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RECENT ADVANCES IN GERIATRIC MEDICINE

Volume 2

AN INTERDISCIPLINARY APPROACH TO GERIATRIC MEDICINE

Editor:
Jeremy W. Grabbe

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Recent Advances in Geriatric Medicine

**Volume 2+*

(An Interdisciplinary Approach to 'Geriatric Medicine')

Edited by

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Recent Advances in Geriatric Medicine

Volume # 2

An Interdisciplinary Approach to Geriatric Medicine

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CONTENTS

PREFACE	i
DEDICATION	i
LIST OF CONTRIBUTORS	ii
CHAPTER 1 THE BASIS OF GERIATRIC MEDICINE	3
<i>Jeremy W. Grabbe</i>	
HISTORY OF GERIATRIC MEDICINE	3
BASIS OF AGING	4
FUTURE DIRECTIONS	5
CONFLICT OF INTEREST	6
ACKNOWLEDGEMENTS	6
REFERENCES	6
CHAPTER 2 HEALTH AND ECONOMIC CONSEQUENCES OF AGING IN US	7
<i>Rashmita Basu</i>	
INTRODUCTION	7
Formal versus Informal Care	9
Availability of Informal Caregivers and Constraints	9
Dual Pressures of Informal Caregiving and Employment	10
Caregiving With and Without Dementia	11
Economic Consequences of Aging	12
Economic Burden of LTSS	13
Characteristics of LTCI Market	13
Risks of using LTSS and Financial Challenges	15
Economic Consequences of Aging: Social Security and Income Security after Retirement	17
Uncertainty and Its Implications	18
Financial Resources of Future Retirees	19
Social Security, Health and Labor Market Behavior	21
Conclusion-Future Agenda	22
CONFLICT OF INTEREST	23
ACKNOWLEDGEMENTS	23
REFERENCES	23
CHAPTER 3 PHYSICAL CHANGES IN AGE	25
<i>Daniela Fabiani-Longo, Kayla Bishop, James Mullen, Caitlin Murphy, Jesselee Allen, Virginia Cornelius, Jocelyn Dismore, Kathryn McGeoch and Jeremy W. Grabbe</i>	
INTRODUCTION	25
Muscular Skeletal System	26
Mobility	26
Cardio-Vascular System	27
Respiratory System	27
Excretory System	28
Female Reproductive System	28
Male Reproductive System	29
Digestive System	29
Autonomic Nervous System	30
Sensory Systems	30
<i>Visual System</i>	30
<i>Hearing</i>	32
<i>Gustation and Olfaction</i>	33
<i>Tactile Perception</i>	34
Endocrine System	35
<i>Immune System</i>	35
CONCLUSION	36
CONFLICT OF INTEREST	37

ACKNOWLEDGEMENTS	37
REFERENCES	37
CHAPTER 4 COGNITIVE CHANGES IN AGING	39
<i>Ann McCarthy and Jeremy W. Grabbe</i>	
INTRODUCTION	39
AGING AND CONGNITIVE CHANGES	42
ATTENTION	42
MEMORY	45
INFORMATION PROCESSING MODELS	46
IMMEDIATE MEMMORY	47
IMPLICIT AND EXPLICIT MEMORY	48
LONG-TERM MEMORY	48
RETROSPECTIVE VS. PROSPECTIVE MEMORY	50
INTELLIGENCE AND WISDOM	51
INTELLIGENCE	51
FLUID VS. CRYSTALLIZED INTELLIGENCE	52
WISDOM AND EVERYDAY INTELLIGENCE/SOCIAL COGNITION	54
NORMAL VS. ABNORMAL COGNITIVE LOSS	55
CONCLUSION	56
CONFLICT OF INTEREST	56
ACKNOWLEDGEMENTS	56
REFERENCES	57
CHAPTER 5 OSTEOPOROSIS	60
<i>Tamara Pobocik</i>	
INTRODUCTION	60
Pathology	61
Risk Factors of Osteoporosis	62
Common Presentations	64
Cost of Osteoporosis	65
Interventions	66
Diet Considerations	66
Treatment	67
Psychological Information	68
Importance of Collaboration	69
CONCLUSION	70
CONFLICT OF INTEREST	70
ACKNOWLEDGEMENTS	70
REFERENCES	70
CHAPTER 6 VISION CHANGES AND OCULAR DISORDERS	72
<i>Jeremy W. Grabbe</i>	
NORMAL CHANGES	72
OCULAR DISORDERS	74
Cataracts	74
Glaucoma	74
Macular Degeneration	75
Diabetes: Diabetic Retinopathy and Diabetic Macular Edema	76
Use of Vision Aids Prescription	77
Types of LVAs	78
Treatments for Diabetic Retinopathy	79
CONCLUSION	81
CONFLICT OF INTEREST	81
ACKNOWLEDGEMENTS	81
REFERENCES	82

CHAPTER 7 DISORDERED SLEEP AMONG OLDER ADULTS	84
<i>Robert E. Davis and Paul D. Loprinzi</i>	
INTRODUCTION	84
ASSOCIATION BETWEEN SLEEP AND NEGATIVE HEALTH CONDITIONS	87
Cardiovascular Health	87
Cognition and Mental Health	87
Physical Functioning and Chronic Pain	89
EFFICACY OF DIFFERENT TREATMENT METHODS FOR SLEEP DISTURBANCES	89
Sleep Hygiene	89
Pharmacology	90
Exercise & Sleep	91
CONCLUSION	91
CONFLICT OF INTEREST	91
ACKNOWLEDGEMENTS	91
REFERENCES	91
CHAPTER 8 SPEECH LANGUAGE PATHOLOGY AND THE AGING POPULATION	96
<i>Kate Hood and Jeremy W. Grabbe</i>	
INTRODUCTION	96
MIT Treatment Procedure: Step 1 (Elementary Level)	104
<i>Step 1: Humming</i>	104
<i>Step 2: Unison Singing</i>	104
<i>Step 3: Unison Singing with Fading</i>	104
<i>Step 4: Immediate Repetition</i>	104
<i>Step 5: Response to a Probe Question</i>	104
Treatment Procedure: Step 2 (Intermediate Level)	104
<i>Step 1: Phrase introduction</i>	104
<i>Step 2: Unison with Fading</i>	104
<i>Step 3: Delayed Repetition</i>	105
<i>Step 4: Response to a Probe Question</i>	105
Treatment Procedure: Step 3 (Advance Level)	105
<i>Step 1: Delayed Repetition</i>	105
<i>Step 2: Introducing Sprechgesang</i>	105
<i>Step 3: Sprechgesang with Fading</i>	105
<i>Step 4: Delayed Spoken Repetition</i>	105
<i>Step 5: Respond to a Probe Question</i>	105
Level A Question	106
Level B Question	106
VAT: Sequence Level 1- Real Object:	108
CONCLUSION	118
CONFLICT OF INTEREST	119
ACKNOWLEDGEMENTS	119
REFERENCES	119
CHAPTER 9 END OF LIFE CARE IN OLDER ADULTS	123
<i>Susan E. Lowey</i>	
INTRODUCTION	123
HISTORICAL PERSPECTIVES	124
Death in Contemporary Society	125
Illness Trajectories in End of Life Care	125
Types of Illness Trajectories	126
Conversations about Goals of Care	127
Organized Models of End of Life Care	127
<i>Palliative Care</i>	128
<i>Hospice Care</i>	128
<i>Similarities and Differences between Hospice and Palliative Care</i>	130
Management of Pain & Symptoms at the End of Life	131
Physiological Health	131
<i>Pain</i>	131
<i>Shortness of Breath</i>	132

<i>Anorexia & Cachexia</i>	133
<i>Terminal Delirium</i>	133
Psychological Health	134
<i>Denial</i>	134
<i>Anger</i>	134
<i>Bargaining</i>	135
<i>Depression</i>	135
<i>Acceptance</i>	135
Spiritual Health	135
Ethical Challenges at the End of Life	136
<i>Resuscitation and Advance Directives</i>	136
<i>Withholding and Withdrawing Care</i>	137
<i>Artificial Nutrition and Hydration</i>	138
<i>Grief and Bereavement</i>	139
CONCLUSION	143
CONFLICT OF INTEREST	143
ACKNOWLEDGEMENTS	143
REFERENCES	143
SUBJECT INDEX	146

PREFACE

This eBook will provide a one-of-its-kind comprehensive examination of recent advances in geriatric medicine. The field of geriatric medicine has expanded exponentially in recent decades due to the increase of the world-wide aging population. According to the National Institute of Aging (www.nia.nih.gov) there are now more than half a billion people over the age of 65 across the globe. This has led to an increase in the need for medical and psychiatric care on a scale unprecedented in history. In light of this change in the population the field of geriatric medicine has become multidisciplinary.

One of the unfortunate consequences of a large multidisciplinary field is that advances that occur within a specific discipline are not always readily conveyed to the other disciplines within geriatric medicine. The growth of highly-specialized journals has made research and advances far more insular. Because of this insular nature within disciplines there have been more problems in large complex settings such as nursing homes which utilize varied professionals of geriatric health.

This eBook will provide a novel approach by highlighting recent advances in geriatric medicine across different disciplines. This will enable clinicians not just to understand what new treatments/discoveries there are, but to allow them the comprehensive understanding necessary to work as a team in a new 21st century approach to geriatric medicine.

Another point where this eBook will break ground on new important issues is the approach it will take in providing insight into the various living conditions of older adults. As the aging population increases so do the diverse living conditions of older adults increase as well. Large numbers of older adults are living independently within the community. However, the population in assisted living residences and nursing homes is increasing. The ability of older adults to contribute to their well-being and interaction with health care professionals is directly linked to their housing situation.

