



Geriatric Care Management Journal

VOLUME 12
NUMBER 2
SUMMER 2002

Published by the
*National
Association of
Professional
Geriatric Care
Managers*

1604 North Country
Club Road
Tucson, Arizona
85716-3102
520.881.8008 / phone
520.325.7925 / fax
www.caremanager.org



Guest Editor's Message

by Cynthia Stuen, DSW

page 2

Vision Loss – A Focus on Function

By Cydney H. Strand, RN

page 3

Hearing Loss and Hearing Aids

By Barbara E. Weinstein, Ph.D.

page 7

Age-related Changes in Chemosensation

By Nancy E. Rawson, Ph.D.

page 11

Maximizing Independence: Reducing/Preventing Falls

By Roberta A. Newton, PT, Ph.D.

page 16



Guest Editor's Message

by *Cynthia Stuen, DSW*

Why Sensory Change

Knowing what are normal changes in vision, hearing, taste, smell and kinesthesia (specifically balance) is critically important to care management of older persons. More importantly, being able to distinguish the normal from the abnormal changes and then to make an appropriate intervention/referral can make a tremendous difference in the health and safety of older clients.

Did you know that vision and hearing impairments are among the top seven chronic health conditions among men and women age 65 and over? Did you know that one-third of older adults report dissatisfaction with their senses of taste and smell? Did you know that up to 50 percent of older adults have a fall each year. I hope I have whet your appetite because this issue of the GCM Journal is designed just for you!

I am delighted to serve as the guest editor for this issue of the *GCM Journal*. I feel strongly that every geriatric care manager should understand which changes in the sensory system are normal and which are not, in order to provide the best quality care management. Prevention of excess disability and safety among older adults are major concerns. Too often in my 28 years of work in gerontological health and human services, I have witnessed the lack of understanding about age-related sensory changes among geriatric care managers and providers of direct services.

The sensory systems include vision, hearing, chemosensory (taste and smell) and somatosensory. The latter is used to identify the complex systems that mediate the sensations for touch, pain, temperature and kinesthesia. The receptors are located in the skin and other soft tissue and impact on one's ability to interact with the environment.

I selected only one area of the somatosensory system that I felt would be a top priority to geriatric care managers and that is preventing/reducing falls through assessment and enhancement of balance.

I have asked experts in the areas of vision, hearing, taste & smell, and prevention of falls to write their articles with you, the geriatric care

the normal and pathological changes to vision among older adults. The emphasis is on function, assessing what the older person wants to do and then showing how the activity can be done in spite of age-related vision loss. Given that among adults age 75 and over, more than one in four report a problem with their vision, why is it that so few know about the specialized field of vision rehabilitation? If an older adult has a stroke, no one questions that physical, occupational and/or speech therapies are important interventions. So why is it that when

an older person experiences vision impairment, no one thinks of vision rehabilitation? A practical screening tool is included to help geriatric care managers determine when it is appropriate to seek additional evaluation of an older person's vision.

Hearing loss among older adults has the highest prevalence of all the sensory areas; 31 percent of persons 65 and over present with a hearing loss and the percentage rises to 70 in those 85 year and older.

Barbara

Weinstein gives a practical approach to its causes and interventions and she too provides a Screening Version of her "Hearing Handicap Inventory" and also gives information on hearing aids and other assistive listening devices.

(continued on page 3)

I have asked experts in the areas of vision, hearing, taste & smell, and prevention of falls to write their articles with you, the geriatric care manager in mind. It is not everything you may want to know but it is meant to be practical and provide the information and tools you need in order to decide when additional expert input is appropriate.

manager in mind. It is not everything you may want to know but it is meant to be practical and provide the information and tools you need in order to decide when additional expert input is appropriate.

Cydney Strand takes a very practical approach to understanding

Guest Editor's Message

(continued from page 2)

Nancy Rawson addresses chemosensation, which covers taste, smell and chemical irritation, by providing a compelling argument for why chemosensory complaints should be taken seriously by caregivers. She notes that diseases such as diabetes or cancer or the effects of medications, surgery or radiation may cause chemosensory dysfunction. She then offers management strategies to address chemosensory changes.

Lastly, **Roberta Newton** shares with readers her community service project pertaining to fall risk identification and balance abilities. She has developed a "Multi-Directional Reach Test" to test balance and it is incorporated in her Fall Prevention Program, a multi-factorial intervention.

Of course what has not been covered is the occurrence of multiple sensory losses in an individual that present unique challenges. It has been a privilege to serve as Guest Editor for this issue. I think the authors have done a wonderful job of synthesizing their areas and providing practical information; it has been such a pleasure to work with all of them.

Cynthia Stuen, DSW, is senior vice president for education at Lighthouse International and director of its Center for Education, formerly, National Center on Vision and Aging. The mission of Lighthouse International is to help people of all ages overcome vision impairment through research, education, service and advocacy. Dr. Stuen's current project is the development of LighthouseLink, an accessible Internet portal for people with impaired vision, professionals who serve them, and the public. Recognizing the impact of normal and pathological changes in vision and the other sensory systems is the main subject of Dr. Stuen's research, teaching and publications. She has been in gerontological social work in institutional and community-based settings for 28 years.

Vision Loss – A Focus on Function

By *Cydney H. Strand, RN*

Several years ago, before my active involvement with vision rehabilitation I worked as a nurse educator in a large New York City hospital. Although well prepared to help my older adult patients with their numerous health management challenges, I had nothing to offer for one of their main debilitating concerns – failing vision. When I recommended a visit to their eye care professional, the response was often a frustrated "I visit my eye doctor regularly but I still can't see." I wrongly assumed that if regular visits to the eye doctor didn't help, then there was nothing more that could be done. I had no solutions nor did I really understand the problem. My patients weren't blind, so what did they mean when they said they couldn't see. Was help available anywhere? Now, some years later I am pleased to have the opportunity to

share with you what I wish I had known then.

Introduction

Unlike children with vision impairment who have parents, teachers, special education programs and counselors making sure that everything possible is done to help maximize usable vision, the safety net for visually impaired older adults is not secure. Because of a lack of understanding and information about vision rehabilitation too many patients continue to fall into the gap between what could be done and what gets done. With an understanding of the types and scope of vision impairment and the rehabilitation resources available, geriatric care managers can play an important role in closing this gap.

(continued on page 4)



Published by the:
National Association of
Professional Geriatric Care Managers
1604 North Country Club Road
Tucson, Arizona 85716-3102
www.caremanager.org

**Published quarterly for members of GCM
Non-member subscriptions: \$75.00 per year**

© Copyright 2002

The GCM Journal is published as a membership benefit to members of the National Association of Professional Geriatric Care Managers. Non-members may subscribe to GCM Journal for \$75.00 per year. Send a check for your one-year subscription to: Subscription Department, GCM, 1604 N. Country Club Road, Tucson, AZ 85716-3102.

EDITORIAL BOARD

Rona Bartelstone, MSW
Fort Lauderdale, FL

Lenard W. Kaye, Ph.D.
Bryn Mawr, PA

Karen Knutson, MSN,
MBA, RN
Charlotte, NC

Marcie Parker, Ph.D.
Golden Valley, MN

EDITOR-IN-CHIEF
Monika White, Ph.D.
Santa Monica, CA.

**COMMUNICATIONS
DIRECTOR**
Jihane K. Rohrbacker
Tucson, AZ

**GRAPHIC
DESIGNER**
Kristin L. Hager
Redmond, WA

Vision Loss – A Focus on Function

(continued from page 3)

Vision Impairment in the Older Adult Population

Vision impairment affects all age groups but is especially prevalent among older adults. The aging process itself causes some changes in vision including the loss of focusing capability especially at near, a declining sensitivity to color and contrast, an increased sensitivity to glare and a diminished ability to adjust between changing levels of illumination. With a few adaptations such as a new bifocal prescription, better lighting, a visor or tinted lenses to ameliorate glare and the patience to wait a bit longer for vision to adjust when moving between bright and dark environments, most adults are able to maintain excellent visual function throughout life.

Unfortunately a sizeable minority of older adults have vision impairment that is not so easily alleviated. One in four patients age 75 and older report a visual impairment that affects ability to accomplish everyday visual tasks. (Lighthouse, 1995). Vision impairment encompasses a continuum from near normal vision to total blindness. “Low vision” falls within this continuum but as the term implies some usable vision still exists. A person with low vision may (or may not) be “legally blind” but they are not totally blind. Legal blindness, defined in most states as a visual acuity of 20/200 or worse in the better eye with correction, and/or a visual field equal of 20 degrees or less, is a measure that determines eligibility for government sponsorship and/or benefits. Both legal blindness and low vision presume that although some usable vision exists, the underlying vision impairment cannot

be corrected—not by corrective lenses, surgery or medication. Unlike legal blindness, however, the term “low vision” is not defined by acuity or field loss. A person has low vision if the uncorrectable vision impairment precludes his or her ability to do the visual tasks he or she deems necessary. Low vision is measured not in quantity of vision but in vision-related quality of life. The most prevalent causes of low vision in the older adult

diseases that affect the retina in or near the center of fixation, parts of the central view may be unclear or missing. If a small object falls within this area, the object may be distorted or disappear. By turning one’s head or moving one’s eyes slightly the object may come into view as it focuses on a more peripheral part of the retina. Many people learn to view objects by not looking directly at them (eccentric viewing) but this forces them to see

The visual system is a complex network that fuses many different elements of vision to form complete images. Functional vision losses will differ depending upon which structures of the eye or parts of the visual system are damaged.

the image with a part of the retina that does not have sensitivity for detail. With central vision loss, a person can have difficulty recognizing faces, seeing words on a page, letters in a word or reading the time on a watch. Color vision and contrast sensitivity may also be reduced.

population are age-related macular degeneration (ARMD or AMD), glaucoma, cataract and diabetic retinopathy.

