Third Edition

Nutrition for the Older Adult

Melissa Bernstein and Nancy Munoz

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To the memory of my father, Stephen Allen, who continues to be a source of inspiration to me.

—Melissa Bernstein

To my husband, Pedro, my son, Peter, and my daughter, Samantha, who are "the wind beneath my wings."

—Nancy Munoz

Brief Contents

Contents

Preface

In 2030, when the last baby boomer turns 65, the demographic landscape of our nation will have changed significantly. One of every five Americans—approximately 72 million people—will be an older adult. With the number of older adults on the rise, we are pleased to bring you this third edition of *Nutrition for the Older Adult*, a book that fills a much-needed role in the textbook market.

Approach of This Text

Because nutrition-related information for older adults is continually expanding with ongoing and exciting scientific research in the areas of medicine and nutrition, this book serves as an introduction to the subject. Our objective is to educate students and those working with older adults so that we can share the common goal of providing the highest quality nutritional care to promote healthy lives and successful aging for all adults.

Nutrition for the Older Adult lays the foundation for the nutritional care of older adults by making expert information available while also providing an introduction to older adult nutrition for students in nutrition and dietetics as well as in the health sciences more generally. In addition, *Nutrition for the Older Adult* can be utilized by health professionals who are currently working with older adults, as well as by those interested in learning more about nutritional connections to the diseases and disorders common in this population.

Organization of This Text

The format of the book is straightforward. The book contains succinct chapters written by experts in the fields of nutrition and clinical health care of older adults. It presents current and up-to-date research and evidence-based guidelines from the scientific and medical literature to guide medical nutrition therapy. To bring nutrition alive to the reader, we discuss nutritional disorders that are seen in community-dwelling and institutionalized older adults.

New to This Edition

We have made many significant improvements in this third edition of *Nutrition for the Older Adult*. Most notably, we have significantly increased the number of pedagogical features found in the text to include interprofessional Viewpoint features highlighting topics unique to the older adult population, sample ADIME notes, and section preview and recap statements. Additionally, a student-centered Learning Portfolio has been added at the end of each chapter, now containing study and discussion questions.

Additionally, each chapter has been thoroughly updated to reflect the most current science and research. Content new to this edition includes the following:

- Chapter 1 has been updated with current statistics on the aging population and aging minorities.
- Chapter 2 includes a revised section on the theories of aging; new and expanded sections on aging and epigenetics, caloric restriction, and life span; and a revised table on age-related changes and nutrient needs.
- Chapter 3 now features a table that includes the grams of carbohydrate, fiber, and calories in common complex carbohydrate foods.
- Chapter 4 includes expanded sections on Vitamin D metabolism and other B vitamins.
- In Chapter 6, the Administration for Community Living objectives have been added, and physical activity recommendations for older adults are revised to reflect 2018 guidelines.
- Chapters 7–16 now include sample ADIME notes. Learning objectives were added to include application of the nutrition care process for diagnosis and intervention. Case studies have been updated to enhance classroom and online discussion.
- Chapter 7 includes information on nutrition-focused physical exams.
- Chapter 8 now includes information on gallstone disease.
- Chapter 14 has been fully revised to include new pressure injury nomenclature and staging

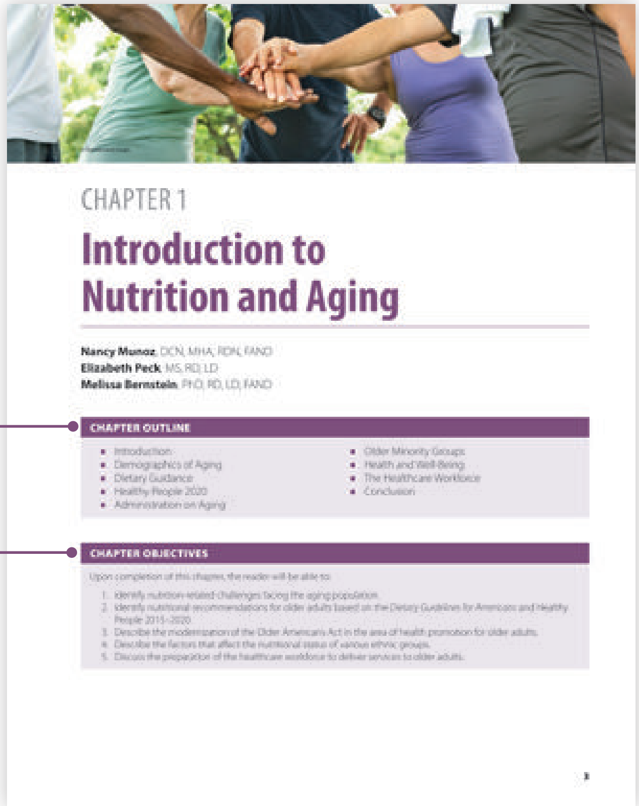
definitions introduced in 2016 by the National Pressure Ulcer Advisory Panel.

- Chapter 15 now includes information on osteomalacia.
- Chapter 16 has been updated to include information on sarcopenia.
- Chapter 17 includes information on common dietary supplement and drug interactions.

Features of This Text

Each chapter contains an array of pedagogical features to facilitate active engagement with the content.

- The **Chapter Outline** at the beginning of each chapter gives readers a preview of topics that will be covered.
- **Chapter Objectives** focus the reader on the key concepts of each chapter and the material that they will learn.
- Each section begins with a **Preview** statement, giving the reader a sense of what content to expect.


CHAPTER 1

Introduction to Nutrition and Aging

Nancy Munoz, DCN, MHA, RDN, FAND
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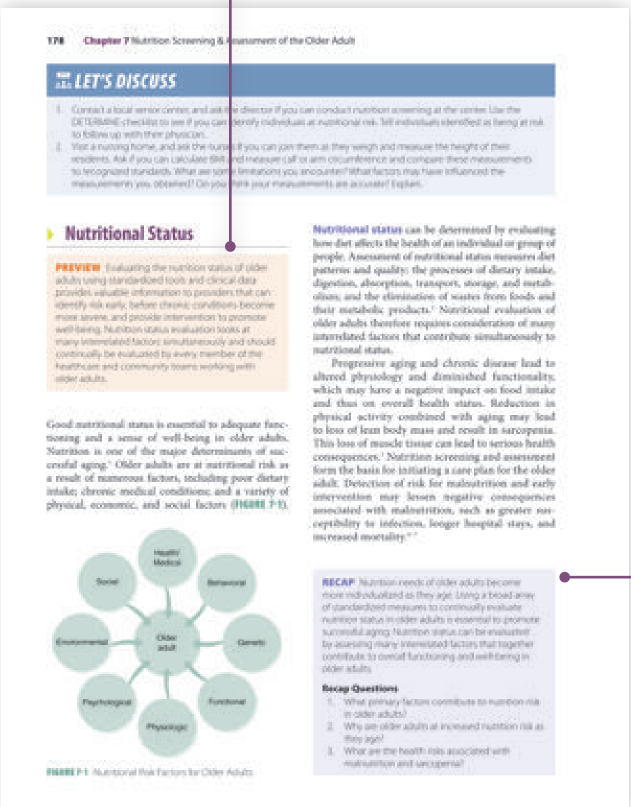
CHAPTER OUTLINE

- Introduction
- Demographics of Aging
- Dietary Guidance
- Healthy People 2020
- Administration on Aging
- Older Minority Groups
- Health and Well-Being
- The Healthcare Workforce
- Conclusion

CHAPTER OBJECTIVES

Upon completion of this chapter, the reader will be able to:

1. Identify nutrition-related challenges facing the aging population.
2. Identify nutritional recommendations for older adults based on the Dietary Guidelines for Americans and Healthy People 2015–2020.
3. Describe the modernization of the Older Americans Act in the area of health promotion for older adults.
4. Describe the factors that affect the nutritional status of various ethnic groups.
5. Discuss the preparation of the healthcare workforce to deliver services to older adults.


178 Chapter 7 Nutrition Screening & Assessment of the Older Adult

LET'S DISCUSS

1. Contact a local senior center, and ask the director if you can conduct nutrition screening at the center. Use the DETERMINE checklist to see if you can identify individuals at nutritional risk. Tell individuals identified as being at risk to follow up with their physician.
2. Visit a nursing home, and ask the nurses if you can join them as they weigh and measure the height of their residents. Ask if you can calculate BMI and measure calf or arm circumference and compare these measurements to recognized standards. What are some limitations you encounter? What factors may have influenced the measurements you obtained? Do you think your measurements are accurate? Explain.

Nutritional Status

PREVIEW Evaluating the nutrition status of older adults using standardized tools and clinical data provides valuable information to providers that can identify risk early, before chronic conditions become more severe, and provide intervention to promote well-being. Nutrition status evaluation looks at many interrelated factors simultaneously and should continually be evaluated by every member of the healthcare and community teams working with older adults.

Good nutritional status is essential to adequate functioning and a sense of well-being in older adults. Nutrition is one of the major determinants of successful aging. Older adults are at nutritional risk as a result of numerous factors, including poor dietary intake; chronic medical conditions; and a variety of physical, economic, and social factors (FIGURE 7-1).

Nutritional status can be determined by evaluating how diet affects the health of an individual or group of people. Assessment of nutritional status measures diet patterns and quality; the processes of dietary intake, digestion, absorption, transport, storage, and metabolism; and the elimination of wastes from foods and their metabolic products. Nutritional evaluation of older adults therefore requires consideration of many interrelated factors that contribute simultaneously to nutritional status.

Progressive aging and chronic disease lead to altered physiology and diminished functionality, which may have a negative impact on food intake and thus on overall health status. Reduction in physical activity combined with aging may lead to loss of lean body mass and result in sarcopenia. This loss of muscle tissue can lead to serious health consequences. Nutrition screening and assessment form the basis for initiating a care plan for the older adult. Detection of risk for malnutrition and early intervention may lessen negative consequences associated with malnutrition, such as greater susceptibility to infection, longer hospital stays, and increased mortality.

Health/Medical
Behavioral
Genetic
Functional
Physiologic
Psychological
Environmental
Social
Older adult

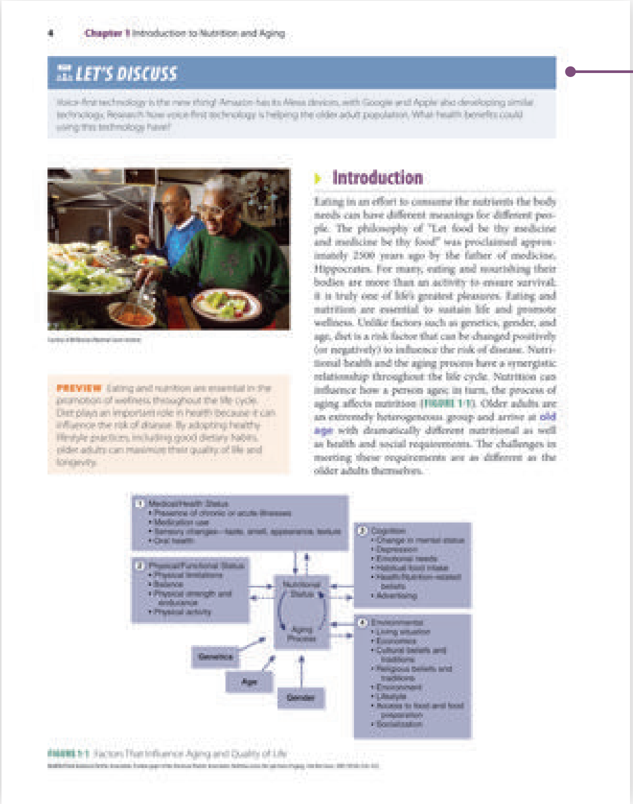
FIGURE 7-1 Nutritional Risk Factors for Older Adults

RECAP Nutrition needs of older adults become more individualized as they age. Using a broad array of standardized measures to continually evaluate nutrition status in older adults is essential to promote successful aging. Nutrition status can be evaluated by assessing many interrelated factors that together contribute to overall functioning and well-being in older adults.

Recap Questions

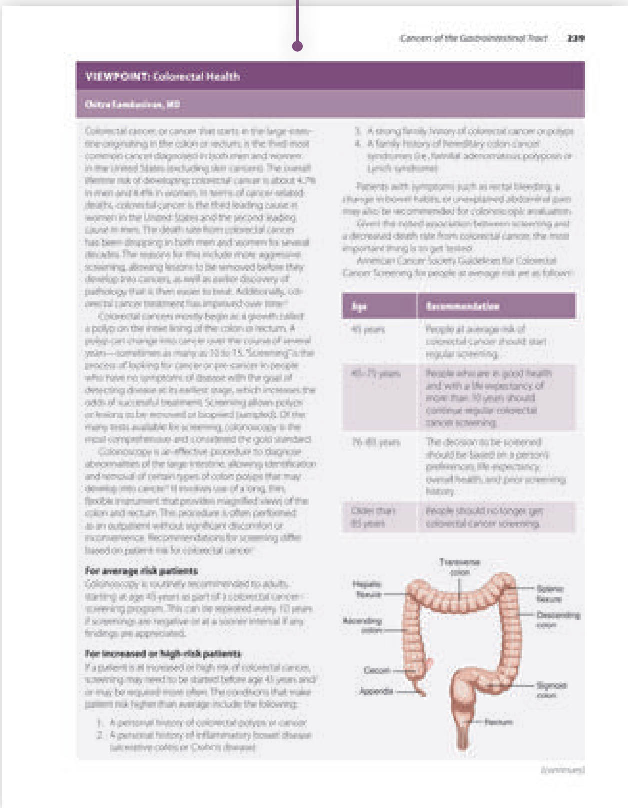
1. What primary factors contribute to nutrition risk in older adults?
2. Why are older adults at increased nutrition risk as they age?
3. What are the health risks associated with malnutrition and sarcopenia?

- **Recap** boxes summarize each section and include questions to engage the reader.



- **Let's Discuss** features provide discussion points for the reader to consider as he or she delves into the content.

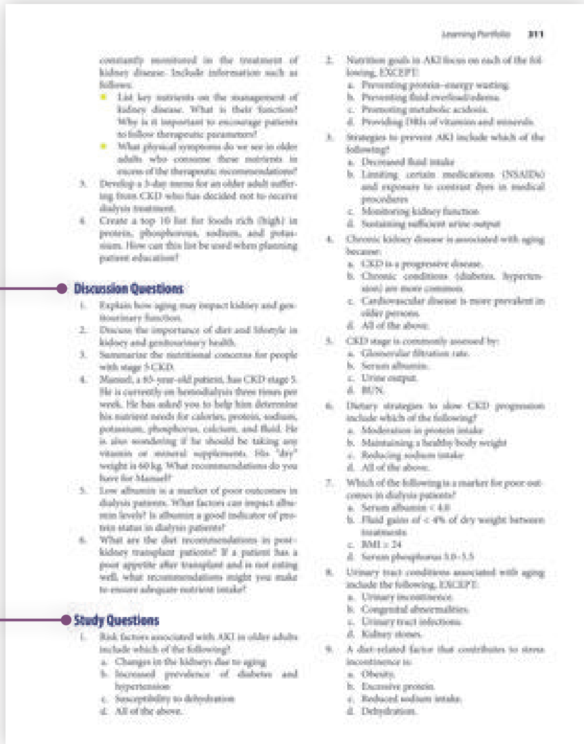
- Each **Viewpoint** feature provides the perspective of a professional who works with older adults. These professionals come from a variety of fields both within and outside the health care professions.



