



Cognition

[Is it Alzheimer's or just signs of aging?](#) Information about the ten warning signs of dementia

University of Arizona: [What is Dementia?](#)

Research and Review Articles on Cognition

Harada CN, Natelson Love MC, Triebel K. [Normal Cognitive Aging](#). *Clinics in geriatric medicine*. 2013;29(4):737-752. doi:10.1016/j.cger.2013.07.002.

The normal aging process is associated with declines in certain cognitive abilities, such as processing speed and some aspects of memory, language, visuospatial function, and executive function. Although these declines are as yet not well understood, promising developments in neurology research have identified declines in volume of gray and white matter and changes in white matter function that may contribute to observed cognitive changes with aging. These changes are small and should not result in impairment in function; nonetheless, driving and certain other activities may be compromised, and it is important to detect safety issues early. Participation in certain activities, building cognitive reserve, and engaging in cognitive retraining are all potential approaches to achieving successful cognitive aging. The majority of adults older than 65 years will develop neither dementia nor mild cognitive impairment, and more work is needed to better understand normal cognitive aging so that quality of life for these individuals can be maximized.

Hearing

[Health in Aging on Hearing Loss](#)

Research and Review Articles

Huang & Tang, 2010. [Age-related hearing loss or presbycusis](#). *Eur Arch Otorhinolaryngol*. 2010 Aug;267(8):1179-91. doi: 10.1007/s00405-010-1270-7

Aging is a natural consequence of a society developing process. Although many adults retain good hearing as they aging, hearing loss related with age-presbycusis which can vary in severity from mild to substantial is common among elderly persons. There are a number of pathophysiological processes underlying age-related changes in the auditory system as well as in the central nervous systems. Many studies have been dedicated to the illustration of risk factors accumulating presbycusis such as heritability, environment factors, medical conditions, free radical (reactive oxygen species, ROS) and damage of mitochondrial DNA. Left untreated, presbycusis can not only lead sufferers to reduced quality of life, isolation, dependence and frustration, but also affect the healthy people around. These can be partly corrected using hearing aids, but it is not enough, more and more strategies of treatment based on the findings associating with presbycusis should be added rather than using single hearing aids. We review here the pathophysiology; heritability, susceptibility genes and

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other risk factors including environmental, medical, especially free radical (ROS) and damage of mitochondrial DNA; and some strategies of treatment, as well as promising rehabilitations associating with presbycusis.

Lee, 2013. [Pathophysiology of age-related hearing loss \(peripheral and central\)](#). Korean Journal of Audiology. 2013;17(2):45-49. doi:10.7874/kja.2013.17.2.45.

Age-related hearing loss (presbycusis) refers to bilaterally symmetrical hearing loss resulting from aging process. Presbycusis is a complex phenomenon characterized by audiometric threshold shift, deterioration in speech-understanding and speech-perception difficulties in noisy environments. Factors contributing to presbycusis include mitochondria DNA mutation, genetic disorders including Ahl, hypertension, diabetes, metabolic disease and other systemic diseases in the intrinsic aspects. Extrinsic factors include noise, ototoxic medication and diet. However, presbycusis may not be related to the intrinsic and extrinsic factors separately. Presbycusis affects not only the physical, cognitive and emotional activities of patients, but also their social functioning. As a result, patients' quality of life deteriorates, compounded by various symptoms including depression, social isolation and lower self-esteem. Presbycusis is classified into six categories, as based on results of audiometric tests and temporal bone pathology, established by Schuknecht (1993): sensory, neural, metabolic or strial, cochlear conductive, mixed and indeterminate types. Among these, metabolic presbycusis is the mainstay of presbycusis types. Age-related changes also develop in the central hearing system. Functional decline of the central auditory system, caused by aging, reduces speech-understanding in noisy background and increase temporal processing deficits in gap-detection measures. This study reviews the literature on the age-related hearing loss.

Lin et al., 2011. [Hearing Loss and Cognition in the Baltimore Longitudinal Study of Aging](#). Neuropsychology. 2011;25(6):763-770. doi:10.1037/a0024238.