This eBook will attempt to provide a thorough and pervasive cross-section of this issue in order to provide the audience with a versatile understanding of each issue and how it is affected by older adults' housing circumstances. The diverse array of fields that are addressed in this book along with the broad issues, from dementia to stroke to physical therapy, will provide a valuable reference for the next generation of professionals.

DEDICATION

For Lisa who helped me to stayed up late and for Regina, Alexander, and Daniella who woke me up early.

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The Basis of Geriatric Medicine

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Abstract: The study of aging and geriatrics is a relatively recent area of study and specialization. Much of the increase in focus on geriatrics has been a result of the explosion of the aging population. It therefore has become essential for the modern clinician to have an understanding of the different disciplines involved in administering to the aging population. Keeping track of recent advances can be a daunting undertaking. This chapter will prepare the reader to appreciate the multidisciplinary approach to geriatric medicine. This growing demographic has a dramatic impact on the future of scientific research.

Keywords: Aging population, Biogerontology, Geriatric medicine, History of geriatrics, Multidisciplinary approach, Research, Theories of aging.

HISTORY OF GERIATRIC MEDICINE

Due to a relatively small population of older adults throughout history geriatrics was not particularly studied in detail. It was not until the 20th century that breakthroughs in medicine and advances in health, occupational safety, and standards of living allowed for the explosive increase of the older adult population. In 1909, the word “geriatrics” was first coined by Ignatz Nascher. In 1909, the average life expectancy in the U.S. was 52.2 years. It was nearly 25 years after Nascher coined the word geriatrics that the average life expectancy in the U.S. crossed over 60 years of age.

In the 1970s, greater interest in geriatrics bloomed. It became a focus for researchers and clinicians. In 1974, the National Institute on Aging was founded (incidentally the average U.S. life expectancy in 1974 was 72.1 years of age). In an interesting comparison, the field of geriatrics blossomed in the U.K. soon after the end of WWII (substantially earlier than the U.S.). However, the increase in life expectancy in the U.K. was remarkably similar to the increase in life

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expectancy in the U.S. throughout the 20th century. It can be speculated that the U.K. was proactive in anticipating the needs of the older adult population. Conversely, it could be assumed that the U.S. was slower to respond to the increasing older adult population.

In the 1980s, fellowships for physicians in geriatrics increased dramatically. The field of psychology saw a renewed interest in aging and brain function/behavior. The psychological community avoided the field of aging due to the negative implications of aging research that stemmed from G. Stanley Hall's 1922 book *Senescence*. These changes in medicine and psychology reflect advances in geriatric nursing in the previous decades. During the 1960s and 70s, nursing formalized geriatric nursing and joined the forefront of geriatrics. In the 21st century, the rise in the population of older adults has made geriatrics a factor in all branches of medicine and clinical practice. In fact, many clinicians find that the majority of patients are over the age of 65. Now is the time of the geriatrician.

BASIS OF AGING

Currently, many theories exist to explain aging and the disorders common to aging. Many theories are specific to one particular aspect of aging. There are some pan-aging theories. In the subsequent chapters there will be more elaborate discussions of such theories. It becomes more imperative that different clinicians and researchers have an understanding of how recent advances influence new theory-based approaches to treatment.

For example, the Third Congress on Biogerontology [1] identified seven different points and predictions upon the soma theory and its role in modern geriatrics:

1. Ageing results from the gradual accumulation of damage in somatic cells and tissues and accordingly longevity is regulated by the efficacy of somatic maintenance and repair. This is now confirmed by a wide range of experimental studies, including comparative studies on repair capacity and stress resistance.
2. Germline immortality may be secured by enhanced mechanisms for maintenance and repair of germ cells, a strong example of this being the action of telomerase. Stem cells occupy an interesting position between germ-line and terminally differentiated somatic cells, and there is interesting data beginning to accumulate on intrinsic ageing of tissue stem cells, such as those of intestinal epithelium.
3. Trade-offs are predicted to exist between key life-history traits such as fertility and longevity, a prediction shared with the pleiotropy theory developed by

George Williams. There are many documented instances where such trade-offs have been observed but there are also some intriguing examples where the existence of trade-offs is yet to be demonstrated.

4. Since the central mechanism of ageing is predicted to be the accumulation of random molecular damage, a key prediction is that the ageing process is inherently stochastic. There is growing evidence to support this and it appears likely that further studies on the role of intrinsic chance variations in ageing will be necessary in order to understand the variability of the senescent phenotype.
5. Multiple, complex systems contribute to the underlying causes of ageing. This requires the development and application of new 'systems biology' methods, including in silico models, in order to address the potential synergism between different candidate mechanisms.
6. The theory predicts that ageing results from evolutionary optimisation of the life history, subject to a number of intrinsic and extrinsic constraints imposed by ecological and physiological factors. This provides a series of interesting problems in terms of understanding how optimality principles have helped to shape organisms' life cycles.
7. The theory suggests that there may be significant opportunity for organisms to have evolved plastic responses to allow them to cope with variable environmental conditions. A good example is the calorie-restriction response in rodents, which the disposable soma theory suggests might have its origins in evolving a plastic response to periods of interrupted food supply.

FUTURE DIRECTIONS

One new and rather germane topic currently in discussion is just who is a geriatrician [2]? This discussion originated as the global population of older adults continued to expand. Now clinicians must cope with a diverse array of older adults as well as conditions and factors. Questions to be asked are what type of population should be the focus: community-dwelling or assisted-living? Young-old or old-old? Chronological age or functional age? Clearly this is not a debate that can be settled in one session let alone one book. The goal of this book is to discuss recent advances in the treatment and interactions with the geriatric population.

As the geriatric population becomes diverse so do the people who work with and study older adults. This book attempts to elucidate on the myriad of different disciplines currently involved in geriatrics. In this book physicians, academics, scientists as well as speech-language pathologists, physical therapists, and the

CHAPTER 2

Health and Economic Consequences of Aging in US

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Abstract: The retirement of baby boomers and the rising share of elderly population are creating health and economic crises in the U.S. The U.S. Census Bureau projects that by 2030 there will be about 71 million Americans aged 65 and older and by 2040, one of every five Americans will be over 65 [1]. These demographics transitions have far-reaching implications for meeting healthcare needs and ensuring economic security for the elderly. As the Baby Boom generation ages, a large number of frail elderly will need health and personal care and progressively use more long-term care services which will have major implications for healthcare costs and public policies.

Keywords: Aging demographics, Baby boom generation, Demographics, Disability, Gender gap, Health care costs, Sociological change.

INTRODUCTION

As individuals age, decline in functional status leads to an increasing need for personal care assistance with activities of daily living (ADLs) required to take care of oneself, such as bathing, toileting, eating, and dressing and instrumental activities of daily living (IADLs) such as cooking, grocery shopping, managing finances or medication. One recent study shows that after accounting for changes in sociocultural, economic and environmental factors between 1982 and 2009, successive cohorts of older adults are becoming more disabled over time [2]. It has been projected that by 2030 there will be over 21 million elderly limited in their activities and need assistance for a progressively long period of time.

In the U.S., the vast majority of personal care that allows older people to live in their communities is provided by family members as unpaid care. The combined effects of increasing older share of the population and greater life expectancy, the demand for long-term care services provided by unpaid caregivers will continue to increase. Due to private insurance policies in the U.S. professional caregiving is

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not always provided. However, the traditional supply of unpaid caregivers is shrinking due to the gap between population growth rates of the elderly and people aged 25 to 54, particularly women who predominantly provide personal care. Beginning from 2025, the number of people aged 65 and over will exceed the number of women aged 25-54 (Fig. 1). Due to increasing participation of women in the workforce (except long-term care workforce), marriage and reproductive trends (such as smaller family sizes) are restricting women's availability to care for family members. Outside of the U.S. these demographic changes are similar to many European countries. All these social and demographics changes will pose significant challenges to the elderly, policymakers, healthcare providers and planners to meet the care needs of older Americans and improve the lives of the family members who care for them.

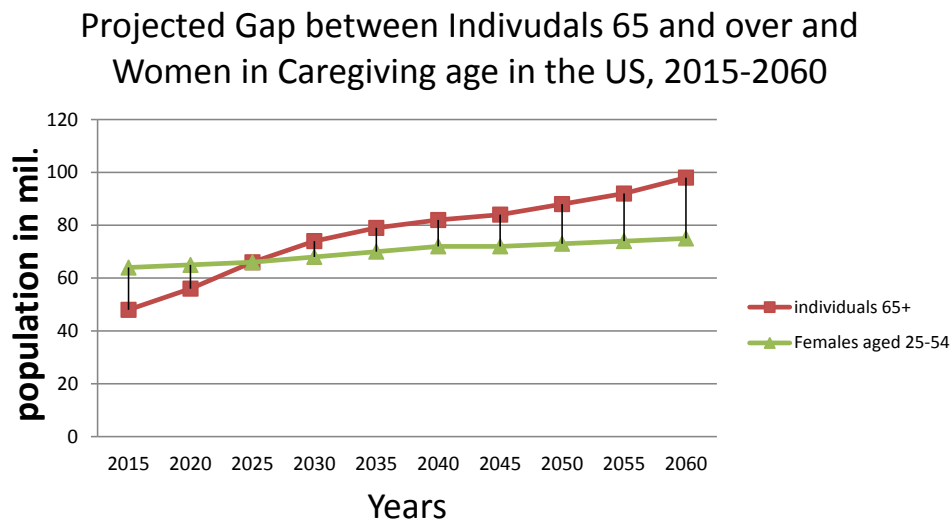


Fig. (1). Source: U.S. Census Bureau, Population Division, National Population Projections, Summary Files, "Total Population by Age and Sex, December, 2014.