Low Vision—A Functional Look

The visual system is a complex network that fuses many different elements of vision to form complete images. Functional vision losses will differ depending upon which structures of the eye or parts of the visual system are damaged. The exact nature of the loss is often hard to describe even by the person experiencing it.

A helpful system for understanding the nature of vision impairment, developed by Eleanor E. Faye, MD, classifies vision losses into 3 functional categories: central vision loss, peripheral vision loss and overall blur (Lighthouse, 1995).

One’s central vision is used for detail visual tasks. In order to see detail we look directly at an object to form the image of that object on the 3-4 mm macular area of the retina. The macula is the only area of the retina capable of 20/20 vision. When the macula is damaged, by AMD or other

Peripheral vision loss, caused by glaucoma, damage to the peripheral retina or neurologic problems (stroke, tumor), creates a very different picture. Depending upon how much of the peripheral retina is damaged, a peripheral vision loss may result in a partial sector loss or a general constriction of the full peripheral field (tunnel vision). In this instance a person may be able to recognize a face and read print, but will not be able to see objects outside of the reduced visual field, making it difficult to walk around safely (indoors and outdoors) and to find objects outside of the limited field. Reduced vision in dim lighting will also factor into the functional loss.

With overall blur, a person may have the full use of central and peripheral fields but vision is reduced by the debilitating effects of glare and fuzziness caused by problems associated with the clouding of normally clear structures of the eye. The most common cause of overall blur in the older adult population is cataract—the opacification of the crystalline lens of the eye.

(continued on page 5)

Vision Loss – A Focus on Function

(continued from page 4)

It should be noted that there is no guarantee that only one pathology will be present. For example, a person with a cataract and AMD may have a central vision impairment and suffer from glare and blur. Also a pathology such as diabetic retinopathy can cause functional losses in any or all of these categories. In diabetic retinopathy, central vision loss may occur related to macular edema, peripheral loss may occur related to a vitreous detachment or from preventative laser photocoagulation treatment. Cloudiness may occur related to leakage from broken blood vessels into the vitreous. In addition, fluctuating blood glucose levels can affect the lens causing variations in vision throughout the day.

Screening for Vision Impairment

Although most people will not hesitate to bring acute vision changes to the attention of their healthcare provider, some vision changes, especially in their early stages often go unattended. To the older adult the vision impairment may be confusing or difficult to describe. In some cases, especially when the visual decline is gradual, the loss may be accepted as a normal part of aging. The caregiver may notice a change in behavior but mistakenly attribute the change to another disorder. Difficulty eating, inability to tell time, inattention, tripping, bumping into objects, losing objects, lack of eye contact, unusual head movements or withdrawal from social activities may be attributed to a number of causes including depression, mental confusion, substance abuse or medication side effects. When such behaviors are observed, vision loss should be added to the list of suspects.

Clarification regarding a possible visual connection to observed changes in behavior can be done by asking questions about functional

vision. Ask about the use of glasses: Do you have glasses? Do you wear them? If not, when and why did you stop wearing them? The fifteen simple yes/no questions listed below, from The Functional Vision Screening Questionnaire (FVSQ) (Lighthouse, 1996) can be used as a tool to further identify vision difficulties at near (reading), intermediate (sewing, eating) or far (watching TV, seeing street signs). A score of “1” is given for each item where a vision problem is reported and a “0” if no problem is noted. People with a score of nine or higher should be encouraged to seek vision evaluation services from an optometrist or ophthalmologist. People who have glasses or contact lenses should be advised to answer the questions based on how they see when wearing their glasses or contact lenses.

Once a vision problem is suspected or confirmed, a visit to an eye care professional for diagnosis and medical treatment is an important step; however, the next step is no less crucial. If the vision problem cannot be functionally corrected to normal, effort should be made to see that patient is further referred for vision rehabilitation.

Vision Rehabilitation Services

Referral to vision rehabilitation services is not always welcomed by the patient. Patients often counter the proposal with the fact that they already see their ophthalmologist or optometrist on a regular basis and the last thing they need is another medical appointment. In addition, they may have been told that “nothing more can be done.” Why then another *doctor’s visit*?

While the patient is correct that everything medically possible is being done to arrest the disease process, the functional aspects of the vision loss are most likely, NOT being addressed. It is helpful to meet these objections with a knowledgeable explanation of vision rehabilitation services—the first step of which is the low vision examination.

(continued on page 6)

The Functional Vision Screen Questionnaire

1. Do you ever feel that problems with your vision make it difficult for you to do the things you would like to do?
2. Can you see the large print headlines in the newspaper?
3. Can you see the regular print in newspapers, magazines or books?
4. Can you see the numbers and names in a telephone directory?
5. When you are walking in the street, can you see the “walk” sign and street name signs?
6. When crossing the street, do cars seem to appear very suddenly?
7. Does trouble with your vision make it difficult for you to watch TV, play cards, do sewing, or any similar type activity?
8. Does trouble with your vision make it difficult for you to see labels on medicine bottles?
9. Does trouble with your vision make it difficult for you to read prices when you shop?
10. Does trouble with your vision make it difficult for you to read your own mail?
11. Does trouble with your vision make it difficult for you to read your own handwriting?
12. Can you recognize the faces of family or friends when they are across an average size room?
13. Do you have any particular difficulty seeing in dim light?
14. Do you tend to sit very close to the television?
15. Has a doctor ever told you that nothing more can be done for your vision?

(Note: This questionnaire is also available in Spanish, French, Polish, Italian, German and Chinese.)

Vision Loss – A Focus on Function

(continued from page 5)

The low vision examination is designed to measure how an individual functions in the real world and to emphasize functional goals. Examinations are done by low vision practitioners, optometrists (ODs) or ophthalmologists (MDs) who use specialized charts and procedures that accurately measure reduced near and distance visual acuity, visual field restrictions and/or distortions as well as contrast and glare sensitivity. An accurate description of the rehabilitative nature of the examination prepares the patient for the task-related outcomes and helps prevent the dashed hopes that come from the unrealistic expectation that this new referral will be the one that restores vision back to normal.

During the low vision examination the patient is queried about how vision loss affects daily life—can he or she see faces, signs, stove dials, curbs and other visual clues needed to get through a typical day? Specific difficulties with ADLs and IADLs are explored. How is the person coping with grooming, shopping, travel, making phone calls, taking medications, writing checks, participation in hobbies or recreational activities?

Optical devices are prescribed based upon task-related goals, amount of magnification needed, how and where the task will be performed as well as patient preferences and economic factors. A lightweight hand-held magnifier may be prescribed for checking prices in the department store, an illuminated stand magnifier (a magnifier with a built in light that sits on the reading material) for prolonged reading at home, while a telescope is prescribed for watching a grandchild at a school play. Instruction in use of the device(s) along with the use of complementary adaptive and assistive devices is also provided. If the patient is interested and the task warrants it, “high tech” electronic devices and computer solutions are also available.

Referral for additional services is another key to independence and safety. Social workers have an important role in helping patients adjust to the loss of vision and navigate the rehabilitation process. The services of orientation and mobility (O&M) specialists and/or rehabilitation teachers (RT) are equally important. These university-trained vision-rehabilitation professionals specialize in promoting independence in people with visual loss by providing training in safe indoor and outdoor travel skills (O&M) and practical strategies and techniques for all ADLs and IADLs (RT). Counselors and/or support groups can also help visually impaired adults cope with the accompanying depression, anger and frustration of vision loss.

Care Strategies

Beyond referral to others, care managers can also make use of effective vision rehabilitation strategies and techniques that improve communication and encourage better compliance with care plans. Support the patient’s use of prescribed low vision devices. If needed, check with the low vision provider to find out the optimal way your patient should use a particular device. “Task-lighting” (use of an adjustable light fixture to focus light on a specific area) is often helpful for illuminating reading materials and other detail objects. A 60-watt bulb is usually sufficient when used at a near range. While enhancing lighting, it is also important to minimize glare from natural as well as from artificial light sources. Some people find it helpful to place a yellow transparency (from a report cover) on reading materials or to wear tinted lenses. Glare from windows should be minimized with opaque curtains or shades. The use of contrast can increase visibility in many areas. Examples include the use of a bold pen for writing, a dark tablecloth to contrast with white china, or a dark doorframe to contrast with a light-colored wall. Encourage the use of tactile marking systems to differentiate colors or medications.

Lighthouse International’s Information & Resource (I&R) Service, available via a toll-free number (1-800-829-0500) can provide additional information on strategies to enhance functional vision. This service also provides information about eye disease, optical devices, support groups and vision rehabilitation services and is available to healthcare providers as well as visually impaired consumers, their family members and caregivers.

When cure is not an option there is still a lot that can be done. Helping clients to optimize their vision can mean increased independence and safety, enhanced quality of life and the difference between disability and capability.

Cydney Strand, RN began her nursing career at the Visiting Nurse Service of New York—Hospice Division. She then went on to work as a health education specialist at Metropolitan Hospital and two New York City based HMOs, where she developed and administered education programs in asthma, diabetes, nutrition, stress management and parenting. She is currently a clinical educator at Lighthouse International and a faculty member of the Lighthouse Center for Education.