Objective: To determine the relationship between hearing loss and cognitive function as assessed with a standardized neurocognitive battery. We hypothesized a priori that greater hearing loss is associated with lower cognitive test scores on tests of memory and executive function. Methods: A cross-sectional cohort of 347 participants ≥ 55 years in the BLSA without mild cognitive impairment or dementia had audiometric and cognitive testing performed in 1990–1994. Hearing loss was defined by an average of hearing thresholds at 0.5, 1, 2, and 4 kHz in the better-hearing ear. Cognitive testing consisted of a standardized neurocognitive battery incorporating tests of mental status, memory, executive function, processing speed, and verbal function. Regression models were used to examine the association between hearing loss and cognition while adjusting for confounders. Results: Greater hearing loss was significantly associated with lower scores on measures of mental status (Mini-Mental State Exam), memory (Free Recall), and executive function (Stroop Mixed, Trail Making B). These results were robust to analyses accounting for potential confounders, non-linear effects of age, and exclusion of individuals with severe hearing loss. The reduction in cognitive performance associated with a 25 dB hearing loss was equivalent to the reduction associated with an age difference of 6.8 years. Conclusion: Hearing loss is independently associated with lower scores on tests of memory and executive function.



Further research examining the longitudinal association of hearing loss with cognitive functioning is needed to confirm these cross-sectional findings.

Metabolism

Hepatic elimination: Overall liver metabolism of many drugs decreases with age. For drugs with decreased hepatic metabolism (such as ibuprofen and morphine), clearance typically decreases 30 to 40%. Theoretically, maintenance drug doses should be decreased this much, but the rate of drug metabolism varies greatly from person to person, and individual dose adjustment is required. After age 30, creatinine clearance decreases an average of 8 mL/min/1.73 m²/decade; however, the age-related decrease varies substantially from person to person. Serum creatinine levels often remain within normal limits despite a decrease in Glomerular Filtration Rate because older adults generally have less muscle mass and are generally less physically active than younger adults and thus produce less creatinine. Maintenance of normal serum creatinine levels can mislead clinicians who assume those levels reflect normal kidney function. Decreases in tubular function with age parallel those in glomerular function.

Metabolism that occurs before a drug reaches systemic circulation decreases by about 1% per year after age 40. Thus, for a given dose, older adults may have higher circulating drug levels. Important examples of drugs with a high risk of toxic effects include nitrates, propranolol, phenobarbital, and nifedipine.

Renal Elimination. One of the most important pharmacokinetic changes associated with aging is decreased renal elimination of drugs. The amount or frequency of dose of drugs that rely heavily on the kidneys should be lower. Because renal function is dynamic, maintenance doses of drugs may need adjustment when patients become ill or dehydrated or have recently recovered from dehydration. Examples would be opioids analgesics and many antibiotics. Clinical implications depend on the extent that renal elimination contributes to total systemic elimination and on the drug's therapeutic index (ratio of maximum tolerated dose to minimum effective dose). Creatinine clearance (measured or estimated using computer programs or a formula, such as Cockcroft-Gault) is used to guide drug dosing.

Pharmacodynamic changes: In older adults, the effects of similar drug concentrations may be greater or smaller than those in younger people. Differences in the effects of similar drug concentrations may be due to changes in drug-receptor interaction, in post-receptor events, or in adaptive homeostatic responses and, among frail patients, are often due to pathologic changes in organs. Older adults are particularly sensitive to anticholinergic drug effects, opioid analgesics and anticoagulants

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Research and Review Articles

Kinirons MT, O'Mahony MS., 2004. [Drug metabolism and ageing.](#)

Important changes in drug metabolism occur with ageing. Age-associated reductions in function of some but not all cytochrome P450 enzymes (CYPs) have been described. Induction and inhibition of CYPs needs to be revisited in light of recent advances. The function and pharmacology of transporters have not yet been examined for an age-related effect. Finally, the concept of frailty is being underpinned by studies documenting a decline in drug metabolism and changes in disposition in frail older people compared with either healthy elderly or the young.