- Select chapters present sample **ADIME** notes relevant to the content. ADIME—**A**ssessment, **D**iagnosis, **I**ntervention, and **M**onitoring/**E**valuation—is a standardized medical record format utilized by registered dietitian nutritionists to promote high-quality nutrition care.

- At least one **Case Study** appears toward the end of each chapter and illustrates how topics discussed in the text might appear in practice.
- Each chapter concludes with a **Learning Portfolio** containing an array of student-centered resources and activities.
- The Learning Portfolio collects a comprehensive list of **Key Terms and Concepts** specific to the chapter, with definitions appearing in the end-of-text Glossary.
- Suggested **Activities Related to This Chapter** provide additional interactive avenues for grappling with the chapter content.

- **Discussion Questions** provide prompts for greater engagement with the content.
- **Study Questions** provide multiple-choice and true/false questions, testing the reader's knowledge of information covered in the chapter. These can be used for self-assessment or as homework assignments, with answers included in the Instructor's Manual.



Instructor Resources

We have endeavored to enrich your classroom learning by providing instructors and students with a robust package of supplemental materials. These include the following:

- Test Bank, containing more than 800 questions
- Slides in PowerPoint format, featuring 550 slides
- Instructor's Manual, including lecture outlines, instructional aids, classroom activities, and an answer key for the in-text case studies and study questions

All of the authors and contributors who are part of *Nutrition for the Older Adult* have a passion for nutrition to promote healthy aging. We are confident that this text will provide an evidence-based, accurate, and current foundation for the nutritional concerns in older adults.

With the increase in demand for health and nutrition resources and the growing number of older adults, it is our goal for you to advance your knowledge and understanding of the nutritional concerns of older adults and the promotion of healthy living at every age. It is our hope that we can all enjoy long, healthy, and vigorous lives.

Melissa Bernstein
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The completion of this third edition of *Nutrition for the Older Adult* would not have been possible without the guidance, contributions, and support of so many people. We especially appreciate the dedication and tremendous hard work of Eva Kaminski Shaw. Eva's proficient editorial skills, her revision of the test bank, and her assistance in administrative tasks were invaluable to the completion of this revision. We would also like to thank Andrea Brescia for updating the slides in PowerPoint format as well as the Instructor's Manual.

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PART 1

Nutrition Basics


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CHAPTER 1

Introduction to Nutrition and Aging

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Melissa Bernstein, PhD, RD, LD, FAND

CHAPTER OUTLINE

- Introduction
- Demographics of Aging
- Dietary Guidance
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CHAPTER OBJECTIVES

Upon completion of this chapter, the reader will be able to:

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4. Describe the factors that affect the nutritional status of various ethnic groups.
5. Discuss the preparation of the healthcare workforce to deliver services to older adults.

LET'S DISCUSS

Voice-first technology is the new thing! Amazon has its Alexa devices, with Google and Apple also developing similar technology. Research how voice-first technology is helping the older adult population. What health benefits could using this technology have?

Courtesy of Bill Branson/National Cancer Institute.

PREVIEW Eating and nutrition are essential in the promotion of wellness throughout the life cycle. Diet plays an important role in health because it can influence the risk of disease. By adopting healthy lifestyle practices, including good dietary habits, older adults can maximize their quality of life and longevity.

Introduction

Eating in an effort to consume the nutrients the body needs can have different meanings for different people. The philosophy of "Let food be thy medicine and medicine be thy food" was proclaimed approximately 2500 years ago by the father of medicine, Hippocrates. For many, eating and nourishing their bodies are more than an activity to ensure survival; it is truly one of life's greatest pleasures. Eating and nutrition are essential to sustain life and promote wellness. Unlike factors such as genetics, gender, and age, diet is a risk factor that can be changed positively (or negatively) to influence the risk of disease. Nutritional health and the aging process have a synergistic relationship throughout the life cycle. Nutrition can influence how a person ages; in turn, the process of aging affects nutrition (**FIGURE 1-1**). Older adults are an extremely heterogeneous group and arrive at **old age** with dramatically different nutritional as well as health and social requirements. The challenges in meeting these requirements are as different as the older adults themselves.

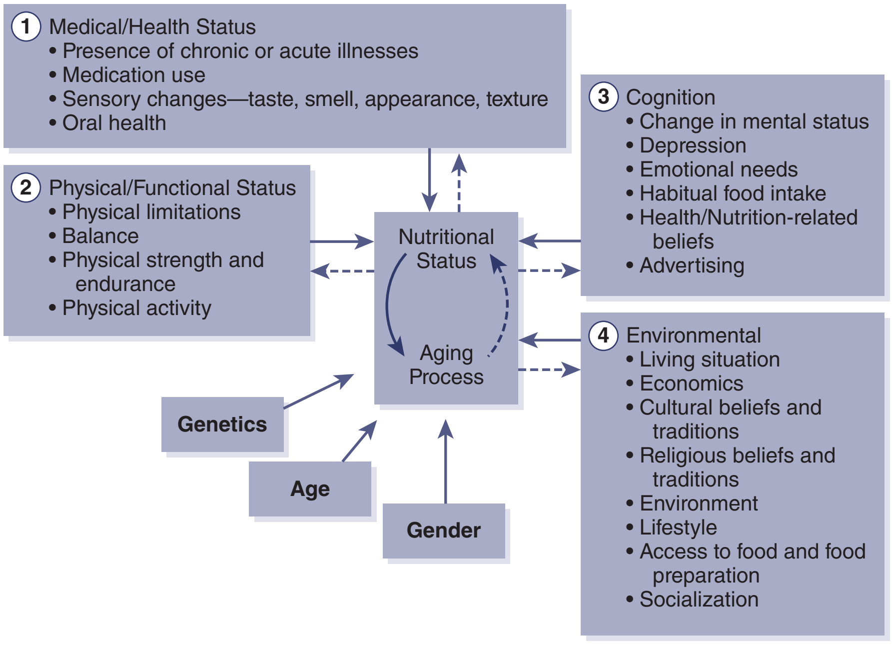


FIGURE 1-1 Factors That Influence Aging and Quality of Life

Modified from American Dietetic Association. Position paper of the American Dietetic Association: Nutrition across the spectrum of aging. *J Am Diet Assoc.* 2005;105(4): 616–633.

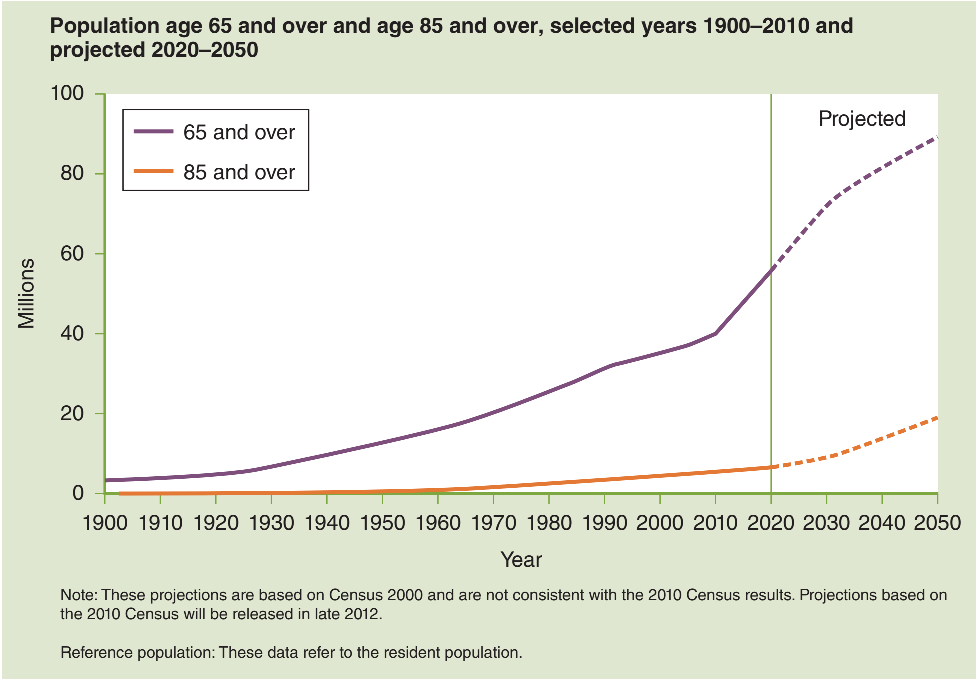


FIGURE 1-2 The Population 65 Years and Older

Reproduced from U.S. Department of Commerce Economics and Statistics Administration. U.S. Census Bureau. Census.gov accessed June 6, 2018. Retrieved from https://www.census.gov/library/visualizations/2017/comm/cb17-ff08_older_americans.html. Accessed June 6, 2018.

In the United States, older adults are the largest growing segment of the population. Ethnic and racial diversity is one of the characteristics of this shift in population. In 2015, 22% of adults older than age 65 years were members of a minority racial or ethnic group.[1] This growth trend in minority populations will continue, and these groups will account for 28% of older adults by 2030.[1] For all age groups, the health status of minority group members has lagged behind that of non-Hispanic white persons. Older adults in minority groups historically have experienced the effects of health disparities more than their younger counterparts. Language and communication barriers, limited access to health care, decreased socioeconomic status, and different cultural norms are some of the challenges that need to be overcome in effort to promote the health and well-being of older adults in an increasingly diverse population.[2] It is of utmost importance that older adults of all groups adopt healthy lifestyle practices and dietary habits to reduce the burden of chronic disease and maximize quality of life and healthy aging.

For the first time in U.S. history, the total number and overall percentage of older adults in the population are unparalleled. By 2060, the number of adults 65 years and older is forecasted to reach 98.2 million people.[1] This is more than double the number of older adults in the United States in 2010.[1,2] In 2010, 40.3 million individuals 65 years and older lived in the United States, representing 13% of the entire population. From 1900 to 2015, the number of older adults in this country increased from 3 million to 47.8 million. Between 2015 and 2040, the number of adults 85 years old and older (considered the "oldest old") is expected to grow from 6.3 to 14.6 million.[1] (See **FIGURE 1-2**.) Since January 1, 2011, and every day thereafter for the next 20 years, 10,000 U.S. citizens will celebrate their 65th birthday. The older population in 2040 is anticipated to more than double the older adult population in 2000, increasing from 35 million to 82.3 million and thus representing almost 22% of the total U.S. population.[1]

Advances in technology and medical care have contributed to increased life expectancy and the explosion of the older adult population.[1] In 2011, 65-year-old older adults had a mean life expectancy of an additional 19.4 years (20.6 years for females and 18 years for males). A child born in 2015 can anticipate living to 78.8 years of age. This is approximately 30 more years than for a child born in 1900.[1]

The baby boomer population (people born between 1946 and 1964) has touched and changed American society in many ways over the years. The sale of commercial baby food in the 1940s, construction of thousands of schools in the 1950s, and housing construction booms in the 1970s and 1980s were driven by baby boomer needs.[3] This cohort of older adults is better educated, better positioned financially, and more nutrition conscious than previous generations have been. **TABLE 1-1** provides 2010 U.S. Census characteristics of adults aged 65 years and older.[4]

TABLE 1-1 Characteristics of the Population Aged 65 Years and Older in the United States (2016 American Community Survey 1-Year Survey)

Subject	Total Population	65 Years and Older
Total population	323,127,515	49,215,165
Sex and Age		
Male	49.2%	44.2%
Female	50.8%	55.8%
Median age (years)	37.9	73.2
Race and Hispanic or Latino Origin		
One race	96.8%	98.9%
White	72.6%	83.1%
Black or African American	12.7%	9.1%
American Indian and Alaska Native	0.8%	0.5%
Asian	5.4%	4.3%
Native Hawaiian and other Pacific Islander	0.2%	0.1%
Some other race	5.1%	1.8%
Two or more races	3.2%	1.1%
Hispanic or Latino origin (of any race)	17.8%	8%
White alone, not Hispanic or Latino	61.1%	77.3%
Marital Status		
Population 15 years and older	262,140,054	49,215,165
Now married, except separated	47.5%	55.2%
Widowed	5.8%	24.2%
Divorced	11%	13.7%
Separated	2%	1.2%
Never married	33.7%	5.6%
Educational Attainment		
Population 25 years and older	218,475,480	49,215,165
Less than high school graduate	12.5%	16.5%
High school graduate (includes equivalency)	27.2%	31.6%
Some college or associate's degree	29%	25.3%
Bachelor's degree or higher	31.3%	26.7%
Disability Status		
Civilian noninstitutionalized population	318,175,867	47,905,788
With any disability	12.8%	35.2%
No disability	87.2%	64.8%

Place of Birth, Citizenship Status, and Year of Entry		
Total population	323,127,515	49,215,165
Native	279,388,170	42,571,346
Foreign born	43,739,345	6,643,819
Entered 2010 or later	18.6%	6.5%
Entered 2000 to 2009	26.7%	8.8%
Entered before 2000	54.7%	84.7%
Naturalized U.S. citizen	48.6%	74.2%
Not a U.S. citizen	51.4%	25.8%
Employment Status		
Civilian population 16 years and older	256,938,305	49,215,165
In labor force	63%	17.6%
Employed	59.4%	17%
Unemployed	3.6%	0.6%
Percentage of civilian labor force	5.8%	3.3%
Not in labor force	37%	84.2%
Income in the Past 12 Months (in 2012 inflation-adjusted dollars)		
Households	118,860,065	29,863,142
With earnings	77.6%	37.2%
Mean earnings (dollars)	83,372	57,131
With Social Security income	31.1%	89.9%
Mean Social Security income (dollars)	18,656	20,362
With Supplemental Security income	5.5%	6.5%
Mean Supplemental Security income (dollars)	9592	9303
With cash public assistance income	2.5%	1.8%
Mean cash public assistance income (dollars)	3057	2861
With retirement income	18.7%	48.8%
Mean retirement income (dollars)	25,829	26,483
With Food Stamp/SNAP benefits	12.4%	8.9%
Poverty Status in the Past 12 Months		
Population for whom poverty status is determined	315,165,470	47,905,549
Below 100% of the poverty level	14%	9.2%
100 to 149% of the poverty level	8.9%	9.6%
At or above 150% of the poverty level	77%	81.2%

Source: Modified from U.S. Census Bureau. American Community Survey. 2016 Washington, DC: U.S. Department of Commerce. https://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_S0103&prodType=table. Accessed August 14, 2018.