References

- Eleanor E. Faye, Ed., *Clinical Low Vision*, Second Edition, 1984, Boston: Little Brown and Company.
- E. Faye and C. Stuen, (Eds.), *The Aging Eye and Low Vision*, 1995, New York: The Lighthouse, Inc.
- The Lighthouse, Inc., 1995, *The Lighthouse National Survey on Vision Loss: The Experience, Attitudes and Knowledge of Middle-aged and Older Americans*. New York: The Lighthouse Inc.
- The Lighthouse, Inc. 1996, *The Functional Vision Screening Questionnaire. Developed in part through a grant from the National Institute on Disability and Rehabilitation Research*, United States Department of Education #133A20019.
- Rosenthal, B. P., 1996, “The function-based low vision evaluation,” in *Functional Assessment of Low Vision*, B. P. Rosenthal and R. G. Cole (Eds.) St Louis, Mosby-Year Book, Inc.

Hearing Loss and Hearing Aids

By Barbara E. Weinstein, Ph.D.

Hearing loss is one of the most prevalent chronic conditions affecting older adults. Of the 28 million persons in the United States with hearing loss, nearly ten million are over the age of 65. Hence, hearing loss prevalence is approximately 31 percent for persons over 65 increasing to a prevalence of nearly 80 percent in adults 80 years of age and older. Given the increase in prevalence with increasing age, the majority of nursing home residents present with hearing impairment. Consistent with the tendency of older adults to rate their health positively, they tend to minimize the impact of hearing loss on daily function. Older adults tend to accept hearing loss and its effects as a natural part of the aging process. In light of evidence linking untreated hearing loss to social isolation, depression and cognitive impairments, it is incumbent on health care professionals to assist in the early identification and referral of older adults to a hearing health care professional. Recent studies have demonstrated that older adults receiving treatment for hearing loss report beneficial effects in the social, emotional and functional domains.

Hearing loss due to the aging process is referred to as presbycusis. Presbycusis is attributable to degenerative changes in the peripheral auditory system (the inner ear which includes the snail shaped cochlea and the eighth nerve) and or the central auditory mechanism which includes the auditory brainstem pathways and the temporal auditory cortex. Noise exposure, vascular disease, and selected medications can exacerbate age related hearing loss. Hearing loss characterizing older adults has several distinctive features. It is slowly progressive and sensorineural in nature. It is symmetrical, bilateral and tends to be mild to moderate in degree. It is more pronounced for high

frequency sounds. Further, with increasing age, the hearing loss becomes more severe in the high and low frequencies. Older men tend to have poorer high frequency hearing loss than do their female counterparts. In light of their good low frequency hearing, older adults can hear when people are speaking and can hear environmental noise that tends to have most of its energy in the low frequency. In contrast, the loss of sensitivity for high frequency sounds and the difficulty discriminating one frequency from another, interferes with reception of consonant sounds which are critical to speech reception and speech understanding. The hearing impairment interferes with difficulty processing timing information, further compromising speech reception. Older adults often bemoan the fact that "they can hear people talking, but they can not make out the words."

The sensorineural hearing loss experienced by older adults has dramatic effects on communication and psychosocial function. With regard to communication function, the Older adults typically experience

interpersonal difficulties at home, at work, at leisure activities; difficulty understanding speech from a distance (e.g. bingo games, church or synagogue); difficulty on the telephone; and difficulty understanding television. Oftentimes safety may be compromised as older adults may not hear car horns, smoke alarms, telephones ringing, fire alarms or the doorbell ringing. Difficulty hearing warning signals can interfere with one's sense of security and independence. Older adults with cognitive impairments and sensory loss are at a particular disadvantage in the safety domain.

Hearing loss has an adverse effect on functional status, quality of life, cognitive function on emotional, behavioral and social well-being. It has been shown to interfere with functional independence and consequently can compromise quality of life. There is considerable individual variability in the reactions of older adults to acquired hearing loss ranging from acceptance and positive personal adjustment to feelings of anger, withdrawal and frustration. A recent survey of over 2000 hearing impaired older

Hearing loss has an adverse effect on functional status, quality of life, cognitive function on emotional, behavioral and social well-being. It has been shown to interfere with functional independence and consequently can compromise quality of life.

adults and caregivers or family members conducted by the National Council on Aging (NCOA, 2000) demonstrated that hearing aid users report significant improvements in many areas of life ranging from interpersonal relationships at home,
(continued on page 8)

Hearing Loss and Hearing Aids

(continued from page 7)

functional independence and improved social life. Interestingly, in every dimension surveyed (e.g. social life, relationships, sense of independence), the families of hearing aid users noted improvements and in many cases were more likely than the users to report improvements in the variety of social and emotional domains studied.

Despite the many advantages of hearing aids, the majority of older persons with hearing impairment do not own hearing aids. The primary barriers to hearing aid use according to the hearing aid users surveyed by NCOA include the feeling that "my hearing is not bad enough," the sense that "I can get along without a hearing aid," and the sentiment that "a hearing aid would make me feel old." About one-half of the non hearing aid users cited the high cost of hearing aids as a deterrent. The availability of and value of conventional and disposable hearing aids, which are less costly than a top-of-the line hearing aid should be emphasized when older adults discuss hearing interventions with health care workers.

Hearing Aids or Assistive Listening Devices to the Rescue

Hearing aids can be viewed as an amplifier with a microphone and a loudspeaker that is made to fit the ear. Sounds of different frequencies are amplified by the hearing aid selectively, based on the configuration of an individual's hearing loss. Hearing aids do not restore hearing, hearing aids amplify speech as well as noise, hence hearing aids are not a panacea especially in the most difficult listening situations namely noise. Hearing aids work optimally when paired with an assistive listening device (ALD). Success with hearing aids is highly correlated with acceptance of a hearing loss, motivation to pursue intervention, and realistic expectations.

The hearing aid industry has seen an influx of technologically advanced hearing aids which are more comfortable to wear, include remote control functions, adjust automatically to differing input signals (e.g. speech versus noise), have multiple memories, and can be reprogrammed if the hearing loss worsens. The cost of hearing aids is variable depending upon the level of sophistication, the type and the style. Hearing aids are available in two basic styles including behind-the-ear and in-the-ear; they can be analog or digital; and more and more hearing aids are programmable. In 2001, 57.7 percent of all devices sold were either digitally programmable or digital signal processing units, hence the majority of the hearing aid market is programmable. The most significant technological advance is the availability of digital signal processing (DSP) hearing aids that differ somewhat from conventional analog units. A conventional hearing aid does not use a computer chip to control the sound input. The response of the hearing aid is manually adjusted by the audiologist.

A programmable hearing aid is programmed by the audiologist using a computer to better tailor the hearing aid response to the hearing aid. Programmable hearing aids have multiple memories and the user selects the preset program depending on the listening environment (quiet, noise, music, etc.). Finally, a digital hearing aid incorporates digital signal processing. In short, speech signals are converted into binary electrical impulses (the incoming sound is converted into numbers that are analyzed) and are manipulated through a digital signal processor (e.g. a computer chip) which is faithful to the signal input. The speech signal delivered to the ear of the listener tends to be free of distortion, soft and loud sounds tend to be more audible than with conventional units, and speech tends to be amplified more so than the noise which ultimately results in improved speech understanding. Digital hearing aids usually adjust automatically and instantaneously to the environment. Digital hearing aids, however, may cost two to three times

more than conventional hearing aids. The price range of hearing aids is quite wide. Disposable hearing aids which are new to the market may cost as little as \$39 whereas high-end digital units can cost as much as \$5000. The consumer must work closely with the audiologist to insure that the benefit outweighs the cost.

Many older adults may not be candidates for hearing aids and there are many situations in which hearing aids need to be supplemented by an assistive listening device (ALD) to achieve maximum communication performance. ALDs are alternative forms of hearing technology which have proved invaluable in overcoming some of the environmental barriers to successful communication with hearing aids. These devices can overcome the disadvantages created by noise and distance by use of a remote microphone that is placed within 3 to 6 inches from the sound source. This arrangement allows the speech to reach the listener's ear directly without attenuation or noise interference.

ALDs are commercially available from electronics and telephone equipment stores. Four categories of devices are available to supplement or to be used in lieu of a hearing aid. The categories include: (1) sound enhancement technology such as a pocket sized device known as a personal amplifier (2) television enhancement technology/media devices which enable better television reception (3) telecommunications technology which includes adaptive equipment such as amplified telephones, text telephones, can facilitate telephone use and (4) signal alerting technology which includes any system that warns, signals or alerts a person with a hearing impairment to important sounds in the environment. The former device has proven invaluable to health care professionals working with older hearing impaired adults who do not own hearing aids. Information about these devices can be obtained from an audiologist or from the American Academy of Audiology or the American Speech-Language-Hearing Association.

(continued on page 9)

Hearing Loss and Hearing Aids

(continued from page 8)

When and To Whom To Refer

When hearing loss begins to effect functional listening abilities, communication with family, friends and co-workers, and/or an individual's well-being, a referral to an audiologist is recommended. An audiologist is a professional with a Masters or Doctorate degree in audiology who is trained to evaluate hearing and recommend hearing aids and/or assistive listening devices. Audiologist work in private practice, speech and hearing departments of hospitals and free standing facilities. The American Speech-Language-Hearing Association or the American Academy of Audiology are good resources for locating an audiologist. The questions listed below, which comprise the screening version of the Hearing Handicap Inventory for the Elderly (HHIE-S) can be used to assist in making a referral to an audiologist (Table 1). A "Yes" response earns 4 points; a "Sometimes" response earns 2 points and a "No" response earns 0 points. The respondent should answer the questions to the HHIE-S according to how he/she hears under typically listening conditions. If the individual uses a hearing aid, responses should be according to how he/she hears with the unit. Scores on the HHIE-S relate to hearing aid use and success such that the majority of hearing aid candidates score 18 or greater and achieve scores below 10 once they have been successfully fitted with hearing aids. If the sum of the points is 10 or higher, the individual should be referred to an audiologist to determine if a handicapping hearing loss exists and if some form of amplification is indicated. If the audiologist identifies a medically treatable condition as a result of the history and hearing test results (e.g. impacted wax, middle ear effusion), he/she will automatically refer to an Otolaryngologist for medical intervention. If a sensorineural (i.e. inner ear) hearing loss and a self perceived

hearing handicap remain following medical treatment, the patient should be encouraged to consider some form of amplification.