The aging in general, and long-term care services in particular, will represent an overwhelming economic burden to the society and the healthcare system, including the public health system such as Medicare, Medicaid and other government sponsored programs. The other aspects of economic burden due to population aging include increase in Social Security payments, out-of-pocket medical care expenditures and cost for supplemental coverage for Medicare beneficiaries. The increasing number of people on Medicare and the aging of the Medicare population are expected to raise both the total and per capita Medicare

spending. The current Medicare spending of \$540 billion is expected to rise to \$1 trillion by 2024. Since 2005, the rate of Medicare spending has been increased faster than the GDP in areas including skilled nursing facility (SNF), outpatient hospital, hospice, and lap services. This increased Medicare spending is contributed by the increase in Medicare population from 20 million in 1970 to 80 million in 2030.

The current study assesses the health and economic dimensions of the population aging in the U.S. The first part of this chapter discusses the logic that suggests the potential challenges for families and healthcare systems to meet the care needs of older Americans and the second part reviews the economic burden of aging in general and long-term care and Social security benefits in particular.

Formal versus Informal Care

In contrast to acute care, the vast majority (75%) of long-term care is unpaid or informal assistance provided by family and friends. As the older share of population is growing and people are living longer with chronic disabling conditions, particularly dementia, long-term care needs will become more challenging for families. Family caregivers are essentially the backbone of the delivery of long-term care needs of the elderly in the U.S. In general, adult children constitute the largest share of caregivers (42%) followed by spouse (25%), who provide assistance on personal care (*e.g.* bathing, toileting, dressing, and eating) and other instrumental activities (*e.g.* transportation for doctor appointment, bill payment, cooking, *etc.*). Although elderly who use informal care also use formal care (*e.g.* paid care from paraprofessional workers or nursing assistants) to supplement care needs. The following sections will focus on the availability and constraints of informal caregivers as long-term care is predominantly provided by the informal caregivers.

Availability of Informal Caregivers and Constraints

Informal caregivers of older adults are predominantly women. Informal caregivers and family caregivers are used to refer to individuals such as family members, partners, friends and adult child who provide care to older adults who have difficulty in performing activities of daily living in home and community setting. Estimates of number of informal caregivers in the U.S. vary depending on the definitions used for caregivers and care recipients as well as the types of care provided. For example, there are about 66 million informal and family caregivers who provide care to an elderly who is ill and disabled in the U.S. and about 27 million family caregivers provide personal assistance to adults with a disability or

Physical Changes in Age

Daniela Fabiani-Longo, Kayla Bishop, James Mullen, Caitlin Murphy, Jesselee Allen, Virginia Cornelius, Jocelyn Dismore, Kathryn McGeoch and Jeremy W. Grabbe*

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Abstract: There are a number of physical, psychological and social changes that occur with the passage of time. Aging, then, can be understood as the impact of time on our bodies. This happens on multiple levels, such as cellular and hormonal aging, accumulated damage, and metabolic aging. Well-being in late life depends on a tight-knit balance of physical, psychological, and social health [1]. If one of these three key components of a balanced life style is disrupted, it throws off the other two. For example, if an elderly individual suffers from flu, that in turn, will affect other aspects of their life. This individual may find it hard to be active when ill, which may lead to negative changes in their mood. In addition, other people may avoid him or her due to fear of catching their illness. This could lead to feelings of depression and social isolation, which may further impair immune system functioning.

Keywords: Balance, Cardiovascular changes, Hormones, Hypertension, Immune system, Osteopenia, Physical aging, Sarcopenia, Sensory changes.

INTRODUCTION

Understanding how the major systems of the body are affected by aging can shed light on what changes are expected as a result of normal aging and what change may be a sign of illness or disease. While people age at different rates depending on genetics, diet, culture, activity levels and environmental exposure, long-term population studies have given us clues about what changes we can expect. The focus of this chapter is to examine the physical changes that take place in the human body over time and how these changes impact the major systems of the body.

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Muscular Skeletal System

The human body is made up of fat, lean tissue (muscles and organs), bones, and water. After age 30, people tend to lose lean tissue. Muscles, kidneys, the liver and other organs lose some of their cells. This process of muscle loss is called atrophy and as a result, this tissue loss reduces the amount of water in the body. Bones lose some of their minerals and become less dense (a condition called osteopenia in the early stages and osteoporosis in the later stages). The tendency to become shorter occurs among all races and both sexes. Height loss is related to aging changes in the bones, muscles, and joints. People typically lose about 1 cm every 10 years after age 40. Height loss is even more rapid after age 70. On average people lose a total of 1 to 3 inches in height as they age. The main cause of the reduction in standing height is the loss of bone mineral content in the vertebrae, which leads to both collapse and compression in the length of the spine. Other causes of the reduction in standing height are changes in the joints and the flattening of the arches of the feet.

The weight loss that occurs in the later years of adulthood is not due to slimming of the torso but to the loss of lean body mass consisting of muscle and bone. Participation in exercise such as active sports can offset the effects of aging on body fat accumulation. Endurance athletes do not gain as much weight and they maintain their physical fitness for as long as they continue to train. Participation in exercise training programs can even be of value to adults who were more sedentary throughout their lives. By engaging in walking, jogging or cycling for about 3-4 days a week an individual can begin to see positive physical changes as soon as 10-20 weeks from starting the activity .

Mobility

An individual's mobility is their ability to move around in their physical environment. This is a combined function of the integrity of the muscles, bones, joints, tendons, ligaments, and the contractibility of flexor and extensor muscles. Mobility changes throughout adulthood, to the extent that movement becomes more difficult, more painful, and less effective and efficient.

Between ages 40 and 70, there is a loss of muscle strength that amounts to approximately 10-20 percent. More severe losses occur between ages 70-80 (30-40%). However, there are individual differences that can lead to deviations from the general pattern of decline. The extent to which aging affects the loss of muscle strength depends upon gender, an individual's activity level throughout life, the particular muscle group tested, and whether the type of muscle strength tested is

static or dynamic.

Bone development in adulthood is similar to muscle development in that it trends toward diminished skeletal strength. This results in a diminished ability of bones to withstand mechanical pressure, as well as showing a greater vulnerability to fracture. Decreases in various measures of skeletal strength range from 5-12 percent per decade starting in the 20s and continuing to the 90s. With time, microfissures develop in response to the stress placed on bones, which also contributes to the likelihood of a fracture.

Maximum skeletal strength loss ranges between ages 50 and 70. This is because the rate of reabsorption exceeds that of new bone growth in later adulthood. This results in the overall reduction of skeletal mass. Body weight is positively associated with bone mineral content, meaning that heavier individuals lose less bone mineral content and that less bone loss occurs in weight-bearing limbs. Genetic factors also play a role, as do lifestyle choices such as physical activity, smoking, alcohol consumption and diet. These factors can account for 50-60 percent of variance in bone density and also may influence the rate of fractures.

Cardio-Vascular System

The most significant overall change regarding the cardiovascular system in response to aging is reduced blood flow to the body, which typically becomes significant in the eighth decade. This results from a number of factors including normal atrophy of the heart muscle, especially in the left ventricle which pumps oxygenated blood out, calcification of the heart valves, loss of elasticity in artery walls (arteriosclerosis or “hardening of the arteries”) and intra-artery deposits (atherosclerosis). The reduced blood flow results in reduced stamina since less oxygen is being exchanged, reduced kidney and liver function, and less cellular nourishment. As a consequence, the individual is more susceptible to drug toxicity, has a slower rate of healing, and a reduced response to stress. Other consequences of these cardio-vascular changes are hypertension with an increased risk of stroke, heart attack, and congestive heart failure [1].

Respiratory System

As with the cardio-vascular system, there is also a reduction in the efficiency of the respiratory system in later life. The airways and lung tissue become less elastic with reduced cilia activity, resulting in decreased oxygen uptake and exchange. The muscles of the rib cage also atrophy, further reducing the ability to breathe deeply, cough, and expel carbon dioxide. These changes are exacerbated

Cognitive Changes in Aging

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Abstract: As people get older, they begin to worry that any type of memory lapse may be the onset of dementia. In fact, the American Psychology Association agrees that dementia is one of the most feared aspects of getting older. It may be important, therefore, for both aging individuals and potential caretakers to have a better understanding of what would be considered to be normal age-related cognitive changes and what would be considered to be changes that might indicate a condition that would need to be evaluated by a medical professional.

Keywords: Attention, Cognitive changes, Dementia, Long-term memory, Memory, Methodology, Mild cognitive impairment, Short-term memory.

INTRODUCTION

What if you encountered a woman wandering through a parking lot looking for her car? Would you be worried that she had dementia or would you assume that she just forgot where she parked? Likely, your answer would depend on the woman's age. We often attribute memory lapses in younger people to be the result of stress, not paying attention, or some other relatively harmless reason, yet for the same memory error in an older person, most of us, including older adults, would attribute the cause to possible dementia or delirium. For the record, I never have been able to remember where I park my car. This includes my adolescent years, my younger adult years, and my middle age years. I'm not expecting the situation to improve in the next twenty years! I am sure, however, that the reaction of people around me will change as they begin to attribute the exact same behavior that has been present for many years to age-related changes rather than to an issue that I've had my entire life.

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So, do cognitive declines or changes occur as people get older? This would be a short chapter if this were an easy question to answer! The “common sense” answer is that of course it is normal to experience cognitive changes as one ages. The scientific answer is much more complicated because cognition itself is complex. The answer to the question is both “yes” and “not so much”, or “quite a bit”, depending on the aspect of cognition being examined. It may also depend largely on the research design used to assess potential cognitive differences between younger and older adulthood.