Successfully managing the state of aging and health in the United States is a challenge. Caring for an aging population puts a strain on the medical community and the healthcare system itself as the healthcare costs rise to meet new healthcare demands. Providing health care for an older adult is three to five times more costly than providing health care for a younger counterpart. The burden of caring for the older population will increase healthcare spending approximately 25% by 2030.[2] Medicare expenses are projected to increase from $555 billion in 2011 to $902 billion in 2020. Preventive care for older adults can help promote a high quality of life and positively affect healthcare costs. Healthy eating and an active lifestyle are key to maintaining a functional quality of life and preventing chronic health problems.

Many older adults can live independently, maintain close relationships with family and friends, and maintain an active lifestyle while successfully managing chronic health issues; medical care; and shopping for, cooking, and consuming nutritious meals. Most age-related biologic functions peak before age 30 years and progressively decline linearly from that point onward. The biologic change that transpires over time has little to no consequence on activities of daily living. Ailments (sickness), rather than natural aging, are the key triggers of functional decline as individuals age. Some of the decline that occurs with aging can be influenced by lifestyle, behavior, diet, and the environment. As such, these factors can be modified to restore wellness. It is important to note that older adults experience physical and cognitive age-related changes. Age-related physical changes could include reduced or impaired hearing and vision as well as development of chronic diseases such as arthritis, hypertension, heart disease, and diabetes. Cognitive changes, although very different from one individual to the next, can include slowing in the speed at which information is processed.[5]

RECAP Older adults are the largest growing segment of the population, and it is expected that caring for the older population will increase healthcare spending approximately 25% by 2030. In order to live long, healthy, quality lives, healthy eating and an active lifestyle are fundamental.

Recap Questions

1. List modifiable risk factors that impact wellness as we age.
2. Discuss why a healthy lifestyle is important for aging adults.
3. What factors have contributed to increased life expectancy and the explosion of the older adult population?

Demographics of Aging

PREVIEW The older adult population is experiencing major growth, with older adult women outnumbering older adult men. Health promotion in this population can increase quality of life, as well as delay or prevent the physiologic changes that are associated with the leading chronic diseases.

More than 3.5 million people celebrated their 65th birthday in 2015.[1] Older adults comprised 14.9% of the U.S. population in 2015, meaning that more than 1 in every 7 Americans was older than age 65.[1] Conservative estimates predict that the number of adults 65 years and older will grow from 35 million in 2000 to 54.8 million in 2020 and to 98 million in 2060. By 2040, older adults will make up 21.7% of the population.[1] The number of old-old (85 years and older) will also grow immensely—from 4.2 million in 2000 to 6.6 million in 2020 and to 14.6 million in 2040.[1]

Older women outnumber older men. By 2020, it is projected that there will be 31 million women older than age 65 compared to 25 million men of the same age.[6] The number of older adults in the population differs significantly by state. In 2015, more than half of the adults 65 years or older lived primarily in 10 states: California (5.2 million); Florida (3.9 million); Texas (3.2 million); New York (3.0 million); Pennsylvania (2.2 million); Ohio (1.8 million); Illinois (1.8 million); Michigan (1.6 million); North Carolina (1.5 million); New Jersey (1.3 million); and Georgia, Virginia, Arizona, Massachusetts, Washington, and Tennessee each had well over 1 million.[1] (See **FIGURE 1-3**.) Eighty-one percent of adults 65 years and older lived in metropolitan areas in 2014.[1] Most of these adults (53%) resided outside main cities, whereas 27% dwelled inside major cities. Only 20% of older adults lived outside of urban regions.[7] Over time, the scholastic level of older adults is increasing. From 1970 to 2016, the percentage of older adults who had finished high school increased from 28% to 85%. In 2016, approximately 28% of older adults had a bachelor's degree, and 90% of non-Hispanic whites had finished high school.[1]

These statistics emphasize the importance of ensuring adequate nutritional intake for all older adults as an essential factor in promoting health and well-being, maintaining functional independence, and preventing malnutrition and related comorbidities such as increased susceptibility to illness and impaired immune function. The cost of providing healthcare services for one person older than 65 years is three times higher than the cost of providing health

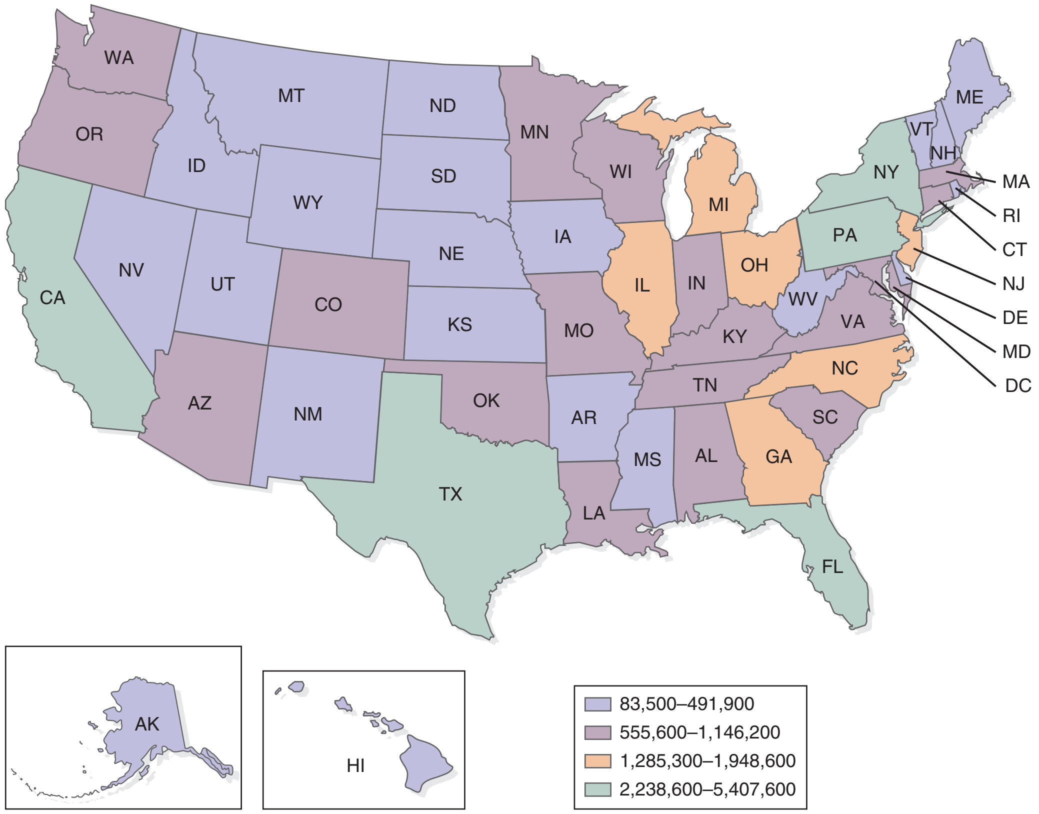


FIGURE 1-3 States with the Highest Older Adult Populations

Reproduced from Henry J. Kaiser Family Foundation. Population Distribution by Age. 2017. Accessed March 19, 2018. Retrieved from https://www.kff.org/other/state-indicator/distribution-by-age/?activeTab=map&currentTimeframe=0&selectedDistributions=children-0-18&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D. Accessed March 19, 2018.

care for younger adults.[3] It is estimated that by 2030, healthcare spending will rise by 25%. This cost will be directly related to the large number of older adults in the U.S. population.[3]

In older adults, some physiologic changes that are associated with the leading chronic diseases and even death are often avoidable or can be delayed. Healthcare providers have many opportunities to develop plans of care that can help older adults to promote and maintain their health. To do so, providers must broadly apply their professional knowledge to reduce the risk and debilitating effects of chronic disease. Death as a terminal outcome is inevitable, but the incidence of chronic illnesses and the decline and disability normally linked with them can be decreased. Research shows that a healthy lifestyle that includes abstaining from tobacco, being physically active, and consuming a healthy diet drastically reduces the chance of developing heart disease, cancer, diabetes, and other chronic illnesses.[8]

The National Center for Chronic Disease Prevention and Health Promotion of the Centers for Disease Control and Prevention (CDC) lists eating fruits and vegetables daily as a health status indicator. Diets high in fruits and vegetables decrease the possibility of being diagnosed with some cancers and chronic diseases, such as diabetes and cardiovascular disease. Fruits and vegetables offer necessary vitamins and minerals, fiber, carotenoids, and other phytochemicals known to promote health.[9] The State of Aging in America 2013 reports that a larger number of adults 65 years and older consume five or more fruits and vegetables every day when compared to other age groups.[3]

At times, older adults might find it difficult to meet their nutritional needs because of increased requirements for some nutrients and an overall decreased energy need. Numerous barriers to adequate food intake complicate the task of maximizing nutrition in older adults (**FIGURE 1-4**). Multiple chronic and acute illnesses; changes in absorption and digestion; polypharmacy; low levels of physical activity; lifelong habits and food preferences; social factors; changes in functional status and dependency; impaired mental status; and problems with oral health, chewing, and swallowing have all been shown to influence the eating habits and nutritional status of both institutionalized and noninstitutionalized older adults.[10–14] Age-related complications that could interfere with food intake accentuate the need for multiple food choices to increase variety and maximize nutritional intake.

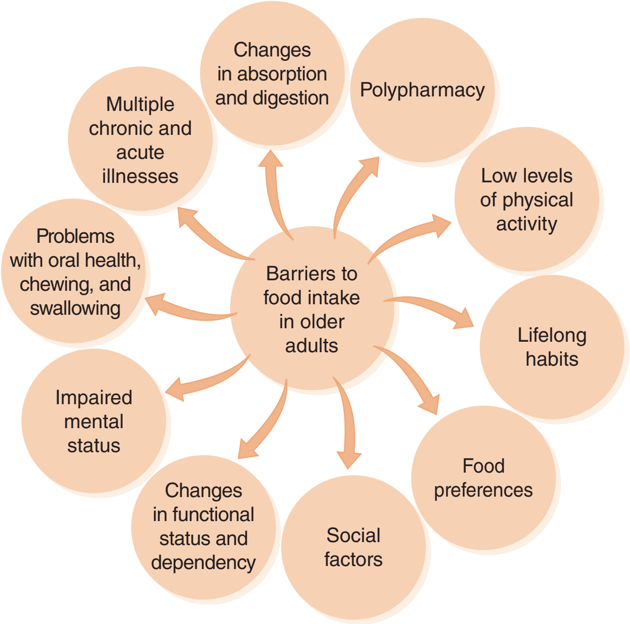


FIGURE 1-4 Barriers to Food Intake in Older Adults

RECAP For the growing older adult population, a healthy diet is key in promoting well-being, maintaining functional independence, and preventing malnutrition and related comorbidities. It is important to remember the many factors that may influence an older adult's dietary intake.

Recap Questions

1. Where do the majority of older adults reside within the United States, and why is this significant?
2. What dietary habits can influence the risk of disease, including cancer and cardiovascular disease?
3. What factors influence an older adult's nutrition status?

Dietary Guidance

PREVIEW Healthy older adults may benefit from the same dietary recommendations as those provided for the general adult population; however, aging and age-related problems can impose significant barriers to achieving a healthy diet as outlined by these guidelines. Modifications to dietary guidelines should be made as needed to optimize nutrient intake.

Emphasizing a nutritionally adequate and nutrient-dense diet is essential to promoting health and preventing nutrition-related complications that could contribute to increased functional dependency and frailty. Aging and age-related problems can impose

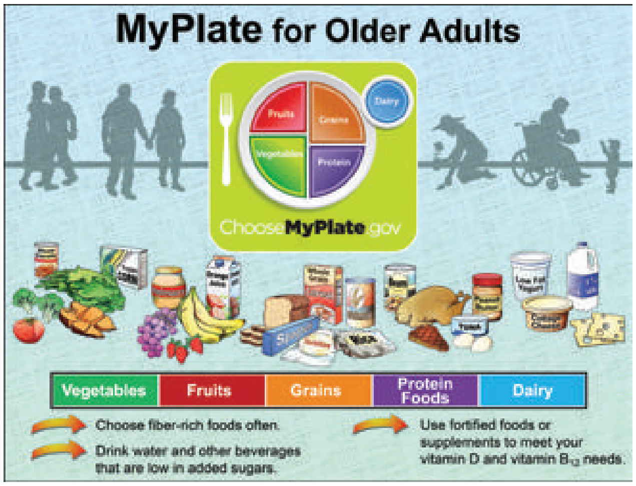


FIGURE 1-5 MyPlate for the Older Adult

© Family, Youth and Community Sciences at the University of Florida. Available at: http://fycs.ifas.ufl.edu/Extension/HNFS/ENAFS/MyPlate.php.

significant barriers to achieving a healthy diet as defined by the *Dietary Guidelines 2015–2020*.[9] With a major focus on health promotion and risk reduction, the *Dietary Guidelines* currently forms the basis of federal food, nutrition education, and information programs. Healthy older adults may benefit from the same dietary recommendations as those provided for the general adult population; however, the appropriateness of and the ability to adhere to these recommendations may decrease as an individual becomes increasingly functionally dependent, frail, and ill.

Although the recommendations of the *Dietary Guidelines for Americans* and the U.S. Department of Agriculture (USDA) MyPlate guidelines are designed for all Americans older than age 2 years, some modifications to MyPlate are appropriate for those older than 70 years to optimize nutrient intake, as shown in **FIGURE 1-5**.[15] While maintaining MyPlate's emphasis on vegetables and fruits, the **Modified MyPlate for Older Adults** addresses the unique dietary needs of adults older than 70 years by emphasizing nutrient-dense food choices and the importance of fluid balance (**FIGURE 1-6**).[16] The Modified MyPlate for Older Adults also provides additional guidance about forms of foods that could best meet the unique needs of older adults and stresses the importance of regular physical activity.

