

# Geriatric Eye Care

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## Author's Bio

Dr. Napier is a graduate of The New England College of Optometry. She completed a residency at the White River Junction, VT VAMC in 2006. Currently she is an assistant professor at Western University College of Optometry where she teaches the courses Special Considerations in Geriatrics, Low Vision Rehabilitation and Interprofessional Education. She also works part time at the Long Beach VAMC. Dr. Napier is the Immediate Past President of the Inland Empire Optometric Society.

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The population of the United States, and the world, is growing older. There are a lot of facets to attribute this change to: aging baby boomers, improvements in medicine and changes in family planning, among many others. The bottom line is: if you haven't noticed yet, your patients are getting older. Merriam-Webster Dictionary defines "*geriatric*" as "a branch of medicine that deals with the problems and diseases of old age and aging people,"<sup>1</sup> and unless otherwise stated, this article will use the most commonly accepted age of 65 for an elderly, or older, person. Be advised, however, that by using this number, many generalities are imposed. There are certainly some people older than 65 who do not fit the picture of health that this article portrays. Further, there are many people under age 65 who do fit this picture.

As of 2012, there were about 41 million people over age 65 living in the United States, which represented 13.4 percent of the population.<sup>2</sup> By 2030, it is estimated that the percent of the population over age 65 will be about 20%.<sup>3</sup> Similarly, in 2013, 11.7% of the world's population was over age 60, and this is expected to rise in most countries to an estimated 21% by the year 2050. Currently, about two thirds of the world's older population lives in developing countries, and in these countries in particular, the older population is growing more rapidly.<sup>4</sup> In most countries, including the United States, the older population is aging within itself. Because the state of medical care is improving, life expectancy is improving. In 2010, at birth life expectancy was 78.7 years. However, if one reaches the age of 65, their life expectancy is 84 years. Women are much more likely than men to live longer, with about 5 extra years of life expectancy than men at age 65.<sup>5</sup> In previous generations it was very rare for someone to live beyond 80 years, but that number is growing at the highest rate. In 2012 the percent of the US population over age 85 was 1.6%, or 5 million people.<sup>2</sup> By 2030, it is estimated that the percent of the US population over age 85 will be about 2.5%, or almost 9 million people.<sup>3</sup> Many older persons live independently, but as of 2004 there were 1.5 million people living in nursing homes, with the vast majority over age 65. The average time that a person lives in a nursing home is approximately 2.3 years.<sup>6</sup>

A significant reason that the older population is living longer is that major strides have been made in infectious disease. However, chronic diseases have replaced infectious disease as a problem in the elderly and from an optometrist's perspective, chronic disease is much more concerning to ocular health. Of the top causes of death in 2010, more than half are a result of chronic disease (see Table 1). More than half of people over age 65 report having hypertension, and approximately 20% report having diabetes.<sup>7</sup> Older adults spend very little time in physical activity which has well known, positive correlations with many health conditions including fall risk.<sup>8</sup> The combined effect of normal aging and chronic disease cause an overall decrease in function of the older patient.

While this isn't a focus of this article, it is important to note that there are many financial effects on society of the growing population of older persons. Older adults are less likely to work than younger adults and, therefore, pay less in taxes. Further, they account for much of the population in poverty in most countries of the world including the United States, and thus live on public assistance. Older adults are also much more likely to have poor health and require more medical intervention which further affects their ability to work and their financial status. Older adults spend about twice as much money on health care than the rest of the population.<sup>9</sup> Preventing and managing chronic conditions and thus

improving health and function can impact the financial effect on society as a whole, and should be a focus of all health care providers, including optometrists.

So, what does this mean for the optometrist? More patients, with more disease, decreased adaptability in the exam room, and greater need for collaboration.

### Geriatric Disease

It would be remiss to discuss geriatric eye disease without first discussing geriatric systemic disease, as many aspects of eye care are affected by disease in other parts of the body. Generally, system decline begins around age 30 and deteriorates at a rate of 1% per year. However, there are many redundancies in the body that make it so decline doesn't reach functional significance until much later. It is this functional significance that is the key factor in development of disease. For example, an older patient may have a normal fasting blood sugar result, but they are unable to handle that glucose load and thus show signs of diabetes.<sup>10</sup>

### Cardiovascular Disease

As seen in Table 1, diseases of the heart were the number one cause of death in the US population in 2010, and further they are the leading cause of death in older adults, worldwide. There are many normal physiologic changes that contribute to the pathogenesis of cardiovascular disease. As stated before, this decline does not manifest as disease until it reaches a level that is critical for cardiovascular function.<sup>10</sup>