Mangoni AA, Jackson SHD. [Age-related changes in pharmacokinetics and pharmacodynamics: basic principles and practical applications.](#)

Advancing age is characterized by impairment in the function of the many regulatory processes that provide functional integration between cells and organs. Therefore, there may be a failure to maintain homeostasis under conditions of physiological stress. The reduced homeostatic ability affects different regulatory systems in different subjects, thus explaining at least partly the increased interindividual variability occurring as people get older. Important pharmacokinetic and pharmacodynamic changes occur with advancing age. Pharmacokinetic changes include a reduction in renal and hepatic clearance and an increase in volume of distribution of lipid soluble drugs (hence prolongation of elimination half-life) whereas pharmacodynamic changes involve altered (usually increased) sensitivity to several classes of drugs such as anticoagulants, cardiovascular and psychotropic drugs. This review focuses on the main age-related physiological changes affecting different organ systems and their implications for pharmacokinetics and pharmacodynamics of drugs.

Muscle Mass

Research and Review Articles

Graf, C. [Functional decline in hospitalized older adults.](#) Am J Nurs. 2006 Jan;106(1):58-67, quiz 67-8.

In older adults who are hospitalized, functional decline can occur in a matter of days. This devastating outcome is a common result of the older adult's "cascade to dependency," in which normal aging changes--combined with bed rest or immobility--result in irreversible physiologic changes, poor outcomes at discharge, and for many, placement in a nursing home. Routine walking schedules, activities to prevent sensory deprivation, and timely hospital discharge are among the interventions that can help prevent functional decline.

O'Brien, K. [Getting around: a simple office workup to assess patient function.](#) Geriatrics. 1994 Jul;49(7):38-42; quiz 44-5

Normal age-related changes in the musculoskeletal, neurologic, and cardiopulmonary systems result in some decline in function for the older patient. The risk of functional loss is



heightened when disease and/or a sedentary lifestyle accompany the normal age-related changes. Primary care physicians are in a key position to identify older adults who are at risk to lose function. Two indicators of loss of mobility are lower extremity weakness and balance deficits, and these can be assessed in a simple office work-up. Referral to a physical therapist who specializes in movement analysis may be indicated when an older adult shows signs of functional decline.

Odetti et al, 2006. [Advanced Glycation End Products and Bone Loss during Aging](#).

It is well known that bone mass density decreases with age. Age-related bone mass loss is ascribed to several factors. Nonenzymatic glycation has been proposed as a new potential factor in the loss of bone during aging. In this study we evaluated the concentration of pentosidine, an advanced glycation end product, in cortical and trabecular bone and in the plasma of subjects undergoing orthopedic surgery. The relationship between these parameters and a clinical index of osteoporosis was also studied. Samples of bone and plasma of 104 nondiabetic subjects (74 women and 30 men), 72 ± 1 years old, were studied. Pentosidine was determined by HPLC after decalcification and hydrolysis. The radiologic Singh index was evaluated blindly by orthopedic surgeons to provide the degree of osteoporosis. Pentosidine concentration of cortical bone shows a significant exponential increase with age ($r=0.610$, $P < 0.001$). This increase, however, is not seen in the trabecular bone, which is characterized by a large spread in the data. Interestingly the concentration of cortical pentosidine is also related to the Singh score ($r_s=-0.274$, $P < 0.01$). Plasma pentosidine has a significant exponential correlation with age ($r=+0.339$, $P < 0.001$) and a linear correlation with the cortical bone pentosidine ($r=+0.248$, $P < 0.05$). This study demonstrates that pentosidine increases exponentially in cortical bone during aging, and is thus a good biomarker for the degree of bone mass density loss. The trabecular bone concentration of pentosidine is more variable, probably because of the turnover rate and the local environment; plasma pentosidine might provide information on the bone turnover rate.