The Modified MyPlate for Older Adults emphasizes the importance of choosing adequate amounts of fiber-rich foods, focusing on whole grain products and whole fruits and vegetables rather than their highly refined and processed forms. Food choices that are easier to prepare, have a longer shelf life, and minimize waste are important when a person has limited income, lives alone, is functionally limited, or has health problems. Therefore, the Modified MyPlate for

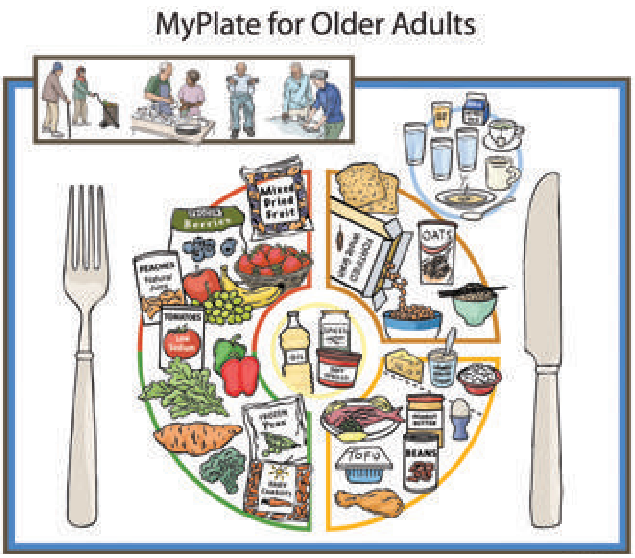


FIGURE 1-6 Modified MyPlate for Older Adults

Copyright 2018 Tufts University. For details about the MyPlate for Older Adults, please see https://nutrition.tufts.edu/research/projects-initiatives/my-plate-older-adults.

Older Adults includes icons depicting packaged fruits and vegetables in addition to fresh examples. Fresh, frozen, canned, and dried fruits and vegetables are excellent sources of many nutrients plus fiber. Examples include bags of frozen precut vegetables that can be resealed or single servings of canned fruit. In addition, by showing numerous sources of liquids, the Modified MyPlate for Older Adults emphasizes the importance of fluid consumption for older adults.[16]

Current food guidelines continue to emphasize that the majority, if not all, of the nutrients an older adult consumes should come from food rather than supplements.[9,17] It is important to remember, however, that some older adults find it difficult to get adequate amounts of some nutrients from food alone, especially when calorie needs are reduced. Therefore, older adults may need certain supplemental nutrients, such as calcium, vitamin D, and vitamin B_{12}, the needs for which increase with age.[9]

RECAP Aging and age-related problems can impose significant barriers to achieving a healthy diet. The Modified MyPlate for Older Adults is one tool that addresses the unique needs of the older adult population, helping to optimize nutrient intake.

Recap Questions

1. Discuss age-related problems that may impact nutrient intake.
2. Name a factor that may influence an older adult's ability to follow the *Dietary Guidelines*.
3. What are specific lifestyle and dietary considerations that the Modified MyPlate for Older Adults addresses?

Healthy People 2020

PREVIEW Healthy People offers evidence-based, 10-year national objectives with the goal of improving the health of all Americans. In response to the rapid growth of the older adult population, Healthy People 2020 includes a new topic area, Older Adults. The aim of the Older Adults initiative is to "improve the health, function, and quality of life of older adults."

The Healthy People initiative (Healthy People 1990, 2000, 2010, and 2020) began in 1979 in the U.S. Department of Health and Human Services. Over the years, the initiative's goals and objectives have changed to serve as the basis for development of state and community planning.[18]

Healthy People 2020 (https://www.healthypeople.gov/) has 42 topic areas with goals and objectives for each topic that serve as mechanisms for monitoring national progress (**BOX 1-1**). In efforts to support a healthier nation, Healthy People 2020 has 15 strategies

BOX 1-1 Healthy People 2020 Topics

Healthy People offers evidence-based, 10-year national objectives with the goal of improving the health of all Americans. For the past 30 years, Healthy People has defined benchmarks and monitored progress over time in order to accomplish the following:

- Promote collaborations across communities and sectors.
- Empower individuals toward making informed health decisions.
- Measure the impact of prevention activities.

New topics included in this initiative include the following:

- Adolescent Health
- Blood Disorders and Blood Safety
- Dementias, including Alzheimer's Disease
- Early and Middle Childhood
- Genomics
- Global Health
- Health-Related Quality of Life and Well-Being
- Healthcare-Associated Infections
- Lesbian, Gay, Bisexual, and Transgender Health
- Older Adults
- Preparedness
- Sleep Health
- Social Determinants of Health

Source: Data from U.S. Department of Health and Human Services. *Healthy People 2020: Understanding and Improving Health*. 3rd ed. Washington, DC: U.S. Government Printing Office; March 20, 2018.

that deal with *prevention*. These strategies include tobacco control, multiple chronic condition management, a "Let's Move" campaign, food safety, and health literacy, among others. The topic area Older Adults is new for 2020 and was developed in response to the rapidly aging population. The aim of the Older Adults initiative is to "improve the health, function, and quality of life of older adults."[18] The Older Adults topic area has 12 objectives that include increasing the number of older adults who receive Medicare benefits, increasing the number of older adults who receive diabetes self-management benefits, and increasing the proportion of healthcare workers with geriatric certification (including dietitians).[18]

By 2030, approximately 98 million older adults will be managing two or more chronic conditions.[18] This number accounts for 60% of that segment of the population. One of the Healthy People 2020 goals is to *improve access to comprehensive, quality healthcare services*. The ability to access comprehensive, quality healthcare services is vital as the nation strives to achieve health equality and improve the quality of life for everyone. The ability to access comprehensive, quality health care includes obtaining access to the healthcare system, accessing a location that provides the desired services, and finding a healthcare provider with whom the patient can communicate and trust. Obstacles to securing healthcare services such as limited availability, high cost, and being uninsured create a healthcare disparity that affects people's ability to obtain their full health potential and quality of life.[18]

Other Healthy People 2020 topic areas include mental health, injury and violence, environmental health, immunization, and access to health services (**BOX 1-2**). Many older people die from influenza and pneumonia because of lack of immunization. The final category, access to health services, is an important problem in older adults. In 2015, approximately 1% of older adults did not have health insurance coverage of some kind and were less likely to receive regular or quality health care, especially minority older adults.[1]

RECAP The Older Adults topic area of Healthy People 2020 has 12 objectives, with the aim to "improve the health, function, and quality of life of older adults." These objectives include increasing the number of older adults who receive Medicare benefits, increasing the number of older adults who receive diabetes self-management benefits, and increasing the proportion of healthcare workers with geriatric certification.

Recap Questions

1. Name some of the objectives of the Older Adults topic of Healthy People 2020.
2. Discuss some of the obstacles that older adults may face when to securing healthcare services.
3. The ability to access comprehensive, quality health care includes obtaining access to what important resources?

BOX 1-2 Twelve Leading Health Indicators for Healthy People 2020

1. **Access to Health Services.** In 2010, nearly one out of four people in the United States did not have a primary care provider (PCP) or health center that could provide consistent medical attention. One out of five U.S. children and adults younger than 65 years of age did not have access to medical insurance. Inability to secure routine medical care increases the risk for critical and incapacitating health conditions.
2. **Clinical Preventive Services.** Clinical preventive services, such as regular illness screening and planned immunizations, are important to decrease death and disability while improving the population's health. These services help to prevent and detect diseases in early stages, thus increasing the possibility of successful treatment and considerably decreasing the risk of illness, disability, early death, and cost of care.
3. **Environmental Quality.** Approximately 25% of preventable illness worldwide is attributable to toxins in air, water, and soil. African Americans and Hispanics make up 25% of the population but constitute 40% of those who live near dangerous toxic sites. This puts them at greater risk for asthma, lead poisoning, and other illnesses.
4. **Injury and Violence.** Vehicle crashes, suicides, and homicides are serious public health problems. They are often associated with substance abuse.
5. **Maternal, Infant, and Child Health.** In 2011, the infant death rate in the United States remained higher than the infant death rate in 46 other countries. Promoting well-being of mothers, infants, and children influences the health of the next generation.
6. **Mental Health.** Knowledge and understanding of mental health have evolved significantly over the past 25 years. One in four Americans suffers from a mental disorder each year. Mental health issues are one of the most common causes of disability.

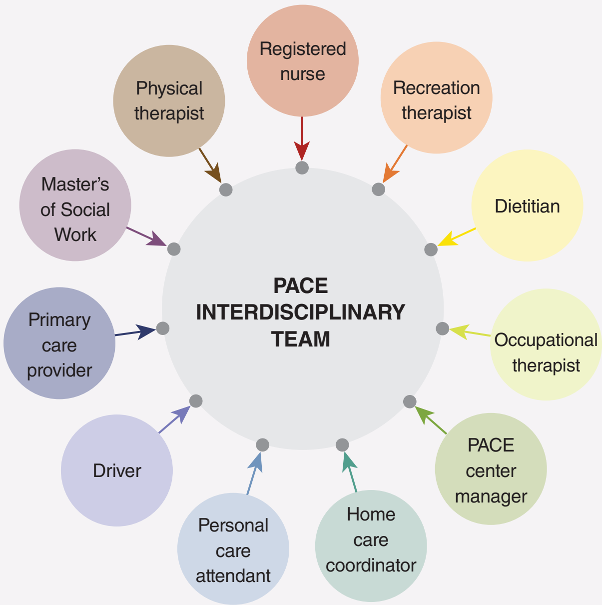
7. **Nutrition, Physical Activity, and Obesity.** Optimum nutritional status, physical activity, and weight are important components of an individual's overall well-being. Management of these health indicators can help to reduce the risk of developing conditions such as hypertension, high cholesterol, diabetes, heart disease, and other ailments. In the United States today, 34% of adults and 16.2% of children and adolescents are obese. Most adults and adolescents, 81.6% and 81.8%, respectively, do not get sufficient physical activity. Many Americans do not consume a healthy diet.
8. **Oral Health.** Oral conditions such as dental caries and mouth cancers contribute to pain and disability for millions of people. Research has established a connection between oral health, specifically periodontal disease, and numerous chronic diseases such as diabetes, heart disease, and stroke.
9. **Reproductive and Sexual Health.** In the United States, 19 million cases of sexually transmitted diseases are diagnosed every year. Fifty percent of newly diagnosed cases occur among teenagers and young adults between the ages of 15 and 24 years.
10. **Social Determinants.** A variety of personal, social, economic, and environmental factors influence individual and population health. Social factors are accountable for differences in health conditions within and between neighborhoods. The selection of Social Determinants as a Leading Health Topic identifies the important role of home, school, workplace, neighborhood, and community in promoting health.
11. **Substance Abuse.** In 2005, approximately 22 million people wrestled with a drug or alcohol condition.
12. **Tobacco.** Tobacco use is a preventable cause of disease, disability, and death in the United States. Every year, the use of tobacco contributes to more deaths than all the deaths from HIV, illegal drug use, alcohol use, motor vehicle injuries, suicides, and murders collectively.

Source: Data from U.S. Department of Health and Human Services. *Healthy People 2020: topics and objectives: older adults*. Washington, DC: U.S. Government Printing Office. http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=31. Accessed March 20, 2018.

VIEWPOINT: PACE: Program of All-Inclusive Care for the Elderly

Randi Drasin, MS, RDN

As our society ages, more and more elderly are striving to stay in their own homes versus going into skilled nursing facilities. PACE (Program of All-Inclusive Care for the Elderly) is an innovative model created so that older individuals can continue to live in the community, in their own homes, and/or with their families.



Reproduced with permission from National PACE Association.

PACE is available to those who are 55 years or older and eligible by their state to need a nursing home level of care, live in a PACE service area, and are able to live safely in the community with the help of PACE.

PACE is similar to a managed healthcare program and it is funded through Medicare and Medicaid. The state's Agency on Aging is responsible for implementing and overseeing the comprehensive and coordinated services provided by this home- and community-based service. PACE is not available nationwide; it is only available in a limited number of states. A monthly premium is accepted if the participant is not eligible for Medicaid, and private pay is also accepted. All of the benefits include primary and specialty medical care; adult day care; in-home services; home care; prescription medications; lab and diagnostic services; physical, occupational, and speech therapy; meals; transportation; activities; and hospital and nursing home care.

PACE's main goal is to provide quality medical care using an interdisciplinary team (IDT) approach. The IDT consists of the center manager, primary care provider, registered nurse, social worker, physical therapist, occupational therapist, dietitian, homecare registered nurse, activities coordinator, center coordinator, and transportation supervisor. PACE is unique in that it is not just a health plan program but includes a center for

(continues)

VIEWPOINT: PACE: Program of All-Inclusive Care for the Elderly *(continued)*

adult day health care, where the entire IDT works on a daily basis. Participants have access to the primary care physicians in addition to the rest of the team. Many care plans are in coordination with other IDT disciplines such as nursing, physicians, and speech therapy. The PACE team is able to manage chronic conditions, which can avoid unnecessary inpatient care, in turn allowing participants to remain in the community.

As the older population ages and becomes increasingly frail, chronic conditions worsen. Therefore, one of the benefits of being a PACE participant is the nutritional services that are offered. Seniors are at risk for many nutrition-related medical concerns, including but not limited to malnutrition, sarcopenia, obesity, uncontrolled diabetes, hypertension, hyperlipidemia, chronic kidney disease, cancer, chewing and swallowing difficulties, gastroesophageal reflux disease, poor dentition, dementia, osteoporosis, chronic obstructive pulmonary disease, declining eyesight, decline in activities of daily living and instrumental activities of daily living, pressure/diabetic ulcers, and financial difficulties, all of which can alter an already frail individual's nutritional status.

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The PACE dietitian is able to offer quality medical nutrition therapy through the evaluation of each participant's nutritional status, nutrient requirements, food tolerance, and resources for meal preparation. The dietitian conducts an initial and bi-annual nutrition assessment to determine the dietary needs of that individual; develops and implements a nutrition plan of care with a nutrition prescription, outcome measures, and recommended interventions; and presents the plan to the IDT. The PACE dietitian is also responsible for maintaining written progress notes every 3 months and any other documentation in the participant's medical record. Signed and dated documentation for nutrition/dietary-related services must be recorded, including diet order changes, significant weight changes, chewing functions; hbA1c monitoring, and any education for the participant, family, or caregiver. Orders placed for nutritional supplements (i.e., nourishment shakes, Prostat, thickeners, protein powder, artificial nutrition) are also to be documented.

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Additionally, the PACE dietitian is required to attend any and all care coordination meetings with assisted living facilities (ALFs), skilled nursing facilities (SNFs), "board and cares," and families, at intervals set forth by the PACE facility (monthly, weekly, quarterly, etc.). Case management notes are to be written as needed to document any significant changes. Moreover, the PACE dietitian is to be a member of the monthly Quality Assessment meetings and the quarterly Quality Assurance and Performance Improvement meetings, as it is required that one representative from each discipline in the IDT be in attendance.