Hypertension is an extremely common condition of the elderly. Up to 2/3 of the elderly may be hypertensive. Hypertension is defined as systolic blood pressure of 120 mm Hg or greater and/or diastolic blood pressure of 80 mm Hg or greater. According to the JNC 2014 recommendations for patients over age 60, treatment should be initiated to achieve blood pressure of systolic less than 150 mm Hg and diastolic less than 90 mm Hg, unless the patient is tolerating the treatment well at a lower level, has chronic kidney disease or has diabetes.<sup>11</sup> If not optimally treated, hypertension can cause many health problems, in particular: stroke, heart attack, congestive heart failure, kidney failure and atherosclerosis. In the eye, hypertension can lead to hypertensive retinopathy, vein and artery occlusions, anterior ischemic optic neuropathy, cranial nerve palsies, macroaneurysms, and ocular ischemic syndrome among other problems.

Coronary artery disease is another common condition of the elderly. Hypertension is the leading risk factor for coronary artery disease, but other risk factors include hypercholesterolemia and smoking. Hypercholesterolemia has known consequences in the eye, namely central or branch ophthalmic artery occlusion, and amaurosis fugax. Coronary valvular disease, as well as atrial fibrillation can also cause embolic ocular conditions similar to hypercholesterolemia. Valvular disease is quite common in the elderly and has been found in about 1/3 of individuals over age 75 at autopsy.<sup>10</sup> Valvular heart disease commonly includes calcification of the valves and more rarely endocarditis from mitral valve prolapse. Atrial fibrillation occurs frequently in older patients. It is caused by electrophysiological changes in the heart that cause decreased ejection of the atrial chamber of the heart. This, in turn, leads to coagulation of blood in the ventricles which can then cause embolism.

As stated above, the result of cardiovascular disease can have many consequences on eye health and vision. Most of these conditions are directly related to conditions that can also cause myocardial infarctions and cardiovascular accidents of the brain, with the additional effect of other disease that cause cardiovascular complications, namely diabetes mellitus. Stroke is primarily a disease of the elderly, as about 75% of strokes occur in people older than 65 years.<sup>10</sup> Therefore, it is of vital importance these conditions are under close care with other physicians, and that any eye disease that occurs as a consequence of cardiovascular disease be managed in direct collaboration with other physicians.

### Cancer

Cancer was the second leading cause of death in 2010,<sup>5</sup> and it commonly occurs in the elderly, as the incidence of many cancers peak in the elderly<sup>10</sup>. Further, most cancers have more devastating effects in the elderly than they do in younger populations. Therefore, it is important for physicians to consider the risk-benefit ratio when evaluating cancer in an older patient. While ocular cancers are not a leading cause of morbidity or mortality in the elderly, it is important

to consider this potential, as well as the effects of non-ocular primary tumors. Primary and secondary ocular tumors can occur in just about any vascularized structure of the eye, adnexa and orbit. Cancer can also cause inflammatory reactions in many parts of the eye.

### Infectious Disease

Certain infections are unequally present in older patients and the cause of this is not well understood. However, since the elderly are more likely to have other health conditions that weaken the immune system, and are at higher risk of nosocomial infections due to greater likelihood of hospitalization, it is easy to see that the elderly would be at greater risk of developing infectious disease as well as greater risk of subsequent morbidity and mortality. Pathogens that are common in the elderly include *Streptococcus pneumoniae*, *Escherichia coli*, *Neisseria meningitidis*, *Neisseria gonorrhoea*, *Staphylococcus aureus*, *Mycobacterium tuberculosis*, and herpes zoster.<sup>10</sup> These infectious agents can cause problems in the eye such as acute conjunctivitis, uveitis, keratitis and effect all other structures of the eye.

### Endocrine Disease

The two most common endocrine diseases that affect the elderly are diabetes mellitus and thyroid disease. By age 75, about 20% of the population has developed diabetes.<sup>10</sup> As stated previously, diabetes mellitus has known effects on the cardiovascular system, but it also can affect most other organs, most notably the kidneys, peripheral nervous system and, of course, the eyes. There are currently four criteria that define the diagnosis of diabetes: HbA1c greater than or equal to 6.5%, fasting plasma glucose greater than or equal to 126 mg/dL, two hour post prandial glucose greater than or equal to 200 mg/dL or random plasma glucose greater than or equal to 200 mg/dL in the presence of classic symptoms of hyperglycemia. The glycemic goals of treatment in diabetes are to lower the A1C to below or around 7%, though this value may not be recommended in many older patients, as higher or lower values may be desired based on a patient's individual clinical profile and life expectancy.<sup>12</sup> Not only does diabetes have its own set of complications, but in the elderly it also is associated with higher morbidity and mortality from other conditions such as cardiovascular, infectious and cognitive.<sup>10, 12</sup> Further, the effect of diabetes on certain systems can cause significant functional impairment that can essentially lead to further morbidity and mortality, such as greater risk for falling if vision or sensation in the foot is affected.