Resilience

Research and Review Articles

Parisi JM, Rebok GW, Carlson MC, et al. [Can the wisdom of aging be activated and make a difference societally?](#) *Educ Gerontol.* 2009; 35(10): 867–879. doi: 10.1080/03601270902782453

The Experience Corps®, a community-based intergenerational program, was developed to promote the health of older adults while simultaneously addressing unmet social and academic needs in public elementary schools. The model was designed to draw on, and potentially activate, the wisdom of older adults. This paper explores the nature of wisdom-related knowledge and how older adults may apply such knowledge when tutoring and mentoring young children. It also examines the potential for the intergenerational transmission of wisdom from the older adult volunteers to the school children being mentored by them. Developing an understanding of these issues may provide a basis for the

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creation of more extensive wisdom-generating opportunities for both older and younger generations.

Sleep

NIH Senior Health: [Sleep and Aging](#)

University of Arizona: [Sleep in Older Adults](#)

University of Arizona: [Sleep in Older Adults – Pharmacotherapy](#)

Research and Review Articles

Wolkove Elkholy O, Baltzan M, Palayew M. [Sleep and aging: 1. Sleep disorders commonly found in older people](#). CMAJ. 2007 Apr 24;176(9):1299-304.

Aging is associated with several well-described changes in patterns of sleep. Typically, there is a phase advance in the normal circadian sleep cycle: older people tend to go to sleep earlier in the evening but also to wake earlier. They may also wake more frequently during the night and experience fragmented sleep. The prevalence of many sleep disorders increases with age. Insomnia, whether primary or secondary to coexistent illness or medication use, is very common among elderly people. Rapid eye movement (REM) sleep behaviour disorder and narcolepsy, although less common, are frequently not considered for this population. Periodic leg-movement disorder, a frequent cause of interrupted sleep, can be easily diagnosed with electromyography during nocturnal polysomnography. Restless legs syndrome, however, is diagnosed clinically. Snoring is a common sleep-related respiratory disorder; so is obstructive sleep apnea, which is increasingly seen among older people and is significantly associated with cardio- and cerebrovascular disease as well as cognitive impairment.

Wolkove N. et al. Sleep and aging: 1. [Sleep disorders commonly found in older people](#). CMAJ. 2007 Apr 24;176(9):1299-304.

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Taste and Smell

[NIH Senior Health on Smell](#)

Research and Review Articles

Boyce & Shone, 2006. [Effects of ageing on smell and taste](#). Postgraduate Medical Journal. 2006;82(966):239-241. doi:10.1136/pgmj.2005.039453

Disorders of taste and smell commonly present diagnostic dilemmas to the medical profession. This may be secondary to the lack of knowledge and understanding of these conditions. There seems to be a low level of interest in the disorders, when compared with disruption of the other senses such as sight and hearing. Nevertheless, impairment of these senses are common and may be life threatening, especially when they involve the elderly patient. The aetiology of the conditions is widespread, and extend beyond the content of this article. This article will relate only to how the ageing process may contribute to sensory dysfunction. It will focus on how the ageing process changes the normal anatomy and physiology of the senses, how this effects the person's quality of life, and the current management of these conditions.

Vision

[CDC on Vision Health](#)

[NIH Senior Health on Vision Maintenance](#)

[Special Report on Aging and Vision Loss](#), American Foundation for the Blind, 2013

A rapidly increasing proportion of the aging population experiences eye problems that make simple daily tasks difficult or impossible, even when wearing glasses or contact lenses. Severe eye problems are not just a matter of "getting older." The risk of severe eye problems has been found to increase significantly with age, particularly in those over age 65. The Special Report on Aging is intended to draw attention to the disproportionate number of elderly individuals who have vision loss. Perhaps even more alarmingly, the trend is expected to continue to grow significantly as the baby boom generation continues to age. Experts predict that by 2030, rates of vision loss will double along with the country's aging population. According to Prevent Blindness America (2008)¹, the four leading eye diseases affecting older Americans are age-related macular degeneration, cataracts, diabetic retinopathy, and glaucoma. As people age, they are far more likely to have serious age-related eye conditions. Younger people are less inclined to experience the full extent of the

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severity of age-related eye conditions until later in life. Thus, a well documented trend indicates that there is a continuously growing disproportionate number of seniors with severe age-related eye conditions.