The answers to these questions are important not just from a human development perspective, but they also have an impact on everyday living situations. Do cognitive changes/declines occur at a particular age so that society may need to apply a maximum age allowed for driving an automobile? Is it acceptable to raise the age to receive social security because not only are people living longer but they are also certainly capable of remaining in the job force? Should there be a mandatory retirement age for some professions due to inevitable cognitive declines? These are not easily answered questions, and it might behoove us, as a society, to consider the actual research rather than our “common sense”.

One of the concepts to understand before discussing the most commonly used research designs is the difference between age-related changes and age-related differences. Age-related change means that whatever is different between an older person and a younger person is due strictly to getting older. For example, a common age-related change that occurs is presbyopia, which is a form of farsightedness. As people get older, normal changes in the eyes (such as thickening and hardening of the lens, less flexibility of the lens) cause them to not be able to see things that are close as well as they did when they were younger. Again, these physical changes are commonly due to aging. Age-related differences are simply things that are different between two or more cohorts of individuals. For example, younger people do not see a problem with an unmarried couple cohabitating before marriage, whereas a person in his seventies might be quite distressed that his granddaughter is “living in sin”. There is a clear difference in moral thinking, but this cannot be attributed to getting older. The gentleman in his seventies was probably not more inclined to think that this was acceptable when he was in his twenties, either. Unfortunately, many times research results are often interpreted as being age-related changes rather than age-related differences.

Another common misinterpretation of research findings involves correlations. Correlations are statistics that are used to describe variables and relationships between variables. One cannot assume, however, that one variable CAUSES a

change in another variable. A common example is that ice cream sales increase when the temperature increases. By the same measure, ice cream sales decrease when the temperature decreases. Suppose two variables behave in the same manner, both increasing and both decreasing. This is a positive correlation. When variables move in opposite directions, one increasing as the other decreases, this is known as a negative correlation. For example, as a student spends increasing time playing video games, her grade point average will decrease. It is important to note that we just cannot conclude that one variable is causing the other reaction. We just do not know what other things might contribute to the relationship. For example, it makes sense that because it is hot outside that people eat more ice cream in an attempt to decrease body temperature. Another reason for the positive correlation may be that more people are going to more places that offer ice cream as a food choice – like fairs, carnivals, zoos, amusement parks, *etc.* We simply do not know because we have not accounted for those types of variables. So, we cannot conclude that warmer weather itself causes people to eat more ice cream, and we certainly cannot reach the conclusion that if we all agree to eat more ice cream, it will cause temperature to increase! We can, however, predict that as it gets hotter outside, ice cream sales will increase.

These types of statistics are often misreported in the media and come to be accepted by the general public. For example, there is a correlation between solving crossword puzzles and/or other mentally stimulating cognitive tasks and dementia [1, 2]. These researchers found that older people who regularly solve crossword puzzles (or partake in other cognitive activities) often have much lower rates of dementia than older people who are not solving crossword puzzles. This is a negative correlation (more puzzles = less dementia). This information CAN be used to PREDICT the incidence of dementia (Mr. Jones does not solve crossword puzzles and may be more likely to suffer from dementia), but it cannot be said that doing crossword puzzles CAUSES people to avoid dementia. Yet, in the media, correlations are quite often presented as causing certain events to occur or not occur. Unfortunately, most people are not reading professional journals or books and take this information as it presented in the media.

A common misconception about most aging research is that these are true experiments, but in reality, there are no studies on age comparisons that can be considered true experiments. (In fact, both of the previously mentioned studies regarding crossword puzzles rely on self-reports of cognitively demanding activities and none of the groups were measured at a baseline and then performed tasks and were later measured). In order to be considered a true experiment, the researchers must have randomly assigned each participant to a condition. This

Osteoporosis

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Abstract: Osteoporosis is a silent destructor of bone. King, Clarke and Sandhu (2014) reported that as many as 10 million Americans have osteoporosis and this number will increase by 50% by 2025. This disease is not gender selective; however, women are the prevalent gender affected. Many do not consider this a problem; because one cannot observe the bone destruction until this disease progresses into advanced stages. Bringing forward information to both genders is an important preventer of this silent, but painful condition. Imagine presenting with a bone or spinal fracture that is not associated with any trauma or injury. This is a typical presentation for a person who has osteoporosis. Pain then becomes the driver of stopping the progression of this disease. As many times after a fracture, a person must deal with the acute pain of the fracture and then has the potential to become chronic pain for many individuals. Knowledge and prevention are the key factors to this devastating disease.

Keywords: Balance, Diagnostics, Fall risks, Falls, Gait, Osteoporosis, Rehabilitation, Walking.

INTRODUCTION

This disease's characteristics are decreased bone mass, deterioration of the bone, and porous bone. Mackey and Whitaker [1] reported that osteoporosis is a progressive disease in which the bones become thin and become prone to fracture. A precursor to this disease is a condition known as osteopenia, and a screening test can identify this condition. Bone reaches its peak mass when an individual reaches the age of 30. After crossing 30, bones lose mass, they start to break-down at a rate faster than bone growth, and bone becomes spongy. When an individual does not maintain a proper diet, engage in weight bearing exercises, and avoid activities that slow or maintain bone structure then osteoporosis starts to occur. Individuals must maintain good bone health and it is never too late to

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influence and improve bone health later in life [2]. Nurses can make an impact on educating individuals on this destructive disease. In the Institute of Medicine Report [3], they recognized that nurses must practice to the fullest extent of their education. What this means is that nurses can improve health outcomes and reduce cost for patients in health care (IOM, 2010). As nurses are the primary education providers to their patients. This chapter will explore relevant information on osteoporosis for anyone who is interested to gain a stronger knowledge foundation on osteoporosis.

Pathology

The pathology of bone formation is critical to understand how this bone destruction leads to osteoporosis. Osteoblasts, osteocytes, and osteoclasts are the three main components of bone formation in the human body. The marrow of long bones is responsible for the production of osteoblasts, osteocytes, and osteoclasts. Osteoblasts are responsible for the formation of new bone, and these osteoblasts then mature into osteocytes, which are the main component of bones. The osteoclasts are then responsible for bone resorption, which is how new bone replaces old bone.

This is a simplification of the normal process of bone formation throughout one's life. There is a positive balance of bone during childhood until peak bone mass is reached in early adulthood, with a subsequent period of stability and then a negative balance in older age with osteoclastic activity greater than production of osteoblastic activity, which leads to bone loss [4]. This means that after the age of 30, bones do not rebuild at the previous rate and without careful planning on how to increase the formation of new osteoblasts the disease process of osteoporosis begins.

Hormones in women influence bone formation. The female sex hormone estrogen plays a major role in the formation of osteoblasts. Tella and Gallagher [5] stated that a decrease in estrogen causes changes in the remodeling bone process. Women have time during their lives when this hormone fluctuates which eventually drops to minimal levels after menopause. Therefore, women at menopause have a decrease in estrogen, and are therefore the most affected gender of this disease. This is why educating women early can lead to prevention of osteoporosis. Another consideration is that some women experience problems earlier in life that can lead to low estrogen levels, for example amenorrhea, polycystic ovarian syndrome, being an athlete, anorexia, and bulimia [6]. Knowing the risk factors early can help to decrease the number of osteoporosis cases.

Other disease processes and treatments can lead to osteoporosis in both men and women. These include, but are not limited to celiac disease, rheumatoid arthritis, hypogonadal states, certain endocrine problems, and some autoimmune diseases. Knowing how these diseases can eventually lead to osteoporosis is important for individuals who may have any of the above diagnoses. These individuals must become advocates for themselves, as some care providers may only focus on the disease process and not the possibility that they could and will develop osteoporosis. Becoming active participants in their healthcare is critical for these individuals.

Taking certain medication can put individuals at risk to develop osteoporosis. These medications include anti-seizure, steroids, oral hypoglycemia agents, proton pump inhibitors, and selective serotonin reuptake inhibitors. Many of these medications people take on a regular basis, and they can obtain these medications with a prescription or without a prescription and could be from different care providers. Which means primary care providers may not even know their patients are taking these medications. This information is critical to stop or decrease the incidence of osteoporosis. Individuals must educate themselves and ask questions to care providers when they do not address the possibility of osteoporosis. Nurses must start to take the frontline to educate and identify individuals who may be at risk of developing this costly disease. These identifiable diagnoses and medications are very simple compared to the risk factors that the next section will focus.

Risk Factors of Osteoporosis

Knowing the risk factors of osteoporosis is the best preventer of this disease. Unfortunately, many young women do not have a primary care provider during their 20's and into their 30's. As many young women do not have medical problems and usually seek care for obstetrics. Recognizing this problem now with the older population, could start to change the face of the disease. This could lead health care providers to address women at a younger age rather than waiting until osteoporosis causes a bone fracture. Therefore, providing information at any point becomes crucial. Bone formation is steady throughout childhood and into one's early 30's. Therefore, during this time an individual must consume adequate amounts of calcium, vitamin D, and obtain certain exercise. Presented in this section are the risk factors for both men and women.

There are both non-modifiable and modifiable risk factors for women and men. The non-modifiable and modifiable risk factors are in Table 1. Individuals are not able to change the non-modifiable risk factors and must gain knowledge about

Vision Changes and Ocular Disorders

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Abstract: Among the sensory changes that negatively impact older adults, changes in vision are the most salient. Problems with vision are associated with trouble reading and driving. The impact on activities of daily living is apparent and pervasive. Many older adults find that their lifestyles are most significantly impacted by visual changes and visual ailments.

Keywords: Accommodation, Diabetes, Retinopathy, Surgical correction, Vision, Vision changes, Visual aids.

