CENGAGE

Nutrition Therapy & Pathophysiology

FOURTH EDITION

Marcia Nelms
Kathryn P. Sucher

Aids to Calculation

Conversion Factors

A conversion factor is a fraction in which the numerator (top) and the denominator (bottom) express the same quantity in different units. For example, 2.2 pounds (lb) and 1 kilogram (kg) are equivalent; they express the same weight. The conversion factors used to change pounds to kilograms and vice versa are:

$$\frac{1\text{ kg}}{2.2\text{ lb}} \text{ and } \frac{2.2\text{ lb}}{1\text{ kg}}.$$

Because a conversion factor equals 1, measurements can be multiplied by the factor to change the *unit* of measure without changing the *value* of the measurement. To change one unit of measurement to another, use the factor with the unit you are seeking in the numerator (top) of the fraction.

Example 1 Convert the weight of 130 pounds to kilograms.

- Choose the conversion factor in which the kilograms are on top and multiply by 130 pounds:

$$\frac{1\text{ kg}}{2.2\text{ lb}} \times 130\text{ lb} = \frac{130\text{ kg}}{2.2} = 59\text{ kg}.$$

Example 2 Consider a 4-ounce (oz) hamburger that contains 7 grams (g) of saturated fat. How many grams of saturated fat are contained in a 3-ounce hamburger?

- Because you are seeking grams of saturated fat, the conversion factor is:

$$\frac{7\text{ g saturated fat}}{4\text{ oz hamburger}}.$$

- Multiply 3 ounces of hamburger by the conversion factor:

$$3\text{ oz hamburger} \times \frac{7\text{ g saturated fat}}{4\text{ oz hamburger}} = \frac{3 \times 7}{4} = \frac{21}{4} =$$

5 g saturated fat (rounded off).

Percentages

A percentage is a comparison between a number of items (perhaps the number of kcalories in your daily energy intake) and a standard number (perhaps the number of kcalories used for Daily Values on food labels). To find a percentage, first divide by the standard number and then multiply by 100 to state the answer as a percentage (*percent* means "per 100").

Example 3 Suppose your energy intake for the day is 1500 kcalories (kcal): What percentage of the Daily Value (DV) for energy does your intake represent? (Use the Daily Value of 2000 kcalories as the standard.)

- Divide your kcalorie intake by the Daily Value:

  1500 kcal (your intake) ÷ 2000 kcal (DV) = 0.75.

- Multiply your answer by 100 to state it as a percentage:

  0.75 × 100 = 75% of the Daily Value.

Example 4 Sometimes the percentage is more than 100. Suppose your daily intake of vitamin C is 120 milligrams (mg) and your RDA (male) is 90 milligrams. What percentage of the RDA for vitamin C is your intake?

120 mg (your intake) ÷ 90 mg (RDA) = 1.33.

1.33 × 100 = 133% of the RDA.

Example 5 Sometimes the comparison is between a part of a whole (for example, your kcalories from protein) and the total amount (your total kcalories). In this case, the total is the number you divide by. If you consume 60 grams (g) protein, 80 grams fat, and 310 grams carbohydrate, what percentages of your total kcalories for the day come from protein, fat, and carbohydrate?

- Multiply the number of grams by the number of kcalories from 1 gram of each energy nutrient (conversion factors):

$$60\text{ g protein} \times \frac{4\text{ kcal}}{1\text{ g protein}} = 240\text{ kcal}.$$

$$80\text{ g fat} \times \frac{9\text{ kcal}}{1\text{ g fat}} = 720\text{ kcal}.$$

Milliequivalents to Milligrams

Cations		Anions	
Milliequivalents	**Milligrams**	**Milliequivalents**	**Milligrams**
1 mEq Potassium (K^+)	39 mg	1 mEq Chloride (Cl^-)	35.5 mg
1 mEq Sodium (Na^{2+})	23 mg	1 mEq Bicarbonate (HCO_3^-)	61 mg
1 mEq Calcium (Ca^{2+})	20 mg	1 mEq Potassium (PO_4^{3-})	31.67 mg
1 mEq Magnesium (Mg^{2+})	12.2 mg		

The equivalent weight of an electrolyte is its molecular weight divided by its valence. Therefore, because the molecular weight of K^+ is 39 and its valance is one, 39/1 is 39 grams. Milliequivalents would be 1/1000 of the equivalents or 39 milligrams. One milliequivalent of Na^+ is 23 milligrams [(23 grams/1) divided by 1000].

$$310 \text{ g carbohydrate} \times \frac{4 \text{ kcal}}{1 \text{ g carbohydrate}} = 1240 \text{ kcal.}$$

- Find the total kcalories:

  240 + 720 + 1240 = 2200 kcal.