TABLE 1
Screening Version
of the Hearing
Handicap Inventory

Answer:
Yes (4) No (0) or Sometimes (2)

1. Does a hearing problem cause you to feel embarrassed when you meet new people?
2. Does a hearing problem cause you to feel frustrated when talking to members of your family?
3. Do you have difficulty hearing or understanding co-workers, clients, or customers?
4. Do you feel handicapped by a hearing problem?
5. Does a hearing problem cause you difficulty when visiting friends, relatives or neighbors?
6. Does a hearing problem cause you difficulty in the movies or in the theater?
7. Does a hearing problem cause you to have arguments with family members?
8. Does a hearing problem cause you difficulty when listening to TV or radio?
9. Do you feel that any difficulty with your hearing limits or hampers your personal or social life?
10. Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?

Total Possible Score = 40
(Scores in excess of 10 suggest the presence of a hearing handicap)

Important Hearing Aid and Communication Tidbits

The patient who is referred for a hearing aid should be aware of the following points. The audiologist who dispenses hearing aids should be licensed by the state in which he/she lives and should be certified to practice audiology. The audiologist should show the patient a range of hearing aids from different manufacturers prior to arriving at a decision regarding the optimal hearing aid for the individual's communication needs. The patient should be reminded that hearing aid cosmetics is not as important as the ability of the hearing aid to improve speech reception and promote an improved quality of life. Hearing aids may not resolve communication problems in all situations so the patient should inquire about assistive listening devices and alerting devices. An infrared system that assists with television reception oftentimes proves to be an important adjunct to hearing aids. The patient should also ask about directional hearing aids and the advantages of two versus one hearing aid. Prospective hearing aid users should ask about the manufacturer's warranty, the return policy and supplemental insurance which covers loss and damage.

Finally, a hearing aid orientation should accompany all hearing aid fittings as, unlike eyeglasses, hearing aids do require a brief adjustment period to attain maximal benefit. New hearing aid users should be mindful of the characteristics of hearing aids listed in Table 2.

(continued on page 10)

Hearing aids may not resolve communication problems in all situations so the patient should inquire about assistive listening devices and alerting devices.

Hearing Loss and Hearing Aids

(continued from page 9)

TABLE 2
Realistic Expectations
Regarding Hearing Aid Use

Hearing aids:

- Should allow you to hear many sounds that you may not be able to hear or may not hear clearly without amplification.
- Should allow you to understand speech more clearly and with less effort.
- Should not amplify normally loud sounds to uncomfortable levels.
- May enable the patient to understand speech more clearly in some, but not all noisy environments.
- Will require some time for adjustment and maximal performance.
- Will not restore hearing to normal.
- Will be least helpful in the situations the hearing impaired most need them.
- Will not filter out all background noise.
- Will improve sound quality.
- Will make sounds easier to hear.
- Will improve the ability to hear environmental sounds including the telephone ringing, the doorbell and a car horn.

Communication partners should be instructed to practice the communication tips listed in Table 3 to promote receptive communication.

TABLE 3
Tips for Communicating with
the Hearing Impaired

- Obtain the person's attention before beginning a communication.
- Speak face-to-face.
- Paraphrase what has been said.
- Speak at a normal level or slightly louder.
- Speak slowly but not exaggerated.
- Stand within 2 to 3 feet of the listener.
- Reduce background noise.
- Pause at the end of the sentence.
- Avoid appearing frustrated.
- Write down key words.
- Have the hearing impaired write down what you have said to verify that the message was understood.

Concluding Remarks

Hearing impairment is a prevalent condition among older adults. More than 30% of non-institutionalized adults over 65 years report some degree of hearing problem. Hearing loss is associated with decreased quality of life, depression, social isolation and cognitive decrements. Hearing aids and assistive listening devices are effective in reversing or forestalling some of the negative effects of hearing loss. Health care professionals who work closely with older adults should encourage older adults to see out the services of an audiologist when a disabling hearing impairment emerges. Early intervention with a variety of amplification devices can ease the burden of hearing impairment.

*Barbara E. Weinstein, Ph.D. is a professor of audiology at Lehman College, City University of New York (CUNY) and the Graduate School and University Center, CUNY. Dr. Weinstein, who did her doctoral studies at Columbia University, is a fellow of the American Speech-Language-Hearing Association. The author of over 50 manuscripts on hearing loss in the elderly, she recently completed a textbook titled *Geriatric Audiology*, published by Thieme Medical Publishers. Dr. Weinstein is the co-developer of the *Hearing Handicap Inventory Scale for the Elderly*, a widely used self-report scale for identifying individuals with hearing problems and for verifying outcomes with hearing aids.*

Age-related Changes in Chemosenation

By Nancy E. Rawson, Ph.D.

Introduction

Taste, smell and chemical irritation are the senses responsible for perception of flavor and aroma, and comprise what is termed "chemosenation." The sensory systems responsible for these perceptions vary considerably in their anatomy and physiology, their ability to regenerate, and their susceptibility to aging and age-associated diseases. One-third of elderly people report dissatisfaction with their senses of taste or smell, and the actual incidence is probably even higher (Pelchat, In Press). Sensory loss with aging affects both quality of life and personal safety. The impact on emotional and physical well-being should not be underestimated and chemosensory complaints should be taken seriously by caregivers, both for their significance to the patient and for the implications they may have for other neurological disorders. This review will present current information about the effects of aging and age-related conditions on the anatomy and biology of these chemosensory systems, the risk factors that may predispose the systems to impairment, and some strategies for coping with chemosensory loss among geriatric care managers.

Anatomy and Physiology

Several features of these systems make them particularly susceptible to age and disease-associated changes that may lead to functional deficits: exposure to an often harsh external environment; replacement of receptor cells throughout life (for taste and smell); dependence on the ability of stimuli to dissolve in and penetrate through watery protective layers; dependence on multiple receptor types each of which is needed to perceive the full sensory spectrum; and dependence on finely balanced

ionic exchange between inside and outside the receptor cells. Sensory loss may be due to changes in the anatomy of the structure (e.g. loss of taste buds or olfactory receptor cells), changes in the levels of specific receptor proteins, ion channels or signaling molecules or changes in the environment surrounding the receptor cell (e.g. reduced salivation or altered nasal mucus composition). The effects of denture use, which provides a physical barrier to some of the membranes where the receptors reside, along with reduced salivation and compounds released from dental adhesive certainly contribute to changes in perception. In other cases, sensory dysfunction may be a consequence of chronic diseases such as diabetes or cancer, or the effects of therapeutic interventions such as medications, radiation or surgery. In these situations, successful treatment of the disease will often improve chemosensory function. In many cases, however, the cause is unknown and likely to be untreatable until more is known about the age-related factors leading to chemosensory loss. Finally, sensory deficits may be an early indication of neurological disorders such as Parkinson's disease or Alzheimer's. Patients with Alzheimer's disease are poorer at odor identification than are age and gender matched patients with multi-infarct dementia or healthy controls (Morgan et al., 1995). Impaired olfaction also appears to be an early sign of Parkinson's disease, which can assist in distinguishing it from essential tremor (Busenbark et al., 1992) or supranuclear palsy (Doty et al., 1993). Alterations in taste and smell (distortions or reduced sensitivity) are also associated with certain endocrinological disorders such as hypothyroidism (McConnell et al., 1975). Thus, changes in olfactory function can be early signals of other

kinds of physiological disorders and therefore warrant further clinical attention. The geriatric care manager should be familiar with these early signals and report them to the patient's physician.

Pharmacological and environmental effects. A large number of medications can elicit chemosensory side effects. These effects can lead to poor compliance or altered food selection and nutritional status. Medications or their metabolites can be secreted into saliva or nasal mucus and directly detected by the receptor cells. This is thought to be the reason for the commonly reported unpleasant taste that is a side effect of many antibiotics, particularly those in the quinolone family (Chodosh et al., 1998). A recent study by Zervakis and Schiffman (2002) found that most drugs applied to the tongue evoke a bitter taste, with some also having a metallic or medicinal quality. In this study, the antihypertensive drug Captopril elicited a sour taste, and diminished the intensity of sucrose and potassium chloride. Earlier studies also have indicated that patients taking captopril for up to 6 months exhibited reduced sensitivity to sucrose and sodium chloride (Abu-Hamden et al., 1988). Thus, both direct effects on taste receptors and indirect effects are possible, and these indirect effects could be due to salivary secretion of the drug or its metabolites, or to the physiological effects of the medication that may interfere with cellular processes necessary for proper chemosensory receptor cell function. Generally these effects do not last beyond the clearance time of the medication following cessation, and awareness of this can help patients to tolerate the effects for the duration of drug treatment. In cases where medication must be taken chronically, dosage adjustments may alleviate the problem, or the caretaker can help the patient to focus on development of compensatory strategies.