NORMAL CHANGES

During the aging process the eye undergoes a series of changes which are most pronounced by a loss of visual acuity. As one ages the crystalline lens starts to become more rigid and begins to acquire a yellow tint. Muscle fibers controlling pupil dilation start to break down and lead to a reduced amount of overall light entering the eye.

Many clinicians may note that some of their older adult patients refrain from driving at night. In normal, healthy younger adults it takes approximately 40 minutes to complete the process of dark adaptation. In older adults the process is long and usually incomplete. Large changes in dark adaptation occur for people over the age of 60. Older adults are considerably less sensitive to light under dark conditions. In addition to these changes in sensitivity to light under dark conditions, older adults become more susceptible to glare. This compounds the detriment to night driving.

Although a minor change with age that has minimal impact, changes in color perception may have some role in interaction with older adults. Older adults are

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less sensitive to blues and greens. These minor changes to color perception may relate to discussions pertaining to décor and/or fashions. One anecdotal tale shows caution in misunderstanding minor sensory changes. A young clinician in speech-language pathology in a geriatric practice met a new patient. The clinician was wearing a blue-green blouse. The patient noted the blue color of the blouse. What followed was a debate between patient and clinician over the color of the aforementioned blouse. At the end of the exhaustive discussion the clinician was under the impression that the intransigence of the older adult in admitting to the color of the blouse was due to possible mild cognitive impairment rather than changes in color perception.

A common and well-documented normal vision change in age is presbyopia. This age-related loss in the ability to focus on close objects leads to farsightedness in older adults. This is easily accommodated with corrective lens and larger print materials. In the clinical perspective of vision changes and aging, an important point to consider is visual function and visual acuity. Hidalgo *et al.* [1] address this issue in great detail. Visual acuity is direct and easy to measure. In contrast, visual acuity may be corrected, but does not reflect visual function. Visual function encompasses the impact of visual acuity changes (*i.e.*, low vision) on activities dependent upon vision. Unlike visual acuity, visual function is more difficult to conceptualize let alone measure.

Hidalgo *et al.* [1] lays out the differences and problems:

Questioning older people about their visual problems may help in detecting visual impairment, however it is not as sensitive and specific as a direct assessment of visual acuity. By combining the scores of several questions, the sensitivity to detect visual acuity of less than 6/12 may be increased to 86%, but an assessment using a standard Snellen's chart is preferable. A systematic review of clinical trials, performed in older people in a community setting, included the assessment of visual function and concluded that evidence for effectiveness of visual screening was lacking, but a small beneficial effect cannot be excluded. In this respect the United States Preventive Services Task Force (USPSTF) recommends visual screening for impaired vision in people aged over 65 years using the Snellen chart (grade B recommendation). The Canadian Task Force on Preventive Health Care (CTF) points out that the high prevalence of visual defects in elderly people and the existence of effective treatment are sufficient reasons for including periodical visual acuity testing with a Snellen sight chart.

OCULAR DISORDERS

Cataracts

A common geriatric condition of the eye is a cataract. A cataract is a condition in which the lens becomes cloudy. This leads to blurriness of vision as well as an increase in problems with glare. Cataract treatment involves removal of the cataract. This procedure involves cutting away at the ectodermal opacity and replacement of the lens with a plastic lens.

Recently, Liu *et al.* [2] discovered a breakthrough in cataractogenesis which is now leading to new ways to delay the progress of cataracts. In the lens the removal of damaged proteins is handled largely by the ubiquitin proteolytic system. The other mechanisms of removal are lysosomal/autophagic mechanisms and calcium-activated proteases. The seven lysine on ubiquitin serve to remove damaged proteins although lysine 6 removes only a small amount of proteins. The research found that mutation of lysine 6 leads to high levels of calcium ions (Ca^{2+}). This also leads to hyperactivation of calpain and eventual to the onset of cataracts in the lens. Methods of exploitation of the ubiquitin proteolytic system and calpain-based degradative system are not attractive areas of exploration for the treatment of cataracts.

Glaucoma

Another common ocular disorder among older adults is glaucoma. Glaucoma is an elevation of intraocular pressure of the vitreous humor. This prolonged pressure damages the neurons in the retina leading to significantly impaired vision. One of the first warning signs of glaucoma is a reduction in peripheral vision function. Often this goes unnoticed by the older adults until significant loss has occurred. This is because many older adults experience less peripheral vision processing due to contraction of the Useful Field of View (UFOV). The only exception is that the in older adults the Useful Field of View expands asymmetrically for word stimuli only [3]. This was theorized as a result of older adults' greater reading experience. A possible earlier warning sign of glaucoma could be if older adults report greater difficulty reading (particularly in reading speed).

The study of glaucoma and lymphatic defects in mice has resulted in the prospect of new treatments for glaucoma [4]. The authors found impaired ocular drainage in mice with a deletion of *Angpt1* and *Angpt2*. This deletion resulted in a disruption of the signaling pathways for angiopoietin/TIE2. Angiopoietin/TIE2 plays an important role in the development of the lymphatic system. The mice did

Disordered Sleep among Older Adults

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Abstract: The National Sleep Foundation (NSF) recommends that the average adult accrue between 7 and 9 hours of quality sleep per night for optimal health and performance outcomes; for older adults the recommendation becomes 7 to 8 hours per night [1]. The Centers for Disease Control and Prevention refer to insufficient sleep as a public health problem and, subsequently, recommend adequate sleep be considered as a vital sign of health. Lifestyle choices and personal habits often prohibit individuals from achieving this recommendation for healthy sleep duration, however, many adults fail to adhere to sleep guidelines because of an existing acute or chronic sleep disorder.

Keywords: Aging and sleep, Apnea, Sleep disorders, Sleep hygiene, Sleep research, Sleep stages.

INTRODUCTION

Staggeringly, in America alone as many as 70 million adults may suffer from a chronic sleep disorder [2]. Sleep disorders are problems regarding an individual's ability to fall asleep, stay asleep, sleeping too much or at the wrong times, and exhibiting unusual behaviors during sleep [3]. Nearly 100 distinct sleep related disorders exist and each is characterized by one or more pronounced disturbances, such as, excessive daytime sleepiness, sleep efficiency, or the manifestation of abnormal events during sleep, such as, sleep disordered breathing or involuntary limb movements [2]. The more common sleep disorders include, but are not limited to, sleep apnea, insomnia, narcolepsy, and restless leg syndrome (RLS).

The diagnosis of sleep disorders comes from a variety of tools such as sleep logs, sleep studies, and sleep latency tests. The "gold-standard" method for the diagnosis of sleep related disorders is Polysomnography. Polysomnography is a sleep study in which brain waves, blood oxygen levels, heart rate, breathing, body positioning, and leg and eye movements are evaluated. In addition to the

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diagnosis of sleep disorders, polysomnography is also used to adjust the treatment regimen of those previously diagnosed with a sleeping disorder. This polysomnography testing can be done in an individual's home; however, it is typically conducted at a sleep center or hospital. There can be advantages to both the laboratory and home based testing. The hospital or lab setting provides a more controlled environment for testing to occur, however, the participant may not exhibit their normal sleep behavior when removed from their usual sleeping environment. Home based polysomnography testing can also present problems with the transition of equipment used for testing from the lab to the participant's home.

Researchers and clinical practitioners often utilize polysomnography to assess sleep disturbances and disorders because of the robustness of the data synthesized. At times however, researchers may use a variety of more subjective assessment devices which rely on the self-report of the individual being evaluated. Such subjective methods consist of survey instruments and sleep diaries which assess the effects of the sleep disorders (*i.e.* sleep disturbances). Although several validated instruments exist, one such questionnaire commonly used in research is the Pittsburgh Sleep Quality Index. Developed in 1988, the Pittsburgh Sleep Quality Index is a self-report assessment of sleep quality disturbances, where the participant is asked to recall sleep related events over a period of one month. Disturbances assessed include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, use of sleep medications, and daytime sleepiness [4].

Sleep architecture is a term clinicians and researchers use to reflect the usual pattern of an individual's sleep. Normal sleep consists of a cycle represented by 5 distinct stages which we continuously move through then repeat during sleep. Each sleep cycle lasts approximately 90 minutes and upon culmination reengages. The first 4 stages comprise what is known as non rapid eye movement sleep (NREM), with stage 5 reflecting rapid eye movement sleep or simply (REM) sleep. The majority of the sleep cycle is spent in what is referred to as NREM sleep and this distinction of the sleep cycle involves movement through 4 stages. The first stage is a state of light sleep where the individual is between a state of awake and asleep. In stage two the individual becomes disengaged from their surroundings and initiates sleep. Finally, stages three and four are the deepest and most restorative. REM sleep is the portion of sleep where the brain is aroused and dreams occur. Seventy-five percent of a sleep cycle is spent in NREM sleep while roughly 25% is spent in REM sleep.

Older adults are perceived as a vulnerable population in regards to sleep problems for several reasons. As much as 70% of elderly individuals may suffer from chronic sleep disturbances [5]. Research also suggests that women may be more vulnerable to disordered sleep than elderly males [6, 7]. Such findings are of public health concern as insufficient sleep is associated with increased cardiovascular risk and early mortality [8 - 10].

Given age group of interest there are several factors worthy of mention which could potentially influence the presence of sleep disturbances. Changes occur as we age which affect or disrupt natural sleep architecture, such as, changes in life related events. However, once reaching the status of “older adults” (typically viewed as 65+ years) chronological age does not seem to alter the presence or severity of sleep disturbances [11]. Regarding sleep architecture, older adults tend to spend more sleep time in the earlier stages of sleep (*i.e.* 1 & 2) and less time in the later, more restorative stages (3 – 5). Whether or not the individual has retired is one such specific event capable of altering sleep behavior. The individual’s daily work/life balance changes, which can cause the altering of sleep behaviors. Some research shows a protective effect of retirement on sleep [7]. This is hypothesized to occur as a result of removal of the pressure of a structured sleep schedule.