Overall, it is the main goal of the PACE dietitian to prevent further nutritional decline and improve the participant's current status by providing interventions and ensuring adequate nutrition and hydration while taking into account personal preferences, medical conditions, and gastrointestinal and swallowing

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functions. It is the PACE dietitian's responsibility to ensure that each participant receives nourishing, palatable, well-balanced meals that meet his or her daily needs. Assessing cognition, ability to perform activities of daily living, and financial status will help determine how to best meet those needs and allow the PACE dietitian to provide the participant with community resources that can provide home-delivered meals and/or caregiving resources to prepare meals at home. Actively participating in coordination of care with the other disciplines, family, living facilities, and caregivers requires open lines of communication in order to relate to the individual plan of care, focusing, of course, on the outcome measures needed to be met in order to best serve the participant.

PACE is a patient-centered program and is associated with significant positive outcomes. The PACE dietitian will work directly with participants and their families to provide support and education on how best to promote health and wellness, to provide a better quality of life, and to maximize dignity and respect during the aging process.

Sources

Medicare.gov. Get help paying costs—PACE. https://www.medicare.gov/your-medicare-costs/help-paying-costs/pace/pace.html.

Centers for Medicare and Medicaid Services. Program of All-Inclusive Care for the Elderly (PACE) Manual. Chapter 1 – Introduction to PACE. https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/pace111c01.pdf.

Centers for Medicare and Medicaid Services. Program of All-Inclusive Care for the Elderly (PACE) Manual. Chapter 6 – Services. https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/pace111c06.pdf.

National PACE Association. Program of All-Inclusive Care for the Elderly (PACE). http://www.npaonline.org/sites/default/files/PDFs/3%20PACE%20Fact%20Sheet%20DRAFT%201.pdf.

National PACE Association. PACE FAQs. http://www.npaonline.org/sites/default/files/PDFs/4%20PACE%20FAQs%20DRAFT%201.pdf.

World Health Organization. Nutrition for older persons. http://www.who.int/nutrition/topics/ageing/en/index1.html.

Administration on Aging

PREVIEW The Administration on Aging's programs are designed to support community-based services and to ensure that these services are provided to economically and socially vulnerable older adults. These vital services positively impact quality of life by helping older adults stay in their communities and homes.

In an effort to promote health and wellness as well as to eliminate health disparities among older adults and, in particular, older minority adults, the **Administration on Aging (AoA)** plays a significant role in the Healthy People 2020 initiative. The AoA supports health prevention and wellness programs in the areas of Alzheimer's disease, behavioral health, chronic disease self-management, diabetes self-management, older adults, and oral health, among others.[19]

The main purpose of AoA programs, which are designed to support community-based services, is to ensure that services are provided to economically and socially vulnerable older adults. The programs focus on the following benchmarks[20]:

- Improving efficiency
- Measuring efficiency of all program activities
- Improving client outcomes
- Looking at indicators such as nursing home predictors, the success of caregiver programs, and protection of vulnerable older adults
- Effectively targeting services to vulnerable elder populations
- Ensuring that states and communities focus on providing services to the most vulnerable elders

In 2011, the AoA was successful in showing that the services provided helped older adults to remain in their communities and homes. A tool used by the AoA to measure success is the nursing home predictor score. This score, which is based on scientific literature and the AoA Performance Measure Project, is a predictor of nursing home placement. The nursing home predictor score measures the older adult's needs for transportation and congregate meals—the higher the score, the greater the need for services. In 2011, the nursing home predictor score was 46.57 and increased to 60.62 in 2013.[20] Even with budget constraints and the expanding number of older adults in the United States, the AoA manages to serve more than 900,000 meals per day in communities across the United States.[21]

The AoA programs are efficient in providing services to needy older adults in an effective manner. In fiscal year 2014, of the total \$814.7 million allocated for the Title III nutrition services program, \$438.2 million was for congregate nutrition (54%), \$216.4 million for home-delivered nutrition (27%), and \$160.1 million for nutrition services incentive grants (19%).[22]

RECAP The Administration on Aging provides vital services to the older adult population, helping older adults to remain more independent and within their communities. These services include nutrition services, with millions of dollars in funding allocated yearly to providing nutrition services to the older adult population.

Recap Questions

1. Discuss how the Administration on Aging plays a role in Healthy People 2020.
2. Name the benefits that the Administration on Aging provides to the older adult population.
3. What is the nursing home predictor score, how has this changed in the past years, and what does this imply?

Older Minority Groups

PREVIEW Minority groups in the United States include Hispanic Americans, African Americans, Native Americans, and Asian and Pacific Islanders. The older adult population is becoming more ethnically diverse, with Hispanic older adults expected to be the largest racial/ethnic minority group by 2030.

The older adult population is projected to be more ethnically and racially diverse in the coming decades. Between 2014 and 2060, the segment of the older population that is non-Hispanic white is expected to decline from 78.3% to 54.6%.[23]

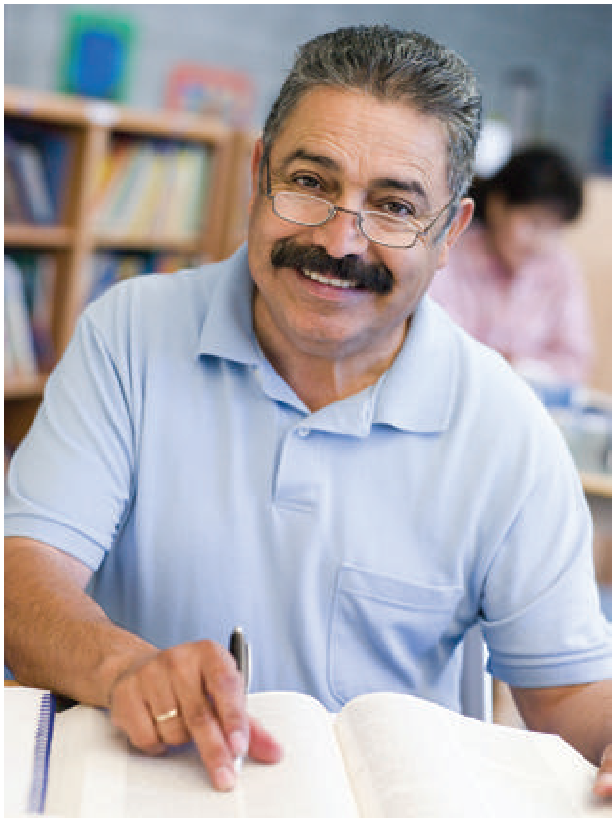
Hispanic Americans

In 2011, the percentage of minority older adults reached 21%.[1] Currently, older adults of Hispanic origin represent 7% of minorities, but this is expected to increase to more than 20% by 2050.[1] By 2030, Hispanic older adults are projected to be the largest racial/ethnic minority group of older Americans. Among states, California had the largest Hispanic total population (15.3 million) in 2016. Texas had the biggest numeric growth in the Hispanic population (233,100).[24]

Hispanic Americans as a group are less educated than other groups of older Americans. In 2014, 54% had completed high school, compared to 84% of the total population of older Americans. Further, only 12% of Hispanic older adults had completed college, compared to 26% of all older Americans. Poverty is a significant problem for Hispanic older adults. In 2013, the poverty rate for older Hispanic adults was 20.4%, twice that of the total older American population (10.2%).[25]

Data from the Behavioral Risk Factor Surveillance System on self-rating of health status offers a collective marker of health for population groups. In 2016, 66% of older Hispanics rated their health as very good/excellent. In comparison, among older non-Hispanic whites, this figure was 70.7%.[26] Life expectancy for older Hispanic Americans surpasses that of non-Hispanic white and African American older adults. On average, older Hispanic Americans live an additional 20.3 years after reaching the age of 65. Older Hispanic Americans who reach the age of 75 years have an average additional life expectancy of 13.2 years.[27] Additionally, older Hispanic Americans seem to be healthier than their counterparts from other ethnic groups.[19] Chronic ailments such as cardiovascular disease, cancer, lung disease, and stroke are less prevalent in this group.[20] However, diabetes, as well as influenza and pneumonia, are more common among older Hispanic Americans than among other ethnic groups.[27]

When compared to non-Hispanic segments of the population, disabilities related to mobility, self-care, and household activities are more common in older Hispanic households. In 2014, the disability rate in Hispanic households was reported as 48%.



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The prevalence of disability in non-Hispanic Asian/other households has been reported as 41%.[28] Household activity disability rates are highest in Hispanic households (62%), closely followed by non-Hispanic black households (60%). Hispanic households aged 65 years and older have a self-care disability rate of 35%.[28]

Older Hispanics report that they have access to medical care. In 2015, most noninstitutionalized persons (93%) 65 years of age and older were covered by Medicare.[1] In 2013, 23% of older Hispanics had both Medicare and supplementary private health insurance, while 17% were covered by both Medicare and Medicaid. In contrast, approximately 50% of all older adults had both Medicare and supplementary private health insurance, and 6% of all older adults were covered by both Medicare and Medicaid. In 2011–2013, 7% of older Hispanics conveyed they did not have a formal source of health care, compared with 4% of all older Americans.

African Americans

African Americans comprise 9% of the minority older adult population.[29] **TABLE 1-2** shows the projected population growth in this racial/ethnic group. By 2060, 12% of older Americans will be African American. In 2013, African Americans lived predominantly in eight U.S. states: New York (331,114), California (248,195), Florida (286,438), Texas (255,362), Georgia (252,101), Illinois (196,584), North Carolina (221,725), and Maryland (177,521).[29]

Educational attainment among African Americans has increased significantly over the past 40 years. In 2014, approximately 74% of older African Americans had finished high school; in 1998, only 44% had attained this level of education, and 17% of older African Americans achieved a bachelor's degree or higher.[29] The poverty rate for African American older adults is 18.7%. This is almost twice the percentage for the total U.S. older population, which is 10.2%.[29]

TABLE 1-2 Projected Growth of the Older (aged 65+ years) African American Population

Year	Number (in millions)
2014	4.0
2020	5.3
2030	7.6
2040	9.0
2050	10.0
2060	12.0

Source: Data from Administration on Aging. http://www.aoa.gov/Aging_Statistics/minority_aging/Facts-on-Black-Elderly-plain_format.aspx. Washington, DC: U.S. Department of Health & Human Services. Accessed March 21, 2018.

When asked to rate their health from excellent to poor, in 2011–2013, 46% of older non-Hispanic white adults rated their health as good, very good, and excellent.[1] Among African Americans, 27% were likely to report good to excellent health. Positive health evaluations decline with age. Among African American men ages 65–74, 31% conveyed very good/excellent health, compared with 17% in those aged 85 or older.[29]

African Americans are living longer than in the past. In 1975, life expectancy at birth for the white population was 6.6 years longer than for the black population; by 2015, the difference had narrowed to 3.5 years.[29] At age 65, African American men have a life expectancy of an additional 16.4 years (to 81.4 years of age); women have 19.7 more years (to 84.7 years of age).[29] These data are similar to those for all older American men and women. The most common chronic illness affecting older African Americans is hypertension (85%), followed by arthritis (51%), diabetes (39%), heart disease of all types (27%), and cancer (17%).[29] These rates are similar for all older Americans, with the exception of hypertension, which is lower in the general population at 71% and diabetes, which is 21% in the general population of older adults.[29]

A large majority of older African American adults state that they have access to health care (96%). However, 16% report that they or their family members have been unable to obtain care or were delayed in receiving necessary medical care.[21] Sixty-six percent of older African American adults do not have supplemental private health insurance, and they rely solely on Medicare. In comparison, 50% of all U.S. older adults lack private health insurance.[29]

Native Americans

There is little information on American Indians and Alaska Natives (AIAN), especially on the older population and those living in rural-frontier/urban areas.[30] This is thought to be because of the expense of accessing small populations located in isolated areas or because the number of people is often too small for statistical analysis in national studies. However, Native Americans are projected to increase to approximately 918,000 by 2050, representing approximately 2% of the total U.S. population.[23,24]

The U.S. government recognizes 567 American Indian/Alaska Native tribes.[31] The Indian Health

Service (IHS) budget provides funds for health care. Care is provided through a network of 679 hospitals and clinics on or near reservations and through specialty services off the reservations.[32]

In 2011, 27.6% of American Indians did not have health insurance coverage. The implementation of the Patient Protection and Affordable Care Act (ACA) has provided Native Americans with new opportunities to promote wellness, health, and strength in tribal communities. The ACA offers American Indians greater insurance protection and benefits such as cost-free preventive services, removal of lifetime caps on health coverage, and prevention of denial of insurance coverage to children with preexisting conditions.[33]

When compared to other racial groups, AIAN populations deal with many health challenges such as increased mortality rates from conditions such as tuberculosis, chronic liver disease and cirrhosis, accidents, diabetes, pneumonia, suicide, and homicide.[4,31,34]

For this segment of the population, substantial health disparities exist for many conditions, including heart disease, tuberculosis, sexually transmitted diseases, and injuries.[35] When compared to other racial groups in the United States, the AIAN population has a greater prevalence of diabetes (16.5%), and the incidence has been increasing. Cultural, genetic, socioeconomic, and behavioral factors have been reported as possible contributing factors to the health disparities in this population.[35]

Older women in this group have a significantly higher prevalence of diabetes, hypertension, cancers (not including breast, colorectal, and lung), cataracts, asthma, and arthritis and have moderately severe to severe functional limitations. As these women age, the prevalence of arthritis, heart failure, hypertension, stroke, colorectal cancer, and cataracts increases. Men have an increased prevalence of prostate cancer with increasing age.[35]

Stroke is a common cause of death in Native Americans. This is related to hypertension, diabetes, and heart disease. Native American women are more likely to be obese and are less likely to exercise, which contribute to these diseases.[35]

As Native Americans age, certain chronic problems, such as asthma and diabetes, diminish in prevalence. People in the younger-old age groups are more likely to have asthma (171%) and diabetes (154%) compared with those 85 years and older. Among older Native Americans, there is increasing prevalence of diabetes (38.8%), stroke (11.7%), and arthritis (60%).[30] Life expectancy for American Indians is 78.5 years—lower than that for the U.S. population (84.1 years as of 2010).[30] However, this varies by regional area. For example, the life expectancy in the California Indian Health Service Area is 76.3 years.

Native Americans face barriers to primary, secondary, and tertiary health care. In rural and frontier communities, this lack of access causes problems. Geographical separation, economic factors, and the overall lack of trust that their traditional spiritual beliefs promote are factors contributing to the health disparities among AIANs compared to other population groups.[30] Fifty-one percent of Native American older adults live in frontier areas, 28% live in rural areas, and 21% live in urban areas. Increasing access to health care is a critical step toward eliminating racial and ethnic health disparities. Further, lower health status correlates with lower socioeconomic status. Poverty is a vulnerability of Native American older adults.

Targeted interventions are being developed and implemented to improve the health of AIAN older adults. **TABLE 1–3** lists primary prevention focus areas currently being addressed by the Indian Health Service.

