overtime, and many may gradually adjust to the reduced function.³⁰ In their findings, Chu-Ai The and colleagues⁶ noted that those who reported impairment were twice as likely to have falls, urinary incontinence, and impaired cognition. They were also more likely to go to an ophthalmology follow-up. Thus, the authors concluded that not all individuals with visual impairment will be identified using this method. Instead, they contend that employing this simple question could provide a user-friendly vision screening tool useful for identifying problem severity and assessing willingness to seek treatment.⁶

An additional subjective measure of visual function comprising multiple questions is the widely cited National Eye Institute Visual Function Questionnaire (NEI-VFQ).^{21,42,43} Questionnaires such as this have been a valued asset to assessing vision because such instruments can provide information regarding symptoms and functional status that cannot be obtained by measuring visual acuity alone.³⁰ The NEI-VFQ is a quality-of-life measure that was devised from a focus group of patients with eye disease to measure areas of vision-related functioning and well-being. The NEI-VFQ consists of 25 core items to measure 12 domains of vision function.⁴⁴ Answers to the questions are scored by summing ranks of responses to certain questions in similar fashion to analyzing data using a Likert-type scale and takes about 5 minutes to administer.⁴²

The NEI-VFQ has many strengths. Owen and colleagues²¹ examined the association between responses to the NEI-VFQ and objective visual impairment measured with the Snellen chart. The results of this study demonstrated that self-reported measures gathered from the NEI-VFQ were associated with objective measures of visual impairment. In addition to correlating with visual acuity, the NEI-VFQ is also sensitive to

additional aspects of vision that could be compromised. For example, subscales related to driving and color vision have been shown to be strongly correlated with contrast sensitivity.⁴⁵ Thus, the NEI-VFQ could easily be used in the clinical setting to provide insight into a comprehensive evaluation of vision function. Crocker Houde¹³ recommends the use of the NEI-VFQ while taking a health history. Turkish and Japanese versions of the NEI-VFQ have also been developed.^{46,47}

Combining Tools

Individual tools used to assess visual function often detect abnormalities in specific parts of the visual system. Hence, a single test cannot be expected to have good sensitivity and specificity for all eye diseases.³² Recent studies have examined the value of multiple screening tests for eye conditions.^{27,29,32} Ariyasu and colleagues²⁹ assessed 4 commonly available visual function tests (Amsler grid, near visual acuity, distance visual acuity, contrast sensitivity) to detect eye conditions at an ophthalmology clinic. This study revealed that different combinations of tests did not result in a more accurate detection of ocular disease. Wang and colleagues²⁷ tested a battery of vision tests in a primary care clinic and determined that there is no single test that can be carried out in a primary care office that will effectively and efficiently identify those with serious visual disorders. Ivers and colleagues³² are in agreement with Wang; their study demonstrated that no screening test had good sensitivity or specificity for detecting the presence of eye disease. They did not attempt to find a combination of tests with both good sensitivity and specificity because they believe that a combination of tests would add difficulty to the screening process making it difficult for nonophthalmic personnel to institute. Thus, the development of more efficient screening tools that can be used in the primary care setting for accurately detecting ocular disease is warranted.^{27,29,32}

In conclusion, early detection of visual impairment can help protect the vulnerable geriatric population from adverse effects such as blindness, falls, and increased morbidity. The Snellen chart, Cardiff acuity test, ophthalmoscope, and Amsler grid are objective measures of visual function that can be easily used in the primary care setting to screen for vision impairment within the geriatric population. Subjective

measures, especially the NEI-VFQ may assist with a comprehensive visual assessment in the primary care setting. However, no combination of tests is ideal for the detection of ocular disease. These screening measures in any combination must be used with caution because their sensitivity and specificity for detecting ocular disease are limited. Early referral to specialist ophthalmologic care is warranted should any disease be suspected. More detailed prospective research on the development of tools to detect accurately the visual problems that geriatric patients experience daily is needed. Comprehensive methods of screening that are easily applied to both the geriatric population and the primary care setting for additional measures of visual function such as glare, contrast sensitivity, and stereoacuity merits further work. Furthermore, additional research is needed to describe how screening for these additional aspects of vision can play a role in strategies for reducing disability among older adults.²³

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MELISSA A. KALINOWSKI, RN, BSN, is a staff nurse and geriatric nurse practitioner student affiliated with the University of Pennsylvania, Philadelphia.

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