Likewise, spousal presence/relationship may play an important role in sleep patterns among adults. Given the strong relationship between depression and sleep-related problems [12], one could theorize about the effect of spousal death on sleep quality. Research reflects modest evidence for an effect of widowhood on sleep behaviors [11].

Additionally, the age of this subpopulation places them at substantial risk for morbid conditions, for example, physical functioning loss, cardiovascular disease, diabetes, cancer, mental health disorders and cognitive decline [11, 13 - 15]. Numerous scientific studies have provided evidence which reflect a positive association between sleep disorders in the elderly and comorbid conditions such as those discussed earlier [11, 16 - 18]. Also contributing to sleep behavior changes and the development of sleep related disorders in older adults are additional biological factors, such as, reduced production of hormones and neurotransmitters responsible for regulating sleep, for instance, melatonin and serotonin [19, 20].

Speech Language Pathology and the Aging Population

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Abstract: In this chapter, we will discuss the scope of practice in Speech Language Pathology (SLPs) specifically with the aging population, implications of the areas of communication, cognition, and swallowing due to abnormal aspects of the aging process, optimal services, and various therapeutic approaches to address those areas of communication, cognition, swallowing.

Keywords: Aphasia, Cognition, Dementia, Dysphagia, Evaluation, Oropharyngeal structures, Rehabilitation, Therapy approaches, Swallowing.

INTRODUCTION

Speech Language Pathologists (SLPs) have been recognized as a type of therapists who address communication disabilities. We integrate our services with others in addressing patients ranging from birth to end of adults nearing the ends of their lives and their families. In the realm of neurogenic communication and swallowing disorders directed therapy services, the SLPs play a primary role in the screening, assessment, diagnosis, treatment, and research. SLPs are recognized as the only profession who are certified and licensed to treat communication disorders (speech, language, cognition), and swallowing disorders [1].

The educational background and clinical training prepare the SLPs to serve in a number of roles related to communication and swallowing disorders. The SLPs evaluate and treat disorders discussed in this chapter in numerous settings including, but not limited to: Skilled Nursing Facilities (SNF), acute care

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facilities, rehabilitation facilities, outpatient rehabilitation facilities, Home Health (HH) care services, hospice care services, children's hospitals, and even the school setting. Where the focus of the chapter will be on the adult population, some SLPs work with pediatrics who do experience a neurogenic communication disorder that may impact their speech, language, cognition, and or swallowing [2].

Evidence Based Practice (EBP) is the integration of research evidence with clinical experience/expertise and expert opinion to provide effective and high quality service. SLPs must use these rigorous criteria to judge the quality of research evidence in at least three domains: validity, importance, and precisions for their therapeutic practice. Judgments necessitate careful reading and evaluation of published studies, particularly their methods and results section. Studies with stronger methods provide higher quality evidence for practice than these with weaker methods. The highest quality evidence comes from a well-designed meta-analysis (quantitative synthesis) of more than one randomized control trial (RCT), whereas the lowest quality evidence involves expert opinions. However expertise option may provide important guidance for clinical decision. The importance and precision of study results are key components for judging the quality of research evidence for the SLPs. Most SLPs are familiar with statistical significance. However in EBP, that also matters in the clinical or practical significance of results as indicated by the importance of study outcomes, the magnitude of study effects, effect size, and the precision with which those effects have been estimated (confidence intervals). SLPs must be able to use the application of the research outcomes to practice with their particular populations or individuals. SLPs must assess the similarity of the study setting and participants to their own circumstances and determine the extent to which the study includes all relevant. Patient needs and clinical preferences must be given due weight in this process. SLPs need to continue to monitor the relevant significant literature for new evidence that may inform subsequent decisions [3].

The reason why SLPs have incorporated EBP into their therapeutic services is to ensure patients receive the best possible service informed by the highest quality of evidence available. This also assists with greater accountability and credibility to our role as provides. Incorporating EBP into our therapy also identifies gaps in the correct evidence, which may also permit the scaling up of research effort to generate high-quality evidence on key practice issues. The results from EBP should explain as to why certain practices work, and to provide a foundation for further innovation and change [4].

When the SLP is critically appraising the EBP, they are rating the overall quality of evidence based on the outcomes with the lowest level of evidence, balancing harms and benefits, balancing benefits and costs, rating the strength of recommendations, and suggesting implementation, evaluation, and updating strategies. When implementing decisions, SLPs must integrate research evidence, clinical expertise, patient values. Evidence does not make decisions. In fact, the same evidence may even lead to different decisions, depending on other relevant factors. However, it should not be assumed automatically that evidence is not applicable when the patients or setting are somewhat different than those in the studies providing the evidence. SLPs are careful to discuss possible options with the patient and/or family, including an explanation of how research evidence figured into the recommendations.

The purpose is to provide sufficient information to support an informed choice by the patient and/or family. Collaborative planning may also be required to refine the chosen option to suit patient or family preferences. The most successful implementation occurs when the evidence is robust and matches professional consensus and patient needs, the context is receptive to change with sympathetic cultures, strong leadership, and appropriate monitoring and feedback systems, and there is appropriate facilitation of change with input from skilled external and internal facilitators. Patients with communication and or swallowing disorders and their families stand to benefit if SLPs are successful in integrating relevant evidence into the clinical decision making [1].

Many changes occur in the body as we age, and should be viewed as natural changes. A sharp line should be drawn between normal declining abilities and deficits that are addressed by SLPs. Orientation will be intact for a normally aging adult, but it is abnormal for an adult not to be oriented to time, place, date, or even who he or she is. Healthy aging adults do not show changes in sustained attention tasks, but they do perform tasks more slowly than young adults performing the same task [5, 6]. Long term memory remains intact for the healthy aging adult; however healthy aging adults may have difficulty with short term memory and episodic memory [7]. An example of this would be that the healthy aging adult may remember childhood memories, but has a difficult time remembering recent events. The ability to process verbal language in daily life remains functional. Reading might be slow as compared to a young adult, but comprehension is still intact [8]. In comparing healthy aging adults to young adults with swallowing, it is normal to see the aging population to have a prolonged pharyngeal delay. Once the pharyngeal swallow is delayed with aging, the delay does not continue to increase as the normal aging continues [9].

End of Life Care in Older Adults

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Abstract: Older adulthood is considered to be the last phase of life in the human lifespan. According to the Centers for Disease Control and Prevention [1], the average age of death in the United States is 78 years. It is a well-known part of the human experience that death most commonly occurs during older adulthood and is more widely accepted by society than when death occurs in a child or young adult. Old age is characterized by the developmental stage of life known as integrity *versus* despair [2]. In this last developmental stage of life, an individual is left challenged to accept and find meaning in the life that he/she has lived.

Keywords: Death, Death and society, Dying, End of life, Family issues, Grieving, Hospice, Palliative care, Stages of development.

INTRODUCTION

Older adults might often think more about death due to the nature of their advancing age and medical afflictions, some of which may lead to or cause death. Nonetheless, society has perceived death as a negative event and something to be feared. Discussions related to death and dying are considered taboo and avoided. Although older adults are in their last phase of life, death is still something that is often feared, not discussed and continues to be the “elephant in the room” no matter the age.

Older adults who are dying are considered to be nearing or at the end of life. The time period from the time a person is known to be dying until they die is known as *the end of life*. There is no real consensus on when the period of time known as the end of life really begins. Although it is known that the end of the end of life period commences with the death of a person, it is less clear when it really begins and how that should ideally be determined. The lack of truly being able to define

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when the end of life begins is one of the main barriers associated with providing quality end of life care. Some older adults are afflicted with illnesses in which the exact end of life period is not as clear as with other medical conditions. End of life care has been included alongside other terminology such as terminal, hospice and palliative care, and has been defined as specialized medical care that is given to a patient who is dying [3].

The length of the end of life period will vary among individuals. For some older adults, the end of life period will be shorter. Patients who suffer some type of acute trauma, such as a fall or automobile accident, or acute illness event, such as a myocardial infarction, may only have an end of life period lasting a few minutes, hours or days. For others, such as older adults who are diagnosed with heart failure or Alzheimer's disease, the end of life period can be much longer and can last several months or even years. Regardless of the length, the end of life is a time in which specialized medical care is needed in order to ease suffering and improve quality of life. The medical care that older adults receive during this time should focus on comfort rather than with the goal of curing the underlying illness. Usually by the time an older adult is considered to be at the end of life, death is anticipated and highly likely in the near future and most often the goals of medical care will ideally shift to a more comfort oriented model.

HISTORICAL PERSPECTIVES

Historically, death usually occurred suddenly, often only days from the onset of illness. Infectious and communicable diseases such as smallpox, diphtheria and cholera were the predominant causes of death back in previous centuries [4]. The average life expectancy was much younger than in the present day, around 50 years of age [5]. The majority of deaths occurred in the home rather than the hospital with care that was provided from family members rather than health care workers. The period of time known as the end of life, was often quick with death occurring in a familiar home environment. Medical science was just beginning to develop which subsequently provided few or no options available to "save" or prolong a person's life. When someone became afflicted with an illness or infectious disease, they would die. Family members were always present witnessing much of the dying process and death of their loved one, which greatly differs from the present day. In the late 1800's and early 1900's, there was a rapid growth in the development of medicine and in the way the sick were cared for. Hospitals were being built all over the country and were now the new place where the dying went for care and died [6].