Asian Americans and Pacific Islanders

In the United States, Asian Americans or Pacific Islanders (AAPIs) number approximately 17.3 million people.[1,36] These groups are frequently categorized as Asian Americans and as Hawaiian and other Pacific Islanders. Asian Americans may be from the Philippines, Korea, Vietnam, China, Pakistan, India, Cambodia, Laos, Thailand, or Japan. The Asian American, Hawaiian, and Pacific Islander older population represents 10% of the diverse U.S. older adult population.[36] Most Asian Americans live in Hawaii (57% of the population of

TABLE 1-3 Health Promotion Focus Areas for Native Americans

Access to health care
Diabetes
Immunization
Mental health
Nutrition
Obesity
Oral health
Physical activity and exercise
Substance abuse
Tobacco cessation

Source: Data from Indian Health Service. Health promotion. Rockville, MD: IHS. http://www.ihs.gov/communityhealth/hpdp/. Accessed March 21, 2018.

Hawaii are Asian).[24] Other areas with high proportions of the elderly Asian American population are California (32.1%), New York (9.1%), Texas (6.4%), New Jersey (4.6%), and Washington, DC (5.4%).[37]

AAPIs comprise 50 different ethnic groups and speak 100 distinct languages and dialects. Most AAPIs have large families, which contributes to the population growth of AAPIs that exceeds any other racial/ethnic group.[38]

In 2007–2009, AAPIs had the highest median household income of any racial group; their current median income is slightly less than (sometimes quoted as more than) that of non-Hispanic whites. However, their income is bipolar: This group has both the highest incomes of any racial/ethnic group and the lowest incomes, especially among new immigrants. A high proportion of AAPIs own their own homes and complete college.[37]

AAPIs' life expectancy in 2009 was 86.5 years of age.[39] Some of the common diseases of this group include cancer, heart disease, Alzheimer's disease, suicide, and diabetes.[40] Other health disorders and risk factors that are predominant among Native Hawaiians and Pacific Islanders are hepatitis B, HIV/AIDS, and tuberculosis. Difficulty with language is a barrier to healthcare access, especially for the poor and newly immigrated. Further, there is a lack of culturally competent healthcare professionals in the U.S. healthcare system. Given the unmet needs for health care, AAPIs may use traditional medicine, including acupuncture, herbal medicine, and massage. Lead poisoning is occasionally reported as occurring from folk remedies.[36]

The population of Native Hawaiian and other Pacific Islanders (NHPIs) rose by 9.7%, or 27,323,632 people, between 2000 and 2010.[41,42] In 2016, the median age of this group was 28.3 years.[43] Adults aged 65–74 years constitute 4.7% of the population, and those aged 75 years and older, about 2.7%.[43] Most NHPIs live in Hawaii; only 1% live in all other states.[33] The 2010 U.S. Census reports that of the total NHPI population, 43% were Native Hawaiian, 15% Samoan, and 12% Guamanian/Chamorro.[42] NHPIs originate from any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands. Most NHPIs live above the poverty level; approximately 7.8% are uninsured, and 17.3% live at the poverty level.[41]

The cuisine of NHPIs varies from culture to culture and is a blend of native foods and Japanese, Asian, American, and European foods.[44] Food plays a central role in these cultures. Starchy foods are the foundation of the traditional diet, but the diet of NHPIs has become Americanized. Many NHPIs now eat fast foods and highly processed items such as white flour, white sugar, canned meat and fish, butter, margarine, mayonnaise, candy, cookies, carbonated drinks, and sweetened cereals. Rice has become a staple, displacing yams and taro.

The prevalence of chronic health problems among NHPIs is somewhat different from other ethnic groups. This segment of the population has higher rates of smoking, alcohol consumption, and obesity.[41] It is estimated that 30.8% of Hawaii's adult population is categorized as overweight or obese based on body mass index.[45] Data from 2012 show that nearly 58.3% of older adults are overweight or obese in the 65–74-year age category; 48% of those 75 years and older are overweight or obese.[46] Data from 2017 show that when compared to the U.S. older adult population data, NHPIs do not meet the federal physical activities guidelines, 47.1% versus 43.7%, respectively.[45]

Caucasian Americans (Non-Hispanic Whites)

Compared to other racial/ethnic groups, the non-Hispanic white population has the highest median age (38.3 years); for Hispanics, it is 27 years; for Alaska Natives, 31.3 years; Asians, 36 years; and African Americans, 31.7 years.[42]

The United States is considered a young country compared to other developed countries. The proportion of total population for the 65 years and older group is approximately 14.9% of the total population. Japan has the highest percentage of older adults, approximately 23%, when compared to countries with a population of at least 1 million people.[1] These older adults can expect to live longer than ever before. Although life expectancy varies by race, the difference decreases with age. In 2016, the life expectancy at birth was 3.5 years greater for whites than for African Americans.[46] At age 65, a white adult can expect to live an average of nearly 1.2 years longer than an African American adult.[1]

RECAP The older adult population is projected to be more ethnically and racially diverse in the coming decades, with each group having unique characteristics that impact health and well-being. Targeted ethnically and culturally appropriate interventions should be developed and implemented to improve the health of all American older adults.

Recap Questions

1. Name the primary chronic conditions/diseases that impact each older adult minority group.
2. What barriers to healthcare access do minority groups face?
3. Name three health promotion focus areas for Native Americans.

Health and Well-Being

PREVIEW Health and well-being are influenced by numerous interrelated factors over a lifetime, with nutrition proving to be a major determinant in successful aging. Dietary patterns are influenced by physiologic, behavioral, social, environmental, and psychological factors. In older adults, functional and health factors also contribute to food intake.

When asked to rate their health as excellent, very good, good, fair, or poor, 39% of people 75 years and older rated their health as very good or excellent.[1] Many older adults have at least one chronic condition, and most have multiple conditions (**TABLE 1-4**). In 2015, the most commonly reported conditions among older adults age 75 and over were arthritis (53%), heart disease (35%), cancer (32%), diabetes (22% in 2011–2014), and hypertension (72% among men age 75 and over and 80% among women age 75 and over in 2011–2014).[1]

Chronic diseases are very common among older adults of all races. Actual prevalence of chronic conditions supports racial differences in self-reported health. White Americans have a lower incidence of hypertension (48.4%) compared to African Americans (58.7%). Diabetes is another chronic illness that occurs less commonly in white Americans: Only 7.6% of white older adults have diabetes compared to 12.1% of older Hispanic Americans and 13.4% of older African Americans. The prevalence of some of these chronic conditions also varies by sex. For instance, arthritis is more common in women than in men, and men have higher instances of heart disease than do women.[47]

Overall, health and well-being are influenced by numerous interrelated factors accumulated over a lifetime. Nutrition is proving to be a major determinant in successful aging. Eighty-five percent of noninstitutionalized older adults have one or more chronic health conditions that could be improved with proper nutrition, and up to half may have clinical evidence of various forms of malnutrition.[48] Many of these illnesses limit activity and diminish functional independence and quality of life. **FIGURE 1-7** highlights the dietary and nondietary risk factors for common diseases in older adults.

Food choice and dietary intake are multifactorial and are influenced by physiologic, behavioral, social, environmental, and psychological factors. These factors are compounded in older adults by functional and health factors that also contribute to food intake (**FIGURE 1-8**).

Consumption of a poor-quality diet can result in inadequate intake of energy and essential nutrients, resulting in malnutrition and worsening of health status (**FIGURE 1-9**). Malnourished older adults are more prone to infections and diseases, their injuries take longer to heal, surgery is riskier, and their hospital stays are longer and more expensive.

TABLE 1-4 Chronic Diseases That Are the Leading Causes of Death among U.S. Adults Aged 65 and Older (2011–2014)

Heart disease
Cancer
Chronic bronchitis
Chronic lower respiratory diseases
Stroke
Diabetes mellitus
Alzheimer's disease

Source: Data from Healthy People 2020. https://www.healthypeople.gov/2020/topics-objectives/topic/older-adults. Accessed March 24, 2018.

RECAP A poor-quality diet can result in worsening health status and quality of life for older adults. Optimizing nutrition status can therefore improve health and quality of life, but the older adult's unique functional and health factors must be considered.

Recap Questions

1. What chronic diseases are prevalent among older adults?
2. Name factors that influence dietary intake for older adults.
3. How does malnutrition impact the health of older adults?

The Healthcare Workforce

PREVIEW Older adults utilize the most healthcare services, yet the largest training gap in any medical education field is in geriatrics. One of the Healthy People 2020 initiatives is to increase the proportion of healthcare workers with geriatric certification by 10%.

Is the healthcare workforce ready for the graying of America? It is widely believed that universities and schools are not well prepared to meet the upcoming need for health professionals qualified to manage the numbers of older adults who will be entering the healthcare system. As the baby boomers continue to

Chronic diseases	Dietary risk factors						Nondietary risk factors					
	High-fat diet	Excessive alcohol intake	Low complex carbohydrate/fiber	Low vitamin and/or mineral intake	High sugar intake	High intake of salty or pickled foods	Genetics	Age	Sedentary lifestyle	Smoking and tobacco use	Stress	Environmental contaminants
Cancers	?*	X	X	X		X	X	X	X	X		X
Hypertension	X	X		X		in salt-sensitive people	X	X	X	X	X	
Diabetes (type 2)	X		X				X	X	X			
Osteoporosis		X		X			X	X	X	X		
Atherosclerosis	X		X	X			X	X	X	X	X	
Obesity	X	X	X		X		X		X			
Stroke	X		X				X	X	X	X	X	
Diverticulosis	X		X	X				X	X			
Dental and oral diseases				X	X		X			X		

FIGURE 1-7 Risk Factors for Disease in Older Adults

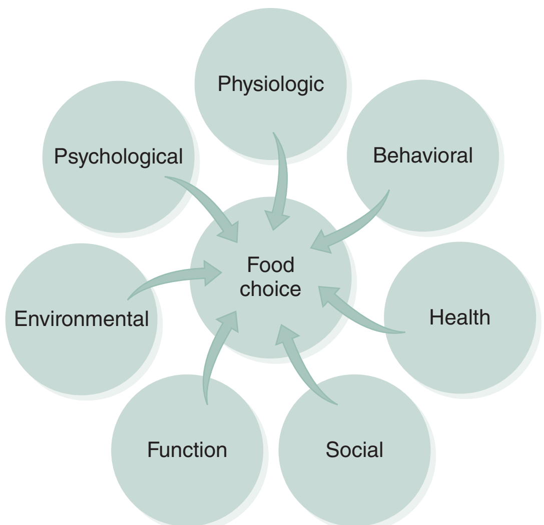

FIGURE 1-8 Classification of Factors That Affect Food Choice in Older Adults

enter into the older segment of the population, the number of older adults eligible for Medicare will double to 98.2 million by 2060.[1] The number of people aged 85 years and older will increase *five times*, to nearly 19 million, by midcentury. **FIGURE 1-10** illustrates the geographic distribution of the total population who are 65 years of age in the United States.

Older adults use more healthcare services than does any other age group.[1] Although this group currently comprises only 14.9% of the population, among people age 75 and over, 23% had 10 or more visits to a doctor or other healthcare professional in the past 12 months compared to 15% among people age 45–64 years.[1] In 2015, 7.1 million people age 65 years and older stayed in a hospital overnight at least one night during the previous year.[1] The average adult aged 75 years has three chronic health problems and uses five prescription drugs. These issues and the changes of aging constitute a challenge for those who are unprepared to care for adults of this age group.

Community-based care jobs have seen some of the greatest employment development in recent years. In 2015, employment in positions providing services to older adults/individuals with disabilities and in home healthcare services increased by 7.5% and 5.0%, respectively. Employment in community care facilities for older adults increased by 2.9%. These recent job increases support the long-term trends of increased community-based care jobs that have been in place since 1990.[49]

In 2011, there were 7029 certified geriatricians practicing in the United States. The nursing workforce is expected to drop by 20% by the year 2020. Securing

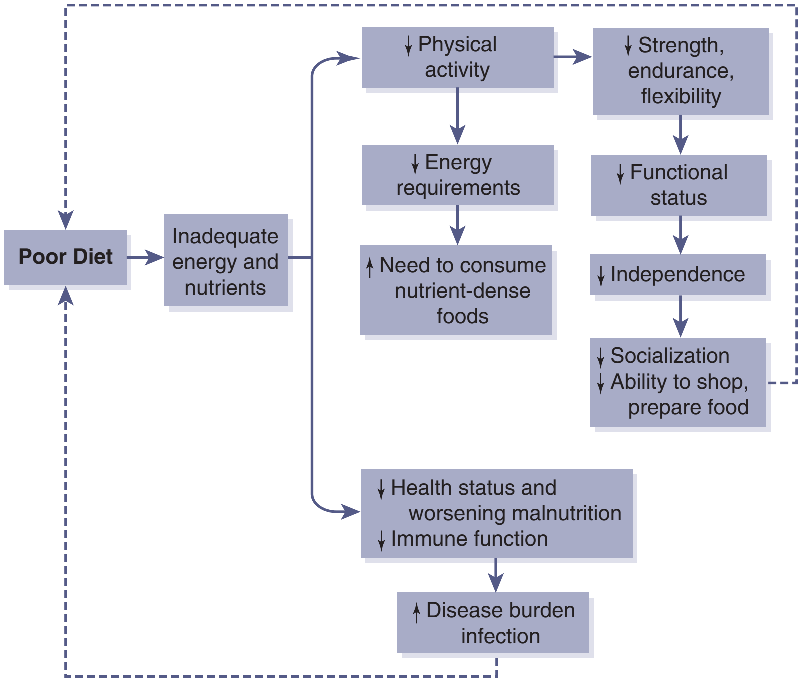

FIGURE 1-9 Poor Diet Affects the Older Adult

a geriatric psychiatrist has been a challenge in most communities in the United States.[50]

Nutritionists and dietitians have long practiced in long-term care settings and hospitals in which the management of older adults is common. One objective of the Healthy People 2020 initiatives is to increase the proportion of healthcare workers with geriatric certification by 10%.[18] This includes increasing the number of registered dietitians with a certification in geriatrics by 10%.