Chemical irritation is least affected by aging, but can be influenced by certain diseases and interventions. The system responsible
(continued on page 12)

Age-related Changes in Chemosensation

(continued from page 11)

for detecting sensations such as the tingle of carbonation (CO₂), the heat of hot pepper (capsaicin) or the cooling effect of menthol are free nerve

endings distributed throughout the oral and nasal cavity. Changes in the amount or composition of mucus and saliva due to dehydration, disease or medication can reduce or increase access of stimuli to these nerve endings resulting in altered pain sensitivity. With aging, dehydration becomes a greater risk and this can lead to keratinization of the epithelium which will prevent access of stimuli to the nerve endings reducing pain sensitivity. However, infections or lesions can cause inflammation and hypersensitivity.

Periodontal disease can render the oral cavity hypersensitive, reduce chewing ability and produce unpleasant tastes and odors. These unexpected perceptions can interact or interfere with food flavors to cause unfamiliar tastes and qualities that are difficult to describe. Studies of human subjects have found a slight decline with advancing age in the oral sensation of irritation. Sensitivity to low concentrations of irritants in the nasal cavity appears to be unaffected by aging, but suprathreshold intensity perception is lower than in younger subjects (Stevens and Cain, 1986). A common but little understood phenomenon is

burning mouth syndrome, which is seen most commonly in women over the age of 60, and is characterized by a persistent, painful burning sensation in the oral cavity (Miyamoto and Ziccardi, 1998). Eating typically alleviates the pain, but patients do not usually become overweight. Patients may also

experience depression and anxiety that could be either predisposing factors or consequences of the chronic pain. Physiological causes are found in about 1/3 of patients, but these are often multifactorial, such as candidiasis, xerostomia and allergy (Guttman, 2000). However, in patients where such causes are found, the prognosis is good when the underlying problem is treated. The etiology in many cases, however, is unknown, and a wide range of therapeutic regimens have been tried without consistent success. In one study, 16 of 25 patients treated with clonazepam

exhibited significant improvement that persisted following cessation of the drug (Woda et al., 1998). Other treatments with limited success have included vitamin regimens, antidepressants or anxiolytics and cognitive behavioral therapy (Grinspan et al., 1995; Zakrzewska et al., 2001). Zinc deficiency, reactions to dental fillings (e.g. mercury or gold) and allergies have all been investigated as causative factors, but data do not support their involvement.

Taste sensitivity diminishes with age for some, but not all qualities in humans (for review see Mojet et al., 2001). Salt sensitivity declines slightly

with age in humans, and higher concentrations are perceived as more pleasant than they are for younger subjects. In a study comparing detection thresholds for salt in water vs. tomato sauce, Stevens et al (1991) found that while salt sensitivity for both young and elderly subjects was poorer in the tomato sauce base, elderly subjects required twice as much salt as younger subjects did in order to perceive saltiness. However, at medium to high concentrations, taste intensity ratings were similar between young (18-30 yrs) and elderly (67-89 yrs) subjects. Interestingly, middle-aged subjects (35-56 yrs) performed no better than the elderly in this study. Sour perception appears to be unaffected by age, so in foods containing both a sour and a salty component, the sourness will appear more intense. Bitter perception is more sensitive to aging, but all bitter compounds are not affected equally. For instance, sensitivity to quinine diminishes significantly with age, while sensitivity to the bitter compound urea, is not affected (Cowart et al., 1994). Perception of sweet tastes is less affected by aging, although certain compounds may appear qualitatively different due to bitter, salty or sour components (e.g. the bitter aftertaste of aspartame may be less noticeable).

Olfaction. What is often heard complaint that 'things don't taste right' reported by the elderly is generally a change in the odor perception. The ability to detect, discriminate and identify odors is most sensitive to age-related impairment. Age-related losses in olfaction result from changes at both the anatomical and the molecular level. Anatomical studies demonstrate non-uniform changes in the density of receptor neurons, immature neurons and proliferating basal cells. Fortunately, it appears that a significant percentage of the olfactory epithelium can be lost or damaged with minimal impact on olfactory sensitivity. This is likely to be due to the ability of each receptor to interact with a distinct but overlapping set of odorant stimuli (Malnic et

(continued on page 13)

Perception of sweet tastes is less affected by aging, although certain compounds may appear qualitatively different due to bitter, salty or sour components (e.g. the bitter aftertaste of aspartame may be less noticeable).

Age-related Changes in Chemosensation

(continued from page 12)

al., 1999). Reduced ability to identify and discriminate odors may be due to changes at the level of the receptor cell. Evidence from our laboratory suggests that with age, more olfactory receptor cells are broadly tuned, responding to a larger number of different odorants than in younger subjects (Rawson et al., 1998). This could account for the poorer odor discrimination and more rapid adaptation reported in sensory studies (Stevens et al., 1989). The decrease in olfactory sensitivity seen with aging in humans begins sooner in males than in females, and it is possible that estrogen plays a protective role, as the rate of decline in post-menopausal females is similar to that of males about 10 years earlier (Doty et al., 1984). Studies to evaluate the impact of estrogen replacement are needed.

While some degree of loss in olfactory sensitivity in general has been documented extensively using both psychophysical and physiological (e.g. fMRI, Suzuki et al., 2001) methods, there is considerable overlap between younger and older subjects, and it is possible to retain olfactory function into very old age (Elsner et al, 2001). There is also evidence that age-associated olfactory loss is not uniform across odors (Wysocki and Pelchat, 1993; Cain and Stevens, 1989; Enns and Hornung, 1988). In the largest dataset ever obtained, results for 1.2 million respondents to a six odor scratch-and-sniff test in the National Geographic were analyzed (Wysocki and Pelchat, 1993). This dataset revealed significant age-related declines in sensitivity for all odors, but the shape of the decline varied among odors. For those respondents able to detect the odors at all, the ability to detect the musky odor androstenone declined steadily from the 2nd through the 10th decade of life, while ability to detect the rose odor phenylethylalcohol did not show a decline until the 7th-8th decade. In another study, sensitivity to butanol was found to decrease with age, while sensitivity to isoamylacetate (banana

odor) appeared to be more stable across age (Kimbrell and Furchtgott, 1963). In a recent study, subjects 60-69 yrs were on average, ten-fold less sensitive to ethyl vanillin than were subjects 20-29 yrs, but only three-fold less sensitive to phenylethylalcohol (rose) or eugenol (clove) (Pelchat, 2001). As most studies use only a few different odors, it is difficult to determine whether sensitivity by the elderly to certain classes of odors is more likely to be retained than others. The result, however, is that perception of complex odors such as a food flavor will not only be less intense, but will also be qualitatively different.

While detection sensitivity relies directly on the function of peripheral receptors, identification and discrimination of odors relies to a greater extent on processes occurring within the central nervous system. With age, the ability to identify and discriminate odors also declines, and this can be a reflection of degeneration within the central nervous system. In particular, odor identification has been found to be a very sensitive early indicator of Alzheimer's disease (Murphy et al.). Experience may also help to maintain this aspect of chemosensation—a study of aging wine tasters found that although detection sensitivity was no better than controls, ability to identify odors (not associated with wine) was better among the wine-tasters, for whom this task was used often, than for age- and education-matched controls (Nordin et al). Whether this effect was specific

for odor identification or carried over to other types of cognitive/sensory tasks was not determined. However, all data to date strongly suggest that the “use it or lose it” principle applies to a variety of brain functions (REF), and it is not unlikely that the same holds true for chemosensation as well.

Impact on behavior and well-being. Changes in flavor perception can and do impact on food selection and the development of preferences and aversions. Reduced olfactory sensitivity has been shown to result in poorer association between an odor and an adverse consequence (such as nausea) in both humans and experimental animals (Pelchat, In Press). In

addition, elderly subjects with a poor sense of smell are less sensitive to dietary monotony than younger subjects (Pelchat and Schaefer, 2000). In this study, subjects were placed on a nutritionally complete monotonous diet for 12 days and reported both cravings and hedonic response (pleasantness) to the diet at several periods before, during and after the diet manipulation. Younger subjects reported a higher number of cravings and a low liking for the diet throughout the monotony

In this study, subjects were placed on a nutritionally complete monotonous diet for 12 days and reported both cravings and hedonic response (pleasantness) to the diet at several periods before, during and after the diet manipulation.

period, while older subjects were insensitive to the monotony, based on either hedonic response (liking) or reported number of cravings. These findings are consistent with the

(continued on page 14)

Age-related Changes in Chemosensation

(continued from page 13)

observation that food selection tends to become less varied with age, which can contribute to increased nutritional risk. Reduced ability to detect the aroma of food can also cause a particular taste to seem more intense—a complaint that food “tastes too salty” or “doesn’t taste right” is linked to an inability to detect the volatile flavors (odors) leading to increased awareness of the non-volatile components (tastes) of food that may be better detected by the elderly.

Management Strategies

The fact that changes are not uniform across sensory modalities provides a further challenge in that the problem becomes one not only of reduced intensity, but of a shift in the overall sensory profile of food flavors and complex aromas as well. Poor sensitivity to hazardous odors or irritants can lead to consumption of spoiled food, unawareness of smoke or exposures to toxic chemicals. While chemosensory losses due to infections, medications or inflammation may resolve upon recovery or changes in medication status, there is no known therapeutic regimen to improve chemosensation in the otherwise healthy elderly. However, there are strategies that can help to compensate for these sensory impairments.