Death in Contemporary Society

At the turn of the 20th century, significant advancements in medicine, education, and technology helped to switch the focus of care solely from providing comfort to the dying to being able to offer a partial or complete cure for many illnesses. The development of antibiotics and immunizations enabled people to become cured from many diseases that once caused certain death. The lifespan started to increase and infant mortality began to decrease, both of which are fairly good indicators about the health of a nation [5]. Chronic illnesses, such as heart disease and stroke, replaced communicable diseases as the main causes of death. In the United States today, heart disease, cancer, respiratory diseases and strokes are the top four causes of death [1]. People are often able to live many years with a chronic disease; however, it can significantly impact the overall quality of the remaining lifespan of an older adult.

Although older adults are living longer due to advances in medical science, there is also a downside. Due to the various options available to manage most illnesses, there is now difficulty in knowing when it is no longer appropriate to continue aiming for a cure. Even with the best treatment options, the natural course of disease will progress and eventually cause death. As witnessed through the news media, medical treatments are often continued beyond the point of providing benefit to the patients' life quality and instead can contribute to an increased burden and prolonged suffering.

Illness Trajectories in End of Life Care

Although individuals each have their own unique illness experience, there are some commonalities associated with the course of various types of illnesses. Since trajectory is defined as “a course”, illness trajectory can be defined as “a course of illness” and is the usual pattern or progression of an illness or disease. It is important for the health care professional who works with older adults to understand illness trajectories for several reasons. By understanding which type of illness trajectory a patient has, it will help the health care professional be able to provide answers for two important and common questions many patients have including, “how long have I got?” and “what will happen?” [7]. Older adults, and patients of any age in general, want to know what will happen to them when they are diagnosed with an illness. This is especially true if the illness is something that is not curable and the patient will have to live with that chronic illness for the rest of his/her life. The other reason that illness trajectory is an important concept health care professionals should understand is because type of trajectory can provide information as to when the patient may be nearing or at the end of life.

SUBJECT INDEX

A

Ability 21, 26, 27, 28, 30, 31, 33, 34, 35, 43, 44, 47, 52, 53, 55, 73, 78, 81, 84, 90, 98, 106, 109, 110
 fluid 52
 individual's 84
 reasoning 52, 53
 verbal 53

Accounts, disabled individuals 13

Action pictures 108, 109

Activities of daily living (ADLs) 7, 9, 10, 11, 12, 14, 15, 28, 56, 64, 69, 72, 77, 89, 127

Adults 9, 10, 16, 26, 31, 34, 45, 55, 84, 86, 96, 98, 132
 middle-aged 55
 young 98

Adults age 30, 34, 88, 91

Affordable care act (ACA) 17

Age differences 47, 49, 50

Ageing results 4, 5

Age-related changes 31, 32, 39, 40, 44, 46, 47

Age-related differences 40

Age-related macular degeneration 32, 75, 76, 77, 81

AGEs 76

Aging 22, 25, 36, 56, 98
 healthy 22, 56, 98
 normal 56, 98
 physical 25, 36

Aging adults 31, 34, 98
 healthy 98

Aging changes 26, 28, 29

Aging demographics 7

Aging parents 10

Aging process 33, 36, 72, 96

Aging research 4, 41, 42

Aging vision research 76

Agrammatism 106, 107

Airway entrance 118

Alzheimer's disease 12, 35, 88, 124, 126

Alzheimer's disease related dementias (ADRD) 12

AMD patients 76

Amyloid-beta 88

Anagram, copy and recall therapy (ACRT) 109, 110

Anagrams 107, 109, 110

Angiotensin/TIE2 74

Annual savings 17

Anorexia 61, 131, 133

Anorexia and cachexia 131, 133

Antiresorptive agents 67, 68

Anxiety 28, 88, 131, 132, 141

Aphasia 96, 99, 100, 101, 102, 103, 106, 107, 109
 severe 107

Aphasic perseveration 101, 102

Apnea 84

Appetite 81, 131, 133, 139

Artificial nutrition 133, 138

Aspiration 115, 116

Assistance 7, 9, 10, 11, 12, 14, 15, 70, 100, 104, 105, 127, 128
 personal care 7
 verbal 105

Atrophy 26, 27, 28, 80

Attention network test (ANT) 43

Automatic enrollment 20

Availability of informal caregivers and constraints 9

Average life expectancy 3, 124

B

Baby boom generation 7

Benign prostatic hypertrophy (BPH) 29

Benzodiazepines 90, 134

Bereaved individuals 142

Blood vessels 28, 29

Bolus, cold 116

Bone destruction 60, 61, 69

Bone formation 61, 62, 67

Bone fracture 62, 64, 65, 69

Bone mineral content 26, 27

Bones 26, 27, 33, 60, 61, 66, 67

Bone stimulatory 67, 68

Breath, shortness of 28, 131, 132, 133, 138

Subject Index

Breathing, disordered 84, 88
Breathing tube 137
Burden, economic 8, 9, 12, 16, 17

C

Cachexia 131, 133
Caffeine 90
Calcium 30, 66, 67, 69
Canadian task force on preventive health care 73
Cardiac arrest 136, 137
Cardiovascular changes 25
Cardiovascular disease 11, 86, 87
Care 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 56, 62, 64, 69, 70, 96, 124, 125, 126, 127, 128, 129, 130, 133, 136, 138
 acute 9, 96
 focus of 125, 133
 goals of 127, 128, 129, 130, 138
 hospice and palliative 124, 130
 hours of 12, 14
 individual 127
 informal 9, 12
 modes of 127, 130
 personal 7, 8, 9
Caregivers 7, 8, 9, 10, 11, 12, 110, 111, 113, 114, 119
 unpaid 7, 8, 12
Caregivers of people 12
Caregiver training 111, 114
Caregiving experience 10, 11
Caregiving responsibilities 10, 11
Care providers, primary 62, 63, 69
Care recipients 9, 10, 11, 12
Care services, long-term 7, 8, 14
Cataracts 31, 32, 74
Cataract treatment 74
Cerebrovascular Accident (CVA) 101
Chest compressions 137
Choroidal vessels 75
Chronic disease 22, 69, 70, 125
Chronic pain 60, 68, 89
Cloud-angle glaucoma 32
Cognitive Changes 39, 40
Cognitive dysfunction 87, 88

Recent Advances in Geriatric Medicine, Vol. 2 147

Communication 96, 98, 99, 100, 101, 102, 106, 107, 109, 110, 111, 112, 114, 115, 118, 137
 address patient's 107
 functional 107, 109, 110, 112
 neurogenic 96, 99
Communication board 99, 100
Communication drawing program (CDP) 107, 109
Communication strategies 114
Community setting 9, 11, 63, 73
Complex treatments 69, 70
Complicated grief 140
Conditions, chronic disabling 9, 12
Confrontation naming 101, 102, 110
Consequences 27, 28, 45, 52
Correlations 41
 negative 41
 positive 41
Cross-sectional study 48, 49, 88, 89
Crossword puzzles 41
 solving 41

D

Daytime sleepiness 84, 85
 excessive 84
Death 53, 126, 134, 135, 137, 139, 142
 entry-reentry 126
 expected 126
 impending 53, 134, 135, 139, 142
 natural 137
 surprise 126
Decisions 52, 97, 98, 100, 111, 128, 136, 138
 clinical 97, 98
Delayed repetition 105
Delirium 39, 42, 131, 132, 133, 134
 terminal 131, 133, 134
Demands, older adult 22
Dementia 9, 11, 12, 14, 39, 41, 42, 55, 87, 88, 96, 99, 111, 112, 113, 114, 115, 129, 133
 late stages of 112, 113
 middle stage of 111
 severe 112, 113
 stages of 111, 114
Dementia-associated communication problems 99

Demographic changes 8, 18, 19
 Diabetic retinopathy 76, 79, 80, 81
 advanced 80
 Disability, lower lifetime 22
 Disease, devastating 60, 63, 65, 68
 Disease process 61, 62, 63, 65, 68, 69
 Disease progression 63, 88, 126
 Disorders, chronic sleep 84
 Dyslipidemia 76
 Dysphagia 96, 115, 117, 131

E

Economic consequences of aging 12, 17
 Economic factors 18
 Edema, macular 80, 81
 End-of-life goals 100
 End of life nursing education consortium
 (ELNEC) 128, 142
 Episodic memory 49, 50, 98, 112
 Estrogen 61
 Evidence based practice (EBP) 97, 98, 101, 118
 Executive attention 43
 Exercises 60, 66, 70, 117
 bearing 60, 66, 70
 motion 117
 Extending disability 22

F

Facial apraxia 107
 Family caregivers 9, 10, 12
 Family issues 123
 Financial challenges 12, 15, 21, 22
 Financial resources 18, 19, 20
 landscape of 18, 19, 20
 Financing LTSS 16, 17

G

Gender gap 7
 Glasses, reading 78, 79
 Glaucoma 32, 74, 75
 warning signs of 74
 Grief 134, 139, 140, 141, 142
 anticipatory 140, 142
 chronic 140

 disenfranchised 141
 manifestations of 139, 141
 unresolved 141
 Grief and bereavement 139
 Grief reactions 140, 141
 normal 140
 Gross domestic products (GDP) 9, 18