[The State of Vision, Aging, and Public Health in America](#), National Center for Chronic Disease Prevention and Health Promotion

Vision impairment is a serious public health concern among older adults, affecting more than 2.9 million people in the United States. This issue brief summarizes the prevalence of vision loss and eye diseases reported by people aged 65 or older, and it provides information about access to eye care, health status, and comorbid conditions among older adults. Data were collected from 19 states that used the Vision Impairment and Access to Eye Care Module (Vision Module) of CDC's Behavioral Risk Factor Surveillance System (BRFSS) during 2006–2008.

Research and Review Articles

Haegerstrom-Portnoy. [Vision in Elders—Summary of Findings of the SKI Study](#). Optom Vis Sci. 2005 Feb;82(2):87-93.

Purpose. To assess a broad range of vision functions in a large older population, to investigate the impact of vision function loss on visual performance measures, and to determine whether low contrast vision measures can predict future loss of visual acuity. **Methods.** A large battery of vision functions, including spatial vision measures, glare tests, visual fields, stereopsis, color vision, temporal sensitivity, reading performance, and face recognition, was administered to a population of 900 community-living older observers (mean age, 75.5 years; SD, 9.3 years; range, 58 to 102 years). A subsample (N=596) was retested on average 4.4 years later (SD, 1.0 years). **Results.** Each vision function is affected differentially by aging. Some functions show little change with age (e.g., standard clinically measured high contrast visual acuity), whereas others demonstrate drastic losses with increasing age. For the oldest age group (>90 years), vision function losses ranged from 1.2 times worse than young observers (critical flicker/fusion frequency) to 18 times worse than young observers (low contrast acuity in glare). Visual performance measures, such as reading or face recognition, are also significantly affected by aging even in those with intact visual acuity. The results demonstrate that low contrast vision functions can successfully predict subsequent loss of high contrast visual acuity. **Conclusion.** Nonstandard vision function measures show significant losses with age that cannot be predicted by standard clinical measures. Measures of low contrast vision function allow clinicians to identify and monitor those patients at high risk for future vision loss

Nini, 2006. [Typography and the Aging Eye: Typeface Legibility for Older Viewers with Vision Problem](#).

The population is rapidly aging and becoming a larger share of the marketplace. Thirteen percent of the population is currently over 65 years old. In 30 years that group will double to 66 million people. People change as they age. Sensory, cognitive and motor abilities

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decline. The built environment is not typically created with the needs of the aging population in mind. How does the choice of typeface in signage systems, for example, impact the older viewer who is experiencing vision problems typical to that age group? Are certain typefaces more suitable to the aging eye?

Additional Resources

Centers for Disease Control and Prevention. [The State of Aging and Health in America 2013](#). Atlanta,GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2013

Twentieth-century advances in protecting and promoting health among older adults have provided many opportunities for overcoming the challenges of an aging society. The health indicators presented in The State of Aging and Health in America 2013 highlight these opportunities. By working to meet the goals for each of these key indicators, our nation can help to ensure that all of its citizens can look forward to living longer and living well. The State of Aging and Health in America 2013 provides a snapshot of our nation's progress in promoting prevention, improving the health and well-being of older adults, and reducing behaviors that contribute to premature death and disability. In addition, the report highlights mobility (referring to movement in all of its forms) and how optimal mobility is fundamental to healthy aging.

Research and Review Articles

Blackwell DL, Lucas JW, Clarke TC. [Summary health statistics for U.S. adults: National Health Interview Survey, 2012](#). National Center for Health Statistics. Vital Health Stat 10(260). 2014.

This report presents detailed tables from the 2012 National Health Interview Survey (NHIS) for the civilian noninstitutionalized adult population, classified by sex, age, race and Hispanic origin, education, current employment status, family income, poverty status, health insurance coverage, marital status, and place and region of residence. Estimates (frequencies and percentages) are presented for selected chronic conditions and mental health characteristics, functional limitations, health status, health behaviors, health care access and utilization, and human immunodeficiency virus testing. Percentages and percent distributions are presented in both age-adjusted and unadjusted versions.

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