In elderly humans, odors of a given concentration may be perceived as half as intense as they are to younger subjects, so flavor supplementation of foods will be needed to produce an equivalent intensity. For instance, using concentrated meat extracts in soup broths or adding tiny amounts of highly aromatic ingredients such as wine or butter as ‘finishes’ just before serving will increase the odor impact much more than adding these ingredients during cooking. Supplementing flavorings in foods has improved food intake and expressed preferences in the elderly and in patient populations with smell losses (Mathey et al., 2001; Schiffman and Warwick, 1993). Recent studies have

demonstrated an interaction between taste and smell such that certain odors are actually better detected in the presence of complementary tastes. For instance, subjects were more sensitive to the odor benzaldehyde (almond) when they held a sweet solution in their mouth, even if the sweet solution was at an undetectable concentration, than when they had only water or no tastant in their mouth (Dalton et al., 2000). This indicates that each sensory modality may enhance each other such that stimulating multiple chemical senses has a greater effect than simply increasing the concentration of a single sensory quality. In some patients, incorporating ingredients such as chili pepper, clove or ginger into appropriate foods may help to add sensory variety and improve palatability by stimulating the third chemical sense. Due to individual variations in sensory changes, individualized strategies for improving food palatability are needed. As the volatility of odors increases with increasing temperature, serving hot foods at the appropriate temperature will increase the likelihood of the odors getting to the receptors in the roof of the nose and, therefore, maximize the intensity of the volatile aromas. The pleasure of eating is nearly universally acknowledged, and keeping these considerations and ideas in mind can help to insure continued enjoyment of one of life’s great pleasures. For individuals with special dietary needs, these considerations are even more important to insure compliance, and while creativity may be needed to meet medical, sensory and economic criteria, it can be accomplished with a little effort and planning.

Environmental considerations are also important in developing strategies for coping with sensory loss. Smoke detectors are of prime importance in this population, and detectors sensitive to natural gas are also available. Given that a substantial percentage of the elderly are insensitive to the mercaptans used to scent natural gas, this added protective device should be considered seriously. Bottles of cleansers or caustic chemicals should be clearly and brightly labeled in large letters with appropriate symbols (e.g.

skull and crossed bones) in order to prevent accidental exposure from a container that is improperly closed or leaking and to reduce the likelihood of mistaking a toxic chemical with an innocuous one. Foods stored in the refrigerator should be clearly labeled with the date and a strict schedule of removal should be adhered to so that spoiled food is not eaten when one’s sense of smell does not detect the spoilage.

In the future, it is likely that robotic detectors will be available for home use for the detection of everything from rancid butter to rotten potatoes, and these ‘electronic noses’ are under development for a range of applications. In addition, there is hope for prevention of these changes through studies aimed at identifying risk factors that increase likelihood of chemosensory loss and isolating dietary or hormonal factors (e.g. vitamin A; Yee and Rawson, 2000) involved in maintenance of healthy sensory tissue throughout life. In the meantime, awareness that age-related losses in these chemosensory systems are real and can significantly detract from one’s quality of life can help the geriatric patient develop coping strategies and avoid health hazards. The most common complaint among patients coming to our chemosensory clinical research center for evaluation is the frustration of not being taken seriously by their health care professionals. When confronted with a patient’s concerns about loss of chemosensory function, the geriatric care manager’s best approach will be to first: provide assistance in contacting appropriate physicians or specialists for medical evaluation (e.g., otolaryngologist, dentist, neurologist, endocrinologist) and second: to provide assistance in helping patients develop strategies to compensate for their loss to insure adequate nutritional status and environmental safety.

Dr. Rawson is an associate member at the Monell Chemical Senses Center, a non-profit research institute in Philadelphia, PA dedicated to research in the fields of taste, smell,

(continued on page 15)

Age-related Changes in Chemosensation

(continued from page 14)

chemical irritation and nutrition. She holds a M.Sc. in Nutrition, a Ph.D in Biology from the University of Pennsylvania, and worked as a Research Nutritionist at Campbell's Soup Co.. Her current research programs in mammalian olfaction focus on the effects of nutrition, aging and disease on the anatomy and physiology of the olfactory system. Her work with human olfaction is part of the NIH-funded Monell-Jefferson Chemosensory Clinical Research Center where human olfactory function is assessed at both the perceptual and cellular levels.

References

- Abu-Hamdan, D.K., Desai, H., Sondheimer, J. "Taste Acuity and Zinc Metabolism in Captopril-treated Hypertensive Male Patients". *American Journal of Hypertension*, Vol. 1 (1988); 303-8S.
- Busenbark, K.L., Huber, S.J., Greer, G., Pahwa, R., Koller, W.C. "Olfactory Function in Essential Tremor". *Neurology*, Vol. 42, No. 8 (Aug. 1992); 1631-2.
- Cain, W. and Stevens, J.D. "Uniformity of Olfactory Loss in Aging." *Annals of the New York Academy of Science*, Vol. 561, (1989); 29-38.
- Chodosh, S., Lakshminarayan, S., Swarz, H., Breisch, S. "Efficacy and Safety of a Ten-day Course of 400 or 600 Milligrams of Grepafloxacin Once Daily for Treatment of Acute Bacterial Exacerbations of Chronic Bronchitis: Comparison with a Ten-day Course of 500 Milligrams of Ciprofloxacin Twice Daily". *Antimicrobial Agents in Chemotherapy*, Vol. 42, No. 1, (1998); 114-20.
- Cowart, B.J., Yokomukai, Y. and Beauchamp, G.K. "Bitter Taste in Aging: Compound-specific Decline in Sensitivity". *Physiology and Behavior*, Vol. 56 (1994); 1237-41.
- Dalton, P., Doolittle, N., Nagata, H., Breslin, P.A. "The Merging of the Senses: Integration of Subthreshold Taste and Smell". *Nature Neuroscience*, Vol. 3, No. 5 (2000); 431-2.
- Doty, R.L., Golbe, L.I., McKeown, D.A., Stern, M.B., Lehrach, C.M., Crawford, D. "Olfactory Testing Differentiates Between Progressive Supranuclear Palsy and Idiopathic Parkinson's Disease". *Neurology*, Vol. 43, No. 5 (1993); 962-5.
- Doty, R.L., Shaman, P., Applebaum, S.L., Giberson, R., Sikorski, L. and Rosenberg, L. "Smell Identification Ability: Changes with Age." *Science*, Vol. 22 (1984); 1441-3.
- Elsner, R.J. "Odor Threshold, Recognition, Discrimination and Identification in Centenarians". *Archives of Gerontology and Geriatrics*, Vol. 33, No. 1 (2001); 81-94.
- Elsner, R.J. "Environment and Medication Use Influence Olfactory Abilities of Older Adults". *Journal of Nutrition in Health and Aging*, Vol. 5, No. 1 (2001); 5-10.
- Enns, M.P. and Hornung, D.E. "Comparisons of the Estimates of Smell, Taste and Overall Intensity in Young and Elderly People". *Chemical Senses*, Vol. 13 (1988); 131-9.
- Grinspan, D., Fernandez Blanco, G., Allevato, M.A., and Stengel, F.M. "Burning Mouth Syndrome". *International Journal of Dermatology*, Vol. 34, No. 7 (1995); 483-7.
- Guttman, C. "Burning Mouth Syndrome is Multifactorial, Treatable". *Dermatology Times*, April 1-2 (2000).
- Miyamoto, S.A. and Ziccardi, V.B. "Burning Mouth Syndrome". *Mount Sinai Journal of Medicine*, Vol. 65 (Oct./Nov. 1998); 343-7.
- Kimbrell, G. and Furchtgott, E.F. "The Effects of Aging on Olfactory Threshold." *Journal of Gerontology*, Vol. 18 (1961); 364-5.
- Malnic, B., Hirono, J., Sato, T., & Buck, L.B. "Combinatorial Receptor Codes for Odors." *Cell*, Vol. 96 (1999); 713-23.
- Mathey, M.F., Siebelink, E., de Graaf, C., Van Staveren, W.A. "Flavor Enhancement of Food Improves Dietary Intake and Nutritional Status of Elderly Nursing Home Residents". *Journal of Gerontology A Biological Science and Medical Science*, Vol. 56, No. 4 (April, 2001); M200-5.
- McConnell, R.J., Menendez, C.E., Smith, F.R., Henkin, R.I., Rivlin, R.S. "Defects of Taste and Smell in Patients with Hypothyroidism". *American Journal of Medicine*, Vol. 59, No. 3 (1975); 354-64.
- Mojet, J., Christ-Hazellhor, E. and Heidema, J. "Taste Perception with Age: Generic or Specific Losses in Threshold Sensitivity to the Five Basic Tastes." *Chemical Senses*, Vol. 26 (2001); 845-60.
- Morgan, C.D., Nordin, S. and Murphy, C. "Odor Identification as An Early Marker for Alzheimer's Disease: Impact of Lexical Functioning and Detection Sensitivity". *Journal of Clinical and Experimental Neuropsychology*, Vol. 17, No. 5 (1995); 793-803.
- Pelchat, M.L., "Is Age-Related Olfactory Loss Uniform Across Odorants?" In: *Compendium of Olfactory Research*, (2001); Edited by Lorig, T.S., New York: Olfactory Research Fund.
- Pelchat, M.L. "Acquired Food Rejections in Young and Elderly Adults". *Appetite*, (in press).
- Pelchat, M.L. and Schaefer, S. "Dietary Monotony and Food Cravings in Young and Elderly Adults." *Physiology & Behavior*, Vol. 68 (2000); 353-9.
- Pelchat, M.L. "Food Cravings in Young and Elderly Adults." *Appetite*, Vol. 28 (1997); 103-13.
- Rawson, N. E., Gomez, G., Cowart, B., and Restrepo, D. "The Use of Olfactory Receptor Neurons (ORNs) from Biopsies to Study Changes in Aging and Neurodegenerative Diseases". *Annals of the New York Academy of Sciences*, Vol. 855 (1998); 701-7.
- Schiffman, S.S. and Warwick, Z.S. "Effect of Flavor Enhancement of Foods for the Elderly on Nutritional Status: Food Intake, Biochemical Indices, and Anthropometric Measures." *Physiology & Behavior*, vol. 53, no. 2 (1993); 395-402.
- Stevens, J.C, Cain, W.S, Demarque, A, Ruthruff, A.M. "On the discrimination of missing ingredients: aging and salt flavor." *Appetite*, vol. 16, no. 2 (Apr. 1991); 129-40.
- Stevens, J.C., Cain, W.S., Schiet, F.T., Oatley, M.W. "Olfactory Adaptation and Recovery in Old Age." *Perception*, Vol. 18, No. 2 (1989); 265-76.
- Suzuki Y, Critchley H.D., Suckling, J., Fukuda, R., Williams, S.C., Andrew, C., Howard, R., Ouldrred, E., Bryant, C., Swift, C.G., Jackson, S.H. "Functional Magnetic Resonance Imaging of Odor Identification: the Effect of Aging." *Journal of Gerontology A Biological Science and Medical Science*, Vol. 56, No. 12 (2001); M756-60.
- Woda, A., Navez, M.L., Picard, P., Gremeau, C., and Pichard-Leandri, E. "A Possible Therapeutic Solution for Stomatodynia (Burning Mouth Syndrome)." *Journal of Orofacial Pain*, Vol. 12, No. 4 (1998); 272-8.
- Wysocki, C.J. and Pelchat, M. "The Effects of Aging on the Human Sense of Smell and its Relationship to Food-choice." *Critical Reviews in Food Science and Nutrition*, Vol. 33 (1993); 63-82.
- Yee, K.K. and Rawson, N.E. "Retinoic Acid Enhances the Rate of Olfactory Recovery After Olfactory Nerve Transection." *Developmental Brain Research*, Vol. 124 (2000); 129-132.
- Zakrzewska, J.M., Glenny, A.M. and Forsell, H. (2001). "Interventions for the Treatment of Burning Mouth Syndrome (Cochrane Review)." *Cochrane Database Syst Rev*, 3: D002779.
- Zervakis, J. and Schiffman, S.S. "Adverse Taste Side Effects of Cardiovascular Medications." *Geriatric Times*, Vol. 3, No. 1 (2002); 1-7.