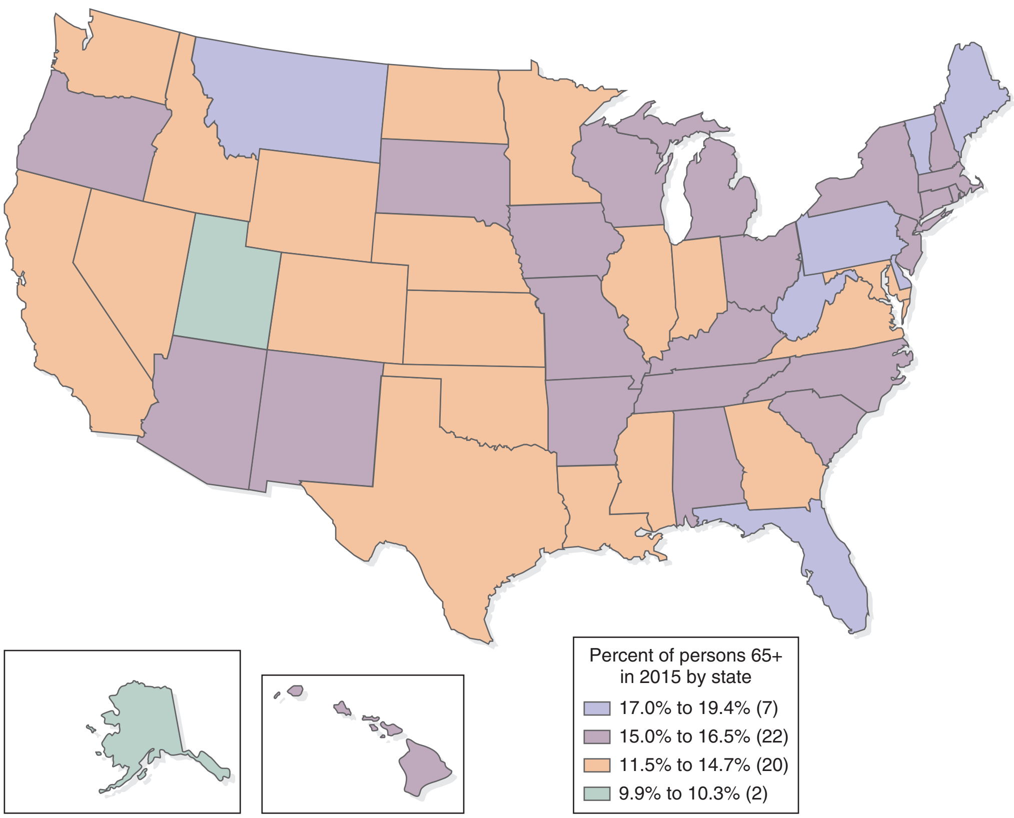

FIGURE 1-10 Percentage of Older Adults 2015

U.S. Census Bureau. Persons 65+ as a percentage of all population in 2015. https://www.acl.gov/sites/default/files/Aging%20and%20Disability%20in%20America/2016-Profile.pdf. Accessed March 24, 2018.

The largest training gap in any medical education field is in geriatrics.[48] Some of the reasons cited for the lack of interest in the field of geriatrics include lack of exposure and decreased opportunity for financial reward.[51]

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RECAP With the older adult population utilizing the majority of healthcare services, and with the population growing, it is important to encourage healthcare providers to consider specializing in the important field of geriatrics.

Recap Questions

1. The average 75-year-old has how many health problems?
2. Why may healthcare providers show a lack of interest in specializing in geriatrics?
3. What is the Healthy People 2020 objective that addresses the geriatric training gap?

Conclusion

Older adults are particularly vulnerable to compromised nutritional status and poor health because of declines in food intake and the decreasing energy needs that accompany aging. Therefore, consumption of a high-quality, nutritionally dense diet becomes critical. However, multiple chronic and acute illnesses, numerous medications, impaired health, low levels of physical activity, poor dentition, impaired mental status, depression, an inability to self-feed, and anorexia have all been shown to influence the eating habits and nutritional status of older adults.[49] As shown in Figure 1-1, these factors alone or in combination may contribute to dietary inadequacies and lead to the consumption of a low-quality diet, thus influencing the health and well-being of older adults.

Poor nutritional status can interfere with older adults' ability to remain independent and can lead to other complications such as increased medical burden, polypharmacy, and reduced socialization and physical activity. Maintenance of health, independence, and functional status is related to an individual's ability to shop, cook, and eat independently, which is directly related to food intake and nutritional status.

Ultimately, the goal for nutrition in the older population is to aid in maintaining health, and specific attention should be given to address the individuality of each older adult, including cultural and ethnic considerations with regard to nutritional requirements, food preferences, and disease prevalence to promote overall healthy aging.

Learning Portfolio

Key Terms and Concepts

- Administration on Aging (AoA)
- Healthy People 2020
- Modified MyPlate for Older Adults
- Old age

Activities Related to This Chapter

1. List nutrition-related challenges facing the aging population based on the classifications of factors that affect food choices for older adults. List two to three specific examples for each group. As you go through the text, you can add to each list.
2. Gather into small groups. Identify five factors that influence the eating and nutritional habits of older adults. For each factor, outline why or how nutritional status might be impacted.

Discussion Questions

1. Discuss the unique barriers to adequate nutrition that older adults face.
2. Explain the unique tools and services that are available to help ensure that older adults are able to maintain adequate functional and nutritional status.

3. Pick an older adult minority group. Discuss common health conditions that this population may face and possible barriers to receiving adequate health care.
4. Identify three specific examples of how you as a healthcare provider can help to promote and maintain health in the older adult population.
5. Identify three unique modifications that have been made to MyPlate to better serve the older adult population. How do these modifications help the older adult achieve healthy lifestyle choices?
6. Mrs. Shaw is a 75-year-old Native American woman who has an appointment for a health assessment at her local clinic. She is a member of a nationally recognized Native American tribe. What are some health concerns that Mrs. Shaw might identify due to her age and ethnic background? Is Mrs. Shaw likely to have health coverage for her visit (please elaborate)?

Study Questions

1. Which of the following statements about the demographics of older adults is true?
   a. By 2060, the older adult population will more than double.
   b. Older men outnumber and outlive older women.
   c. The baby boomers are less nutritionally aware than previous generations of older adults.
   d. The number of older people in the United States will decline over the next 20 years.
2. Quality of life and aging are influenced by which of the following?
   a. Physical function
   b. Health
   c. Habitual food intake
   d. Socialization
   e. All of these are correct.
3. Which of the following is NOT a barrier to food intake in older adults?
   a. Problems chewing and swallowing
   b. Polypharmacy
   c. Age
   d. Functional dependency
   e. Changes in digestion and absorption
4. The Modified MyPlate for Older Adults:
   a. is designed to help older adults meet their nutritional requirements.
   b. teaches older adults how to cook and prepare healthy foods.
   c. emphasizes the importance of choosing convenience foods, processed foods, and fast foods, which are easier for older adults to prepare and are less costly.
   d. suggests that all older adults older than age 65 years have the same nutritional requirements.
5. Regarding older minority groups, which of the following statements is true?
   a. Ethnic and racial minority older adults are more likely to rate their health care and access to health care as excellent.
   b. The most common chronic illness affecting older African Americans is cancer.
   c. Asian Americans and Pacific Islanders have the shortest life expectancy among the racial/ethnic groups in the United States.
   d. Hispanic Americans are projected to be the largest racial ethnic minority group of older Americans.
6. The ability to access comprehensive and quality health care includes:
   a. obtaining access to the healthcare system.
   b. the ability to access a location that provides the desired and necessary health services.
   c. finding a healthcare provider who is trustworthy and communicative.
   d. All of these are correct.
7. Older adults are expected to live longer because of:
   a. advances in technology and medical care.
   b. consuming calorie-restricted diets.
   c. reduced levels of physical activity leading to less-frequent falls.
   d. All of these are correct.
8. Older adults who eat a healthy, well-planned diet may still find it difficult to get adequate amounts of which nutrients?
   a. Calcium, protein, and zinc
   b. Vitamin B_{12}, vitamin D, and calcium
   c. Energy, vitamin K, and iron
   d. Fat, vitamin C, and vitamin B_6
9. All of the following are considered age-related physical changes, EXCEPT:
   a. reduced vision and hearing.
   b. development of arthritis.
   c. development of heart disease.
   d. the speed at which information is processed.
10. ____________ offers evidence-based, 10-year national objectives with the goal of improving the health of all Americans.
   a. Healthy People 2020
   b. *Dietary Guidelines*
   c. Administration on Aging
   d. MyPlate

References

1. Administration on Aging, Administration for Community Living, U.S. Department of Health and Human Services. A profile of older Americans 2016. 2016. https://www.acl.gov/sites/default/files/Aging and Disability in America/2016-Profile.pdf. Accessed March 24, 2018.
2. Center for Disease Control and Prevention. Healthy aging data. 2017. https://www.cdc.gov/aging/agingdata/index.html. Accessed March 3, 2018.
3. Centers for Disease Control and Prevention. The state of aging and health in America 2013. 2014. https://www.cdc.gov/aging/pdf/state-aging-health-in-america-2013.pdf. Accessed March 20, 2018.
4. U.S. Department of Commerce Economics and Statistics Administration U.S. Census Bureau. Profile America: Facts for features: CB17-FF.08. Older Americans Month: May 2017. https://www.census.gov/content/dam/Census/newsroom/facts-for-features/2017/cb17-ff08.pdf. Accessed March 18, 2018.
5. Besdine RW. Evaluation of the elderly patient. *Merck.* 2018. https://www.merckmanuals.com/professional/geriatrics/approach-to-the-geriatric-patient/evaluation-of-the-elderly-patient. Accessed March 19, 2018.
6. Vespa J, Armstrong DM, Medina L. Demographic Turning Points for the United States: Population Projections for 2020 to 2060. 2018. https://www.census.gov/content/dam/Census/library/publications/2018/demo/P25_1144.pdf. Accessed March 19, 2018.
7. Administration on Aging, Administration for Community Living, U.S. Department of Health and Human Services. A profile of older Americans: 2015. 2015. https://www.acl.gov/sites/default/files/Aging and Disability in America/2015-Profile.pdf. Accessed March 18, 2018.
8. Fries JD. Measuring and monitoring the success in compressing morbidity. *Ann Int Med.* 2003;139:455–459.
9. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *2015-2020 Dietary Guidelines for Americans.* 8th ed. 2015. https://health.gov/dietaryguidelines/2015/guidelines/chapter-2/a-closer-... Accessed March 20, 2018.
10. Chernoff R. Meeting the nutritional needs of the elderly in the institutional setting. *Nutr Rev.* 1994;52:132–136.
11. Goodwin J. Social, psychological and physical factors affecting the nutrient status of elderly subjects: separating cause and effect. *Am J Clin Nutr.* 1989;50:1201–1209.
12. Ausman LM, Russell RM. Nutrition in the elderly. In Shils ME, Olson JA, Shike M, Ross AC eds. *Modern Nutrition in Health and Disease.* 9th ed. Philadephia, PA: Williams & Wilkins; 1999.
13. Grey-Donald K. The frail elderly. *J Am Dietet Assoc.* 1995;95:538–540.
14. Bernsten M, Munoz N. Position of the Academy of Nutrition and Dietetics: Food and nutrition for older adults: Promoting health and wellness. *JAND.* 2012;112(8):1255–1277. http://jandonline.org/article/S2212-2672(12)00749-6/fulltext. Accessed March 20, 2018.
15. University of Florida IFAS Extension. My Plate for Older Adults. 2016. http://edis.ifas.ufl.edu/fy1260. Accessed March 20, 2018.
16. Jean Mayer, USDA Human Nutrition Research Center on Aging, Tufts University. My Plate for Older Adults. 2018. http://hnrca.tufts.edu/myplate/. Accessed March 20, 2018.
17. U.S. Department of Agriculture. Frequently asked questions. 2018. https://www.nutrition.gov/subject/dietary-supplements/faqs. Accessed March 20, 2018.
18. U.S. Department of Health and Human Services. Healthy People 2020 topics and objectives: older adults. 2018. http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=31. Accessed March 20, 2018.
19. Administration on Aging, Administration for Community Living. About the Administration on Aging (AoA). 2017. https://www.acl.gov/about-acl/administration-aging. Accessed March 20, 2018.
20. U.S. Department of Health and Human Services, Administration on Aging. FY 2011 Report to Congress. 2011. https://www.acl.gov/sites/default/files/about-acl/2017-04/AOA_2011_AnnualReport.pdf. Accessed March 20, 2018.
21. Administration on Aging, Administration for Community Living. Nutrition services. 2018. https://www.acl.gov/programs/health-wellness/nutrition-services. Accessed March 20, 2018.
22. Older Americans Act: Title III Nutrition Services Program. EveryCRSReport.com. 2014. https://www.everycrsreport.com/reports/RS21202.html. Accessed March 20, 2018.
23. Mather M, Jacobsen LA, Pollard KM. Aging in the United States. *Population Bulletin* 2015;70(2). http://www.prb.org/pdf16/aging-us-population-bulletin.pdf.
24. U.S. Census Bureau Population Division. The nation's older population is still growing, Census Bureau reports. 2017. https://www.census.gov/newsroom/press-releases/2017/cb17-100.html. Accessed March 20, 2018.
25. Administration on Aging, Administration for Community Living. A statistical profile of older Hispanic Americans. 2015. https://www.acl.gov/sites/default/files/Aging and Disability in America/Statistical-Profile-Older-Hispanic-Ameri.pdf. Accessed March 20, 2018.
26. Clark TC, Norris T, Schiller JS. National Center for Health Statistics. Early release of selected estimates based on data from the 2016 National Health Interview Survey. 2017. https://www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease201705.pdf. Accessed March 20, 2015.
27. Hummer RA, Hayward MD. Hispanic older adult health & longevity in the United States: current patterns & concerns for the future. *Daedalus.* 2015;144(2). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4465804/. Accessed March 20, 2018.
28. Joint Center for Housing Studies, Harvard University. *Projections and implications for housing a growing population: older households 2015–2035. Chapter 3 – Disabilities among older adults*. 2016. http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/harvard_jchs_housing_growing_population_2016_chapter_3.pdf. Accessed March 21, 2018.
29. Administration on Aging, Administration for Community Living. A statistical profile of older African Americans. 2015. https://www.acl.gov/sites/default/files/Aging and Disability in America/Statistical-Profile-Older-African-Ameri.pdf. Accessed March 21, 2018.
30. Moulton P, McDonald L, Muus K, Knudson A, Wakefield M, Ludtke R. *Prevalence of chronic disease among American Indian and Alaska Native elders*. Grand Forks, ND: Center for Rural Health, The University of North Dakota School of Medicine & Health Sciences, 2005. http://ruralhealth.und.edu/projects/nrcnaa/pdf/chronic_disease1005.pdf. Accessed March 21, 2018.
31. U.S. Census Bureau and the National Center for Health Statistics. Profile America: Facts for features: American Indian and Alaska Native Heritage Month: November 2012. 2012. https://www.census.gov/newsroom/releases/archives/facts_for_features_special_editions/cb12-ff22.html. Accessed March 21, 2018.