Thyroid function can be affected anomalously in older patients, including hypothyroidism, hyperthyroidism or subclinical euthyroid. Hypothyroidism occurs primarily in patients age 50-70 years. Hypothyroidism can often go undiagnosed in older patients because the symptoms mimic those of normal age changes, namely fatigue, memory loss and decreased hearing. Untreated hypothyroidism can lead to heart problems and can be associated with thyroid eye disease. Hyperthyroidism has a propensity to affect older adults as about 20% of patients are older. Untreated hyperthyroid can cause congestive heart failure, stroke and infection. Thyroid eye disease can occur in older adults with hyperthyroidism, but it is less likely than in younger patients.<sup>10</sup>

### Cognitive

Cognitive decline includes delirium and dementia. Dementia must be differentiated from delirium. Delirium is an acute state that consists of changes in level of consciousness and is usually secondary to other medical conditions. Dementia is a chronic condition with a prevalence that increases with advanced age. While it is normal for mild changes in memory and information processing to occur, dementia is marked by a disorder of memory and one other task: aphasia, apraxia, agnosia or impaired executive function. Dementia can be caused by many conditions including Alzheimer's Disease, Lewy Body Dementia, Vascular Dementia and many others. Currently there are no clinical guidelines that indicate ocular markers for dementia, though there is some evidence that such markers may exist.<sup>13-16</sup>

Depression is a common, undertreated condition in the elderly that can have devastating consequences. Depression can occur secondary to disease or medications, but can also be a consequence of isolation and psychosocial stress and should not be overlooked by health care providers.

### Special senses/mobility

Hearing loss is a normal consequence of aging. About 60% of people over age 65 have presbycusis, a sensorineural hearing loss.<sup>10</sup> Presbycusis affects the cochlea of the inner ear, and is associated with loss of sensitivity, distortion of signals and difficulty localizing signals. Other aspects can affect hearing loss beyond presbycusis, most notably wax build

up in the ear. Patients with hearing issues are first referred for wax removal, then to their primary care provider or an audiologist for a hearing evaluation.

Mobility issues are a serious concern in the elderly, as 1/3 of those over age 65 have had a fall each year. Table 1 shows that accidents are the fifth leading cause of death and in the elderly and falls account for 2/3 of these deaths.<sup>10</sup> Mobility is also important for maintaining physical activity and independence. Balance is a component of mobility, as good balance is required to shift weight from one leg to the other in order to move. Balance is maintained by 3 systems of postural control: somatosensory, vision and vestibular. Of all 3, vision is the most important, as it informs the body about the physical environment in relation to the body. Central vision is necessary for locating obstacles, guiding gait and gaze stabilization through the vestibuloocular reflex. Peripheral vision gives input about the position of the body in space, and also participates in locating obstacles. Stereopsis is important in determining distance between obstacles. Some studies suggest that in some situations, movement is safer when single vision lenses are worn for mobility rather than multifocal lenses, and that lens changes can affect mobility in the elderly.<sup>17</sup> In optometric practice, older patients should be queried for fall history and counseled regarding spectacle prescription and lens changes.

### Ocular Health

Some aspects of ocular health are affected by normal aging changes; however, many represent abnormal disease processes that happen to occur at high rates in the elderly. See Appendix 1 for a summary of normal age-related changes in ocular health. Normal changes to the eye and adnexa include skin laxity and decreased muscle tone that contribute to conditions such as dermatochalasis, neuronal degeneration of the lacrimal gland and decrease in goblet cells that contribute to dry eye syndrome, and changes in muscle action of the ciliary muscle that may contribute to presbyopia, among others. Two areas of great importance to optimal visual function do not have normal age-related decline: ocular alignment and visual acuity. The extraocular muscles have unique satellite cells that counteract the normal striated muscle atrophy of the body to ensure that the extraocular muscles continue to work at their optimal performance to maintain alignment of the eyes. Aging has a minimal effect on visual acuity alone and any decrease in visual acuity worse than 20/20 is never a normal aging change, but is always due to some disease process.<sup>18-24</sup>

### Pharmacology

Pharmacologic issues can be of great importance to the elderly. Polypharmacy is a hallmark of aging, with some reports of older patients taking on average up to 15 medications.<sup>25</sup> Polypharmacy draws attention to other issues of pharmacology in the elderly, namely aging changes on pharmacodynamics, drug interactions and medication adverse effects. Polypharmacy also highlights another common concern in the elderly-that older patients see many different providers and the providers don't always have access to a complete problem and medication list.