Note: Additional information on chemosensation and chemosensory loss may be found at: www.achems.org

Acknowledgement: The author is funded in part by NIH DC00214.

Maximizing Independence: Reducing/Preventing Falls

By Roberta A. Newton, PT, Ph.D.

Falls and their physical and psychological consequences can be reduced, if not prevented through a conscious effort on the part of geriatric care managers and other health care professionals working together and with caregivers. Everyone, regardless of age falls; however, the seriousness of an unintentional fall and subsequent injury in the older adult is greater than in younger people. A minor fall in a frail older adult is more serious than in an active older adult.

The fear of falling in frail or active older adults can result in a decline in activity, and loss of self-confidence in addition to an increased risk for future falls and a reduced quality of life. The purposes of this article are to provide an overview of risk factors for falls, specifically balance dysfunction; and to provide an overview of fall prevention measures.

Balance

What does a complaint of feeling “off-balance” indicate? The complaint could refer to an interaction of prescribed or over the counter medications and herbal remedies; an underlying cardiovascular problem; or to age or disease-related declines in the balance system. Balance instability is a marker of fall risk and frailty.

Balance can be defined as the ability of the person to remain in equilibrium and to orient to gravity the support surface and objects in the environment when performing routine activities of daily living. Balance abilities are both static (standing or sitting still) and dynamic (moving in the environment). Anticipatory balance responses are triggered and precede movements such as raising the arm up to comb the hair. These types of automatic responses enable the person to perform activities without losing balance. Older adults

with balance dysfunction or age related declines in balance, might have to hold on to the sink in order to perform this simple task. Holding onto an object or a person is an adaptation that is used by individuals with balance instability to avoid falling. This is an excellent strategy providing the object or person is stable.

Compensatory balance responses occur in response to an external event, such as being pushed, or tripping over an obstacle. Compensatory balance responses are automatic, helping the individual maintain or regain balance following the perturbing event.

Balance results from the integration of sensory information, the development of a balance response by the brain, and the execution of that balance response by the musculo-skeletal system. The integration of the visual, vestibular (inner ear) and somatosensory systems is necessary for the individual to perceive and interact with the environment. The somatosensory system of the legs includes cutaneous receptors located in the feet and proprioceptors located in the joints. Proprioceptors located in the neck and trunk also provide important information for balance. Current environment input and memory of similar situations occurring in the past are integrated in the brain. The resultant postural or balance response is produced and executed by the muscles in order to maintain the person in an upright position or to have the person regain balance. A balance response occurs within 90 milliseconds from the time of an external perturbation. Slowing of the nervous system conducting capabilities, weak muscles or poor posture resulting from osteoporosis, a nervous system disease or even inactivity can result in balance instability and falls even if the sensory information and the balance response that is devel-

oped is appropriate.

Many age-related sensory changes occur gradually and older adults are able to compensate until a critical threshold is reached, resulting in balance instability. Gradual sensory declines also occur with disease. Reduced somatosensory or peripheral sensation associated with diabetic neuropathy may not, by itself, result in balance dysfunction. However, peripheral neuropathy in patients with Alzheimer’s disease is a cause of falls.

Older adults tend to place greater reliance on the visual system to compensate for age or disease-related reductions in the vestibular or somatosensory system. In situations where minimal or misleading spatial information is provided by the visual system, the resultant balance response may be inappropriate and may result in a fall. Older adults who are known fallers tend to be more field-dependent (orienting to environmental cues) than older adults who are non-fallers.

The auditory and olfactory senses are also important when considering balance instability and falls. These senses alert the individual to potential danger, a loud sound or the smell of something burning. If these senses demonstrate age-related declines, then these warning systems do not function optimally. In potentially harmful situations, the older adult may have to hurry to avoid the harmful situation. Moving quicker than the preferred or typical movement speed for that individual is also a fall risk factors.

Etiology of Falls

Falls are defined as an unintentional event that results in the older adult coming to rest on the ground or on another lower level (Kellogg

(continued on page 17)

Maximizing Independence: Reducing/ Preventing Falls

(continued from page 16)

International Work Group). Therefore falling against the wall or falling into a chair may be considered a fall). Falls can occur when the older adult stands quietly, moves from one place to another (i.e. bed to chair), interacts with the environment when performing activities of daily living, or is pushed or trips.

Falls are rarely the result of a single entity, but are generally the result of an interaction of several factors that are from intrinsic, extrinsic, or environment sources. Not all risk factors have been identified or thoroughly examined. An individual may have one risk factor but in combination with other intrinsic, extrinsic or environmental factors, that particular risk factor becomes significant. Tinetti and colleagues (1988) demonstrated the percentage of community dwelling older adults falling increased from 27 percent with no or one risk factor to 78percent with four or more risk factors. Robbins and colleagues developed a predictive model using three risk factors: hip muscle weakness, unstable balance, and taking more than four medications (1989). Community-dwelling older adults who demonstrated all three risk factors had

100percent risk of falling within a year.

Other internal risk factors that have a strong association with falling include: cognitive impairment, age (greater than 80), female, stroke or Parkinson's disease, impaired gait, impaired ability in standing up and transfers, and reduced visual contrast sensitivity. Inactivity is also a risk factor. Approximately 40 percent of adults do not engage in leisure time physical activity. Limitation in activities of daily living (ADLs) is also

strongly associated with falling.

Fear of falling is a recognized risk factor because fear leads to inactivity and loss of confidence. Not only is a fear of falling a concern of the older adult but also the fear of the inability to get up once a fall has occurred. Approximately 50 percent of older adults who fall need assistance to get up. Individuals who have fallen and experience a long-lie, the inability to get up and remaining on the floor for over an hour, are more susceptible to declines in health, pressure sores, dehydration and pneumonia.

Extrinsic factors associated with falls include: polypharmacy defined as taking four or more prescription medications, outdated eyeglass prescription, footwear, and the use of assistive devices. Individuals with cognitive impairments may have greater difficulty navigating with a cane because attention is also directed toward the assistive device. For example the older adult may be looking at the cane and thinking "Am I using the cane in the correct hand?" rather

occur. When the polished floor is encountered, the older adult may believe the floor is wet or slippery and begin to walk slower with a crouched position (lowering the center of gravity). This change in movement may be sufficient to cause a fall.

Incidence rate of falls in the hospital, or long-term care setting is a key concern. Incidence rates in these setting can range from 0.6 to 3.6 falls per person annually. In comparison, incidence rates for the community range from 0.2 to 0.8 per person annually. Approximately 60percent of older adults fall during the first year of residency in the nursing home and approximately 41percent fall during the first week of hospital stay. One of the most important predictors of falls among residents in long-term care settings is a history of falls. Other risk factors include use of an assistive device (cane or walker), reduction in activities of daily living, balance dysfunctions and unsteady gait, cognitive and neurologic impairment, greater than 85 years, wandering behavior.

An important concept is life space. The environment is unfamiliar to an older adult who is moved into the hospital or long-term care setting. Time is needed to develop a spatial map of the environment and how to navigate in the environment. Developing

such a spatial or cognitive map may be slowed in the older adult who has an acute episode requiring care, a change in medications, impaired cognition, etc.