32. U.S. Department of Health and Human Services. Indian Health Service. 2018. https://www.hhs.gov/about/budget/fy2018/budget-in-brief/ihs/index.html. Accessed March 21, 2018.
33. National Congress of American Indians. Healthcare. 2018. http://www.ncai.org/policy-issues/education-health-human-services/health-care. Accessed March 21, 2018.
34. National Congress of American Indians. Indian country demographics. 2018. http://www.ncai.org/about-tribes/demographics. Accessed March 21, 2018.
35. Barnes P, Adams PF, Powell-Griner E. *Health characteristics of the American Indian or Alaska Native adult population: United States, 2004–2008*. Hyattsville, MD: National Center for Health Statistics, 2010. http://www.cdc.gov/nchs/data/nhsr/nhsr020.pdf. Accessed March 21, 2018.
36. U.S. Department of Health and Human Services, Office of Minority Health. Profile: Asian Americans. 2017. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=63. Accessed March 21, 2018.
37. Asian and Pacific Islander American Health Forum. *Demographic and socioeconomic profiles of Asian Americans, Native Hawaiians, and Pacific Islanders in the United States*. 2012. http://www.apiavote.org/sites/apiavote/files/APIAHF%20July%202011.pdf. Accessed March 22, 2018.
38. Asian and Pacific Islander American Health Forum. *Snapshot: Asian American, Native, Hawaiian, and Pacific Islander health*. 2017. http://www.apiahf.org/sites/default/files/September2017_SnapshotAANHPIHealth_Factsheet_0.pdf. Accessed March 22, 2018.
39. Henry J. Kaiser Family Foundation. Life expectancy at birth (in years), by race/ethnicity. 2018. https://www.kff.org/other/state-indicator/life-expectancy-by-re. Accessed March 24, 2018.
40. Yoo GJ, Musselman E, Lee Y-S, Yee-Melichar D. Addressing health disparities among older Asian Americans: data and diversity. *J Am Soc Aging*. 2015. http://www.asaging.org/blog/addressing-health-disparities-among-older-asian-americans-data-and-diversity. Accessed March 24, 2018.
41. U.S. Department of Health and Human Services, Office of Minority Health. Profile: Native Hawaiians/Pacific Islanders. 2017. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=65. Accessed March 24, 2018.
42. U.S. Department of Commerce Economics and Statistics Administration, U.S. Census Bureau and the National Center for Health Statistics. The Native Hawaiian and Other Pacific Islander population: 2010. 2012. https://www.census.gov/prod/cen2010/briefs/c2010br-12.pdf. Accessed March 24, 2018.
43. U.S. Census Bureau Population Division. 2016 American Community Survey 1-Year Estimates. 2016. https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. Accessed March 24, 2018.
44. Misra R, James DCS. Pacific Islander Americans, diet of. http://www.faqs.org/nutrition/Ome-Pop/Pacific-Islander-Americans-Diet-of.html. Accessed March 24, 2018.
45. U.S. Department of Health and Human Services, Office of Minority Health. Obesity and Native Hawaiians/Pacific Islanders. 2017. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=85. Accessed March 24, 2018.
46. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. *Health, United States, 2012*. 2012. http://www.cdc.gov/nchs/data/hus/hus12.pdf. Accessed March 24, 2018.
47. Department of Health and Human Services, Centers for Disease Control and Prevention. *Health, United States, 2016*. 2016. https://www.cdc.gov/nchs/data/hus/hus16.pdf - 054. Accessed March 24, 2018.
48. Chernoff R. *Geriatric Nutrition: The Health Professional's Handbook*. Sudbury, MA: Jones & Bartlett Publishers; 2006.
49. U.S. Bureau of Labor Statistics. *Workforce growth in community-based care: meeting the needs of an aging population*. 2016. https://www.bls.gov/opub/mlr/2016/article/pdf/workforce-growth-in-community-based-care.pdf. Accessed March 24, 2018.
50. Alliance EW. 3.5 million workers needed by 2030 to care for older adults, current levels of workforce already stretched. 2011. https://eldercareworkforce.org/newsroom/press-releases/article:3-5-million-workers-needed-by-2030-to-care-for-older-adults-current-levels-of-workforce-already-stretched/. Accessed March 24, 2018.
51. Meiboom AA, de Vries H, Hertogh CMPM, Scheele F. Why medical students do not choose a career in geriatrics: a systematic review. *BMC Medical Education*. 2015;15:101. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4470031/. Accessed March 24, 2018.

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CHAPTER 2

The Physiology of Aging

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CHAPTER OUTLINE

- Introduction
- Theories of Aging
- Gastrointestinal Changes
- Body Composition Changes
- Cardiovascular and Respiratory System Changes
- Renal System Changes
- Skeletal Health
- Changes in Other Body Systems
- Conclusion

CHAPTER OBJECTIVES

Upon completion of this chapter, the reader will be able to:

1. Describe the key changes that occur with age in each body system.
2. Discuss the theories of aging and the relationship between genetic and environmental (including dietary) factors.
3. List five changes to the gastrointestinal tract with age that affect nutrition.
4. Describe the changes in body composition that commonly occur with age and the implications of these changes on health and quality of life.
5. Explain the diet-related risk factors for cardiovascular disease in older adults.
6. Describe how dietary interventions can slow aging and the progression of disease.

LET'S DISCUSS

1. Choose a wide variety of popular beverages—both nonalcoholic and alcoholic—and calculate the amount of sugar found in each beverage. Stack sugar cubes to document the number of teaspoons of "hidden sugar" found in each beverage. Discuss the nutritional pros and cons of each beverage for older adults.
2. Almost 75% of adults 65 years and older use the Internet daily, and about one-third regularly use social media. Develop a list of credible Internet sites that support healthy aging to use as a resource while counseling older adults.
3. Create and share 280-character Twitter and/or Facebook messages that focus on health and nutrition for on older adults.

Introduction

Aging is a highly complex and multifactorial life process in which nutrition is one of the major determinants of how well any one individual ages. Beginning even before conception, nutrition is dynamic in its effect on human development; growth; and, ultimately, the aging process. From early in life, eating a nutritious diet, maintaining a healthy body weight, and leading a physically active lifestyle are key influential factors in helping individuals avoid the physical and mental deteriorations associated with aging. Throughout the life span, successful aging depends on the interaction of a variety of factors, including health behaviors, genetics, environment and lifestyle, and medical conditions (see **TABLE 2-1**). Lifelong dietary habits influence risk for acute and chronic conditions and disease as well as influence the response to age-related biologic and physiologic changes. Food is not only critical to one's physiologic well-being but also contributes to one's social, cultural, and psychological quality of life. Social factors such as access to food and physical factors such as functional ability to prepare meals and economic resources to purchase wholesome foods also influence the nutritional component of the aging process.

Aging is characterized by a gradual decline in organ function beginning as early as 30 to 40 years of age. The loss in organ functional reserves reduces the body's ability to maintain homeostasis, especially under conditions of stress. Aging in and of itself does not mean pathology and without the presence of disease is often referred to as normal or physiologic. In the absence of pathogenic stimuli, aging alone does not lead to overt disease; however, physiologic changes that occur as part of aging can make the occurrence of disease more likely. Alterations to the skeletal system,

TABLE 2-1 Age-Related Changes and Nutrient Needs

Change in Body Composition or Physiologic Function	Impact on Diet and Nutrient Requirements
Decreased muscle mass and strength	Decreased need for energy Increased need for high-quality protein Functional impairment, which could limit food access
Decreased total energy expenditure and reduced physical activity	Decreased energy requirement; increased importance of nutrient-dense diet
Decreased immune competence	Increased need for vitamin B_6, antioxidants, vitamin E, zinc, and high-quality protein
Atrophic gastritis and increased gastric pH	Increased need for vitamin B_{12}, folic acid, calcium, iron, zinc, and vitamin K
Decreased calcium bioavailability	Increased need for calcium and vitamin D
Decreased bone density	Increased need for calcium and vitamin D
Decreased skin capacity, renal activation, and gut response to synthesize active vitamin D	Increased need for calcium and vitamin D
Decreased skin recoil, thickness of skin, size of rete ridges, vascularity, and number of capillaries	Increased need for protein with adequate calories and fluids

Increased dry skin due to atrophy of sweat glands	Increased need for adequate amount of essential fatty acids
Decreased efficiency in metabolic use of vitamin B_6	Increased need for vitamin B_6
Increased levels of homocysteine	Increased need for folate, vitamin B_{12}, and vitamin B_6
Decreased vitamin absorption	Increased need for food choices with high nutrient density
Olfactory changes, reduced sense of taste and smell	Decreased amount and/or quality of food intake
Detrimental oral changes	Decreased amount and/or quality of food intake
Increased wintertime parathyroid hormone production	Increased need for vitamin D
Menopause	Decreased requirement for iron, likelihood of undesirable weight gain, increased bone loss
Increased retention of vitamin A; altered hepatic metabolism	Decreased requirement for vitamin A
Decreased kidney ability to concentrate urine, increased constipation, and reduced thirst sensation	Increased need for fluids
Increased oxidative stress, cognitive impairment, cataracts, and age-related macular degeneration	Increased need for antioxidants such as beta-carotene, vitamin C, vitamin E
Slowed gastric motility	Increased need for fiber and water
Decreased ability to regulate fluid balance	Fluid needs possibly increased or decreased; fluid monitoring required

Source: Insel P, Ross D, McMahon K, Bernstein M. *Discovering Nutrition*. 6th ed. Burlington, MA: Jones & Bartlett Learning; 2019; Blumberg J. Nutritional needs of seniors. *J Am Coll Nutr.* 1997;16(6):517–523; and Ross, et al. *Modern Nutrition*. 11e. Copyright (c) 2012 by Lippincott Williams & Wilkins.

such as changes in bone turnover and loss of bone mass, make osteoporosis and associated fractures more likely. It can therefore be difficult to separate alterations related to aging from those related to disease.[1]

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Senescence, the aging processes in the absence of disease, involves normal biologic and physiologic changes that affect the entire body. The presence and rate of progressive changes of aging differ significantly among individuals. Some of these changes can be slowed with good health habits, including diet and exercise and appropriate medical interventions, whereas others at this time are thought to be part of normal aging. Ultimately, many changes can lead to a decline in health and functional capacity as well as contribute to an increase in the vulnerability to disease or susceptibility to injury or insult. Although aging cannot be reversed, one key factor by which it may be altered is nutrition. This chapter provides an overview of some of the theories that explore why we age, discusses the biologic and physiologic developments associated with the aging process, and introduces the nutritional implications for the many changes experienced by the human body as we get older.

Theories of Aging

PREVIEW For several decades, researchers have made dramatic progress in uncovering the biomolecular mechanisms that drive the aging process, including the role of cell replication, DNA mutations, oxidative damage, telomere length, and the relatively new field of epigenetics.

The world population is indeed getting older, including among those individuals who have lived as long as a century or more. As of 2015, an estimated 500,000 people worldwide were centenarians (aged 100 years or older).[2] That number is projected to reach 3.7 million by 2050. Based on the available data (some of which may be unreliable because of lost or nonexistent birth certificates), the United States leads the world in the number of centenarians, followed by Japan, China, and India.[3] According to the National Center for Health Statistics, between 2000 and 2014, the number of Americans aged 100 and older increased by 43.6% from 50,281 to 72,197.[4] While the process of aging is obviously unavoidable, the decline in quality of health does not have to be inevitable as scientists seek to explain why some individuals seem to resist age-related diseases better than others. Observational studies suggest that the average centenarian appears to be in better health than the average 80-year-old,[5] a phenomenon that has scientists speculating over the extent to which both genetics and environmental factors contribute to these differences between age groups.

Over the past several decades, there has been significant progress made in understanding the mechanisms responsible for aging, but despite these advances, the biologic systems that control the human life span and influence healthy aging remain a mystery. What many scientists do agree on is that the human aging process results from many different and intersecting mechanisms coexisting in one single organism.[6] These mechanisms are believed to be encoded in our genes and in one way or another are associated with mounting cellular damage that brings about dysfunction within the cell and eventually the end of life.[7]

Consequently, recent theories of human aging cover two broad and interconnected categories. The first category holds that the average life span within a given species is genetically predetermined—a concept known as programmed theory. In this scenario, there is a built-in cellular timetable initiating mechanisms that unfold in accordance with changes in gene expression (gene behavior) that in turn affect the systems responsible for the body's maintenance, repair, and defense responses.[8] During an organism's lifetime, cells are constantly exposed to external and internal stressors, and in the case of irreversible damage, they respond to these stressors through apoptosis (programmed cell death) or cellular senescence (permanent cell-cycle arrest).[9]

Based on this concept, the assumption is that human cells are programmed to die after a certain number of replications. The ability to divide is tied to the functionality of DNA, which is stored within the cell's chromosomes. At the end of each chromosome, there are little "caps" of noncoding DNA called telomeres that protect genetic material from errors in copying. Each time a cell divides, the telomeres that are found on the new cells are a little shorter than those on the original cell. So, with each subsequent division, the telomeres become increasingly shorter. A cell reaches its dividing limit once the telomeres are so short that they can no longer protect the chromosomes, and the cell dies. In effect, telomeres function as a kind of biologic clock with their length considered a biomarker of aging. Shorter telomeres are linked with shorter life spans and a higher risk of a variety of age-related diseases.[10]

Telomere length is highly heritable and varies greatly among individuals and is noted to be longer in women than in men. Scientists are uncertain to what extent telomere length is associated with life span potential, but it appears to be inversely related to chronologic age. Moreover, accelerated telomere loss has been associated with many chronic diseases of aging, possibly through increased oxidative stress and DNA damage (further details below). Research around telomere biology is rapidly expanding but still remains an area in need of far more scientific investigation to make any firm conclusions about its impact on longevity.[11]

The second aging theory category is known as error or damage theory. These ideas emphasize environmental stressors to living organisms that wreak cumulative cellular deterioration and, as a result, cause aging. Chief among these concepts is that free radicals bring about accumulated damage within the cells, and eventually the organs are unable to function properly, ultimately leading to death.[7] According to damage theory, the process of cellular respiration (the breaking down of organic compounds to release energy in the form of ATP) produces a form of oxygen known as reactive oxygen species (ROS), which inflicts oxidative damage to DNA, consequently causing harmful mutations and hindering the cell's ability to divide and sustain the life of the organism.[8]

The Role of Cell Replication

Although aging is a multilevel and complex process, the concepts that underlie the theories of aging ultimately relate to the stability of cellular DNA structure and function and the ability of the body's cells to divide.[9] Human cells (with the exception of red blood and nerve cells) continuously replicate themselves. Before a cell divides, it is necessary for it to create a full copy of its genetic material by "unzipping" the original DNA strand. The splitting of the strand breaks the bonds between the connecting nucleotides or bases (adenine, cytosine, guanine, and thymine) that form base pairs (the "rung" component of the DNA ladder). The exposed bases that belong to each half of the split strand are then matched up with the appropriate free-floating nucleotides in order to form two