H

Health 3, 7, 9, 11, 12, 13, 15, 17, 19, 21, 23, 53,
 64, 68, 84, 87, 90, 125, 131, 135, 140
 cardiovascular 87
 spiritual 131, 135
 Healthcare costs 7, 16
 total lifetime 16
 Health care professionals 111, 127, 131, 133,
 136, 139
 Health care providers 36, 62, 132, 138
 Health care systems 136, 142
 Health care workers 124
 Healthier individuals 22
 Health risk factors 19
 Healthy lifestyles 22
 Hearing changes 33, 54
 Hearing loss 33
 Heart disease 35, 87, 125, 129
 coronary 87
 Heart failure 124, 130, 131
 Hemisphere, left 103
 History of geriatrics 3
 Hospice care 128, 129, 130
 Hospice programs 129, 142
 Hospice team 100
 Hydration 133, 138
 Hyperglycemia 76
 Hyperpigmentations 75
 Hypertension 19, 25, 27, 34
 Hypnotic medication 90
 Hypoxia 88, 89

I

Illness 10, 14, 25, 124, 125, 126, 127, 128, 129,
 130, 131, 132, 133, 137, 142, 143
 chronic 10, 14, 125, 126
 life-limiting 128

terminal 126, 128, 129, 130
 Illness progression 126, 127
 Illness trajectories 125, 126, 127
 Immediate reform 21, 22
 Immune system 25, 35, 36
 adaptive 35
 innate 35
 Implications 7, 12, 18, 19, 20, 21, 96
 important 18, 19
 Implicit memory 48, 49
 Incontinence, urinary 28
 Individual care setting 136
 Individual differences 26, 53
 large 53
 Individuals age 7
 Individual's biology 36
 Individuals communication 119
 Individuals focus 66
 Informal caregivers 9
 Information 41, 42, 43, 44, 46, 47, 48, 49, 52,
 55, 62, 65, 69, 70, 98, 112, 113, 125, 134
 to-be-remembered 46, 47
 Information processing models 46
 Inpatient hospitalizations for life-sustaining
 treatments 129
 Insomnia 84, 90, 139, 141
 Instrumental Activities of Daily Living
 (IADLs) 7, 11, 14, 15, 56
 Intact long-term memory ability 112
 Intake, oral 116, 117
 Intelligence 42, 51, 52, 53, 55
 crystallized 52, 53
 fluid 52, 53
 lifelong 55
 mechanics of 53
 pragmatics of 53
 Intelligence measure 52, 53, 54
 Interventions 32, 33, 66, 103, 111, 130, 133,
 134, 136, 137, 138, 139
 direct 111
 medical 136, 137, 138
 Interventions for comfort and palliative care
 137
 Intraocular pressure, increased 80

L

Labor force 10, 21
 Labor market 11, 21
 Laser treatment 80
 focal 80
 scatter 80
 Lean tissues 26
 Levels, individual's activity 26
 Life 30, 81, 100, 123, 124, 125, 127, 128, 129,
 130, 131, 133, 138
 developmental stage of 123
 improving quality of 128, 129, 130
 patient's quality of 100, 138
 quality of 30, 81, 124, 125, 127, 128, 131, 133
 Life care programs 128, 130
 Life expectancies, longer 10, 13
 Life expectancy 3, 7, 130
 Life history timeline 113
 Life history videos 114
 Life period 123, 124, 126
 Lifestyle choices and personal habits 84
 Lifetime costs 16
 Lifetime earnings results 20
 Long-term care 9, 12, 13, 14, 15, 22, 65
 Long-term care costs, incurring 13
 Long-term care expenditures 13
 Long-term care risks 14
 Long-term care workforce 8
 Long-term memory 39, 45, 46, 48, 49, 50
 Loss 27, 61, 67, 69, 140, 141
 bone 27, 61, 67, 69
 recent 140, 141
 Loss of independence 139, 140
 Loss of muscle strength 26
 Low vision aids (LVAs) 77, 78, 79
 LTCI policies 14, 15
 LTC spending 13
 LTSS, expected costs of 16
 Lymphocytes 35
 Lysine 74

M

Macular degeneration 75, 81
 dry age-related 75

late age-related 75
 wet age-related 75
 Magnifying reading glasses 77, 78
 Medical order for life sustaining treatment (MOLST) 137
 Medical treatments, life-sustaining 129
 Medicare population 8, 9
 Medication management 10, 11, 14
 Memory 39, 42, 45, 46, 47, 48, 49, 50, 52, 55, 88, 99, 109, 111, 112, 113, 115
 declarative 49
 explicit 48
 immediate 46, 47, 48, 50
 nondeclarative 49
 retrospective 50
 short-term 39, 46, 47
 working 47, 52
 Memory prosthesis 111, 113
 Memory tasks 45, 54
 Memory trace 45, 46
 Mortality rates 19
 Motor control, oral 117
 Multidisciplinary approach 3
 Muscle strength 26, 115

N

National health and aging trends study 12
 National health and nutrition examinations survey (NHANES) 19
 National hospice and palliative care organization (NHPCO) 129, 130
 National sleep foundation (NSF) 84
 Naturalistic setting 50, 51
 Natural killer (NK) cell 35
 Nervous system, autonomic 30
 Nicotine 89, 90
 Nonfluent individuals 106
 Nonimmigrants 19
 Nursing home care 13, 15
 Nursing home entry 15
 Nutritionist 69

O

Occupational therapist 69, 70
 Older adults 43, 46, 48, 51, 87

healthy 43, 46, 51
 non-demented 87
 outperformed 48
 Older adults experience 74
 Olfaction 33
 Oropharyngeal structures 96, 117
 Osteoblasts 61
 Osteopenia 25, 26, 60, 65, 66, 67, 69, 70
 diagnosis of 67
 Osteoporosis 62, 63, 65, 67, 68, 69, 70
 cost of 65
 diagnosis of 65, 67, 70
 risk factors of 62
 secondary 63
 treatment of 68, 69

P

Pain management 131, 132
 Palliative care 123, 124, 128, 129, 130, 137
 Palliative care and hospice 127
 Palliative care programs 128
 Payroll tax cap 22
 Perimenopause 28
 Personal retirement accounts (PRAs) 18
 Phonological loop 47
 Photocoagulation, panretinal 80
 Photoreceptors 31, 76
 Physical activities 22, 27, 64, 91
 Physical therapists 5, 65, 66, 69
 Pittsburgh sleep quality index 85
 Policyholders 14
 Polysomnography 84, 85, 89
 Population, geriatric 5, 91
 Presbycusis 32, 33
 Presbyopia 31, 40, 73
 Preventive health care 73
 Private LTCI 13, 16
 Probe question 104, 105
 Procedural memory 46, 48, 49
 Processing resources 45
 Program, healthcare 89
 Propensity 90
 Prospective memory 46, 50, 51
 time-based 50, 51
 Proteins, damaged 74
 Providers, healthcare 8, 63, 69, 137

R

Randomized control trial (RCT) 97
 Ranibizumab 81
 Reactions, individual's bereavement 140
 REM sleep 85, 91
 Restless leg syndrome (RLS) 84
 Retinal pigment epithelium (RPE) 75, 76
 Retinopathy 72, 79
 Retirement income 17, 20
 Retirement plans 20
 Retirement savings 18, 19, 20, 21
 Retirement savings plans 20, 21
 Right hemisphere 102, 103
 Risk factors 62, 63, 65
 modifiable 62, 63
 non-modifiable 62, 63, 65
 Risk factors for osteoporosis 64

S

Sarcopenia 25
 Semantic memory 49
 Sensory changes 25, 72, 73
 Sensory memory 46
 Sentence production program for aphasia (SPPA) 101, 106
 Short term memory 46, 47, 98
 Skilled nursing facility (SNF) 9, 96
 Sleep 84, 85, 86, 87
 insufficient 84, 86, 87
 rapid eye movement 85
 Sleep architecture 85, 86
 Sleep behaviors 86
 Sleep cycle 85, 91
 Sleep disorders 84, 85, 86, 87, 91
 diagnosis of 84, 85
 Sleep disturbances 85, 86, 87, 88, 89, 90, 91
 Sleep duration 85, 87
 Sleep hygiene 84, 89, 90
 Sleep hygiene practices 89, 90
 Sleep problems 86, 90
 Sleep quality 86, 89, 91
 Sleep research 84
 Sleep stages 84, 86
 Sleep studies 84

Sleep time 86, 87, 89, 91
 adequate 87
 total 89, 91
 Slow wave sleep 88, 91
 SLP and patient 104, 105
 SLP fades 104, 105
 SLPs roles 99, 100
 Social security funds 22
 Social security system 12, 17, 18, 19, 20, 21, 22
 Social workers 69, 70, 129
 Sociological change 7
 Space retrieval training (SRT) 111, 112, 113
 Speech Language Pathologists (SLPs) 96, 97, 98, 99, 100, 101, 102, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119
 Spiritual care 135, 136
 Spoiled food 34
 Sprechgesang 105
 Stages of development 123
 Swallowing disorders 96, 98, 99, 115
 System 8, 9, 22, 27, 74, 129
 healthcare 8, 9, 22
 life care delivery 129
 respiratory 27
 ubiquitin proteolytic 74

T

Tasks 41, 42, 43, 44, 45, 47, 48, 50, 53, 54, 56, 98
 cognitive 41, 42
 recall 48, 50
 recognition 48, 54
 Tax deductibility 16
 Tax rates, payroll 18, 19
 Tax revenues 22
 Telescopes, spectacle-mounted 79
 Tests, screening 60, 65
 Theories of aging 3
 Thickness, central retinal 77
 Tolerance levels, individual 90

U

Unison singing 104

United states preventive services task force
(USPSTF) 73
Urinary tract infections (UTIs) 28
Useful field of view (UFOV) 74

V

Vignettes 55
Vision 30, 31, 73, 74
impaired 73, 74
quality of 30, 31

Vision changes 72, 73
Visual acuity 30, 72, 73, 79, 80, 81
Visual aids 72, 77, 78
Visual field 75
Visuospatial sketchpad 47
Vitrectomy 80

W

Word retrieval problems 102



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