Statistics related to fall injury are disconcerting. Up to 50 percent of older adults have more than one fall per year. Of these who fall 25-40 percent restrict their activity, which is a fall risk factor. Although only 1-2 percent result in hip fractures, 33

(continued on page 18)

Environmental factors also present risk factors for falls and are grouped according to lighting, condition of the support surface, and location of objects in the environment. Lack of safety equipment in the bath also poses fall risk.

than scanning the environment for obstacles. Shoes that have soles that are too grippy or too slippery also cause stumbles and slips.

Environmental factors also present risk factors for falls and are grouped according to lighting, condition of the support surface, and location of objects in the environment. Lack of safety equipment in the bath also poses fall risk. Shiny floors, particularly with sun-light shining on them are prime locations for falls to

Maximizing Independence: Reducing/ Preventing Falls

(continued from page 17)

percent of those hospitalized will die within a year of falling, 50 percent are unable to return home or to independent living, and hip fractures alone account for 3 billion dollars in direct medical costs. Not only is there a direct medical cost associated with falls, but also the psychological, social and financial costs that burden the older adult, their caregiver and the family.

Assessments and Reduction/Prevention

The goal is to reduce the risk for falls and injuries associated with them. Several principles need to be considered when assessing falls and developing fall reduction/prevention programs. These include but are not limited to the eight principles outlined below:

- The cause of a fall is generally multi-factorial. What causes a fall in one person does not necessarily cause a fall in another person.
- The risk of falls increases with the number of physiologic risk factors, functional impairments, and number of medications.
- Falls can lead to the fear of falling and the fear of the inability to get up once a fall has occurred.
- Inactivity is a fall risk factor. Inactivity ranges from prolonged bed rest to an inactive lifestyle. Inactivity includes both physical and mental inactivity.
- Some fall risk factors can be modifiable; others are not.
- A fall prevention program includes a screening component, an education component and an activity component.
- An older adult may be more likely to modify the home environment than make the recommended changes in his/her lifestyle.

- Fall prevention programs should address the social, cultural, financial, and lifestyles of the participants.

A comprehensive assessment is needed for high-risk groups, including those older adults who are recurrent fallers, or have comorbidities that identify them as fallers or potential fallers. A comprehensive assessment identifies fall risk factors that are modifiable, that is, muscle weakness, visual impairments, gait and balance and the number of medications. The assessment also identifies those risk factors that are not modifiable. These include age, neurologic conditions such as hemiplegia, cardiopulmonary pathology and visual conditions that are not corrected by lenses.

An assessment of the functional level or activity level as well as fall history of the individual are necessary components of an assessment. The caregiver or health care professional can record important information at the time of the fall. Such information includes the date, time, and activity at the time of the fall, symptoms associated with the fall, injuries and if the person needed assistance getting up. When a fall has occurred, the patient should be referred to his/her physician or to the emergency room. Even a minor fall such as sitting down hard in a chair in a very frail older adult can result in a head injury or other serious complications that need to be assessed. Once assessed for medical consequences, a physician may refer the older adult to another health care professional for further evaluation to determine the level of independence of the individual.

An assessment of the functional level or activity level as well as fall history of the individual are necessary components of an assessment. The caregiver or health care professional can record important information at the time of the fall.

The assessment can examine the relationship between impairment, and physical and cognitive performance. It can also identify precipitant causes of functional limitations. Based on the assessment, recommendations are made: fitting the individual with the appropriate assistive device, referral to other health care professionals, or participating in an intervention or prevention program. Depending on the severity of the fall, an older adult may be referred for nursing home admission. Assessment of the caregiver is included to determine if the caregiver, often as old as the patient, is capable of providing the

necessary assistance if the older adult remains at home.

Fall Prevention and Intervention Programs

Geriatric care managers are in the ideal position to design a fall prevention and intervention program. The first question to ask is: Will the older adult make the necessary changes? Factors that need to be addressed include:

- Fear of falling and resultant inactivity.
- An understanding and a willingness to change.
- Matching the goals of the program with the goals of the individual.
- Recommending a modification is aesthetically appealing, affordable, easily obtained, simple to implement. Hip pads may be effective to reduce hip fracture, but they may not be cosmetically appealing.

(continued on page 19)

Maximizing Independence: Reducing/ Preventing Falls

(continued from page 18)

- Acknowledging that environmental change is easier than personal change. Adult children may modify their parent's home to make it more comfortable. However, a living room with deep pile and a compliant under mat will feel uncomfortable to the older person with unsteady balance, and hence the person may not use the room.

Activity or exercise programs that address both strength and endurance have proven benefits, but the type, duration and intensity to reduce falls is not clear. Guidelines for establishing an activity program include:

- Fitness does not outweigh safety.
- High-impact activities or those with high risk for falls are avoided.
- The program is based on the individual's abilities, designed for maximum benefit, and fits into his/her lifestyle.
- The program gradually increases in intensity and movement complexity.

Activity or exercise programs include:

- Aerobics – land-based or water.
- Endurance and flexibility exercises.
- Low impact activities.
- Walking.
- Tai Chi. Tai Chi can be used for a balance and has cardiovascular and stress reduction benefits. Further research is necessary to determine if Tai Chi is the preferred form of activity for balance and fall reduction.

Activity programs for older adults who are more homebound or restricted can be designed for groups in order to maximize the social benefits. Seated

(continued on page 20)

FALL RISK CHECKLIST¹

Previous falls (past 3 months)

Defined as an event where the person unintentionally comes to rest on the ground or other lower level- chair, bed, toilet, bathtub, stairs, etc.

Near falls

Defined as an event where the person almost falls- loses balance but is able to catch him/herself by holding on to walls, furnishings, and other environmental features for support

Poor vision

- Cataracts
- Macular degeneration
- Glaucoma
- Wears glasses

Lower extremity weakness

- Arthritis
- Muscle weakness
- Impaired sensory function
- Foot problems

Gait/balance disorder

- Stroke
- Parkinson's Disease
- Uses cane/walker

Bladder dysfunction

- Nocturia
- Urinary incontinence
- Frequency

Cognitive dysfunction

- Dementia
- Depression
- Anxiety
- Fear of falling

Medications

- >4 drugs
- Diuretics
- Antihypertensives
- Sedatives
- Psychotropics

FALL REPORTING SHEET²

There are many causes of falls. In order to prevent (or treat) falls, we need to know as much about the fall as possible. Each time you fall write down the date and time and where you fell (location). What were you doing at the time of the fall (activity)? How did you feel at the time you fell (symptoms)? How did you feel after you fell (injuries) and did you need help to get up (assistance)?

Date	Time	Location	Activity	Symptoms	Injury	Assistance

¹ Adapted from Tideiksaar, ² Newton, 5/2000



National Association of Professional Geriatric Care Managers

1604 North Country Club Road
Tucson, AZ 85716-3102

PRESORTED
STANDARD
US POSTAGE
PAID
Tucson AZ
Permit NO 3178

Maximizing Independence: Reducing/ Preventing Falls

(continued from page 19)

and standing activities, including strengthening and flexibility exercises set to music, modifications of tai chi, chair rises, and walking are a few recommendations. Such activity may also improve endurance and alertness.

Educational programming includes risk factors associated with falls, how to get up once a fall has occurred, topics such as osteoporosis and nutrition, medication review including herbals, modification of the home environment, foot inspection and proper foot ware. Loose fitting or long clothing is to be avoided as they may become entangled in the legs or be stepped on. Shoes of proper fit include slip resistant soles, good fitting shoebox and a heel back. Shoes and slippers with no heel back should be avoided. Daily washing of eye-glasses is also important for clear vision. Instruction for appropriate use of mobility aids may be included. Short, interactive educational sessions tend to be more effective.

Environmental modifications are similar regardless of the location of residency. These include inspection of

lighting, floors, stairways, and location of obstacles in the environment. Floors and stairs are free of clutter and obstacles. Furniture is arranged so that it does not block passageways or presents as a fall hazard. For example, a coffee table with a clear glass top is a fall hazard because it produces a visual conflict. Edges of steps need to be clearly marked, particularly if the last step is the same color and texture as the landing. Patterned rugs are also to be avoided as they create visual clutter. Modifications may also include low height beds, appropriate height chairs and toilet seats, light switches and personal effects.

Summary

Older adults and their caregivers can benefit from a multi-factorial intervention that includes an activity program, environmental modifications, and education. Geriatric Care Managers can become advocates to reduce the number of falls and unintentional injuries. We can challenge the myths of old age and work with older adults to reduce their risk of falling and perhaps improve their quality of life and help them maximize their level of independence.

Roberta A. Newton, Ph.D. is professor and director of the Institute on Aging at Temple University in Philadelphia, PA. Dr. Newton's research program and community service pertains to fall risk identification and balance abilities and to develop effective interventions for older adults primarily from culturally diverse backgrounds. She developed the "Multi-Directional Reach Test" to test balance. As part of her Fall Prevention Program, Dr Newton developed fall prevention brochures translated into eight different languages, a Fall Prevention Manual, a videotape on Assessment of Balance Abilities in Older Adults and website, www.temple.edu/older_adult. She is a well-recognized leader and lecturer in the area of fall prevention at the national and international level and had published extensively.

References

Center for Disease Control:
www.cdc.gov.

Fall Prevention website by Dr. Roberta Newton: www.temple.edu/older_adult.

Lord S.R., Sherrington C., Menz H.B. *Falls in Older People*. Cambridge University Press, United Kingdom, 2001.

Tideiksaar, Rein. *Falling in Old Age: Prevention and Management*, 2nd ed. Springer Publishing Co., New York, NY, 1997.