### Collaboration

As discussed in previous sections of this article, collaboration between the optometrist and other health care providers is crucial in geriatric health care. Older patients often have a complicated medical picture, and many co-morbidities. Collaboration, communication and information sharing between providers will ensure that the most individualized, appropriate care is provided to the patient.

### Optometric care of the older patient

Older patients may require a variety of different approaches to be taken in the eye exam. Many older patients will require additional time in their exam to account for more extensive history taking, objective testing and interpretation. Attempts to obtain additional medical information from other providers, including medication lists and laboratory reports, can be very useful to the optometrist in ensuring the best optometric care is taken for the patient. Exam modifications may be required to adapt the exam for patients who are wheelchair bound, have functional impairments or have cognitive problems. Eye exams may be best done outside of the exam room entirely and instead done bedside in the patient's home or nursing home, in the inpatient setting, or a variety of other settings.

In summary, the care of the older patient is a complex task that can be challenging, stimulating and rewarding. Older patients deserve compassion and dignity in their care and the well-equipped doctor of optometry can provide the utmost of care for this group of people.

**Table 1**<sup>5</sup>

The 15 leading causes of death in 2010 were:

1. Diseases of heart (heart disease)
2. Malignant neoplasms (cancer)
3. Chronic lower respiratory diseases
4. Cerebrovascular diseases (stroke)
5. Accidents (unintentional injuries)
6. Alzheimer's disease
7. Diabetes mellitus (diabetes)
8. Nephritis, nephrotic syndrome and nephrosis (kidney disease)
9. Influenza and pneumonia
10. Intentional self-harm (suicide)
11. Septicemia
12. Chronic liver disease and cirrhosis
13. Essential hypertension and hypertensive renal disease (hypertension)
14. Parkinson's disease
15. Pneumonitis due to solids and liquids

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Appendix 1

Ocular Structure	Normal physiological change	Condition caused	Functional Impairment
Adnexa/Eyelids	Decreased tissue elasticity Decreased number of cells Decreased fat cells Decreased bone mass	Dermatochalasis Blepharitis	Dropping eyelids Dry eye syndrome
Lacrimal gland	Neuronal degeneration Decreased hormonal action	Decreased aqueous tears	Dry eye syndrome
Extraocular muscles	Muscle atrophy Decreased number of cells Neuronal degeneration Continuously expressing satellite cells	None	No effect
Eyelids	Muscle atrophy Decreased number of cells Decreased tissue elasticity Decreased fat cells Neuronal degeneration	Dermatochalasis Blepharitis Ptosis Ectropion/entropion Punctal displacement	Dropping eyelids Dry eye syndrome Epiphora
Conjunctiva	Decreased number of cells Decreased tissue elasticity	Decreased mucin Conjunctivochalasis	Dry eye syndrome
Cornea	Decreased number of cells Decreased tissue elasticity Neuronal degeneration	Decreased sensitivity Decreased ability to maintain water equilibrium Steepening of horizontal meridian	Corneal edema Keratitis Against-the-rule astigmatism
	Cholesterol deposits	Arcus	None
Ciliary body and muscle	Unknown	Presbyopia Decompensated near phoria	Decreased near vision Tendency towards hyperopia Can have diplopia at near
Iris	Muscle atrophy Decrease number of cells Neuronal degeneration	Dilator muscle atrophy (miosis)	Increased depth of focus Decreased light to retina ( <i>decreased glare and photophobia, decreased night vision, decreased contrast sensitivity</i> ) Decreased action of mydriatic agents

Lens	Decrease in elasticity Yellows and opacifies from absorption of light	Presbyopia Cataract	Decreased near vision Decreased light to retina (decreased glare and photophobia, decreased night vision, decreased contrast sensitivity)
Vitreous	Liquifaction Detaches from retina	Syneresis Posterior vitreous detachment	Floaters
Retina neurology	Decrease number of cells (foveal rods) Neuronal degeneration (rods and cones) Thinning of RPE		Mild decline in visual function (mostly night vision) Decrease in motion perception Decrease in contrast sensitivity Decrease in color vision perception
Retinal vasculature	Muscle atrophy Decreased number of cells Decreased tissue elasticity Decreased fat cells Neuronal degeneration	Increased susceptibility to vascular insult	Can decrease visual acuity or visual field
Choroid	Decrease in number of cells	Choroidal drusen	Can decrease visual acuity
Optic nerve	Decrease in number of cells (ganglion) Neuronal degeneration		Mild visual field decline
Brain	Decrease in number of cells Brain atrophy Neuronal degeneration		Mild decrease in visual function