- Find the percentage of total kcalories from each energy nutrient (see Example 3):

  Protein: 240 ÷ 2200 = 0.109 × 100 = 10.9 = 11% of kcal.

  Fat: 720 ÷ 2200 = 0.327 × 100 = 32.7 = 33% of kcal.

  Carbohydrate: 1240 ÷ 2200 = 0.563 × 100 = 56.3 = 56% of kcal.

  Total: 11% + 33% + 56% = 100% of kcal.

In this case, the percentages total 100 percent, but sometimes they total 99 or 101 because of rounding—a reasonable estimate.

Ratios

A ratio is a comparison of two (or three) values in which one of the values is reduced to 1. A ratio compares identical units and so is expressed without units.

Example 6 Suppose your daily intakes of potassium and sodium are 3000 milligrams (mg) and 2500 milligrams, respectively. What is the potassium-to-sodium ratio?

- Divide the potassium milligrams by the sodium milligrams:

  3000 mg potassium ÷ 2500 mg sodium = 1.2.

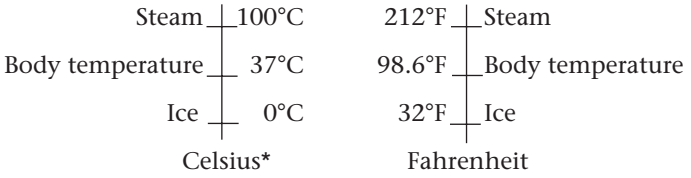
The potassium-to-sodium ratio is 1.2:1 (read as "one point two to one" or simply "one point two"), which means there are 1.2 milligrams of potassium for every 1 milligram of sodium. A ratio greater than 1 means that the first value (in this case, potassium) is greater than the second (sodium). When the ratio is less than 1, the second value is larger.

Weights and Measures

LENGTH

1 meter (m) = 39 in.
1 centimeter (cm) = 0.4 in.
1 inch (in) = 2.5 cm.
1 foot (ft) = 30 cm.

TEMPERATURE



- To find degrees Fahrenheit (°F) when you know degrees Celsius (°C), multiply by 9/5 and then add 32.
- To find degrees Celsius (°C) when you know degrees Fahrenheit (°F), subtract 32 and then multiply by 5/9.

VOLUME

1 liter (L) = 1000 mL, 0.26 gal, 1.06 qt, or 2.1 pt.
1 milliliter (mL) = 1/1000 L or 0.03 fluid oz.
1 gallon (gal) = 128 oz, 8 c, or 3.8 L.
1 quart (qt) = 32 oz, 4 c, or 0.95 L.
1 pint (pt) = 16 oz, 2 c, or 0.47 L.
1 cup (c) = 8 oz, 16 tbs, about 250 mL, or 0.25 L.
1 ounce (oz) = 30 mL.
1 tablespoon (tbs) = 3 tsp or 15 mL.
1 teaspoon (tsp) = 5 mL.

WEIGHT

1 kilogram (kg) = 1000 g or 2.2 lb.
1 gram (g) = 1/1000 kg, 1000 mg, or 0.035 oz.
1 milligram (mg) = 1/1000 g or 1000 µg.
1 microgram (µg) = 1/1000 mg.
1 pound (lb) = 16 oz, 454 g, or 0.45 kg.
1 ounce (oz) = about 28 g.

ENERGY

1 kilojoule (kJ) = 0.24 kcal.
1 millijoule (mJ) = 240 kcal.
1 kcalorie (kcal) = 4.2 kJ.
1 g carbohydrate = 4 kcal = 17 kJ.
1 g fat = 9 kcal = 37 kJ.
1 g protein = 4 kcal = 17 kJ.
1 g alcohol = 7 kcal = 29 kJ.

*Also known as *centigrade*.

Nutrition Therapy and Pathophysiology FOURTH EDITION

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Dedication

For my husband Jerry, my children:
Taylor, Eva, Emory, Marialejandra,
my grandchildren: Campbell and Andrea—you
are the light of my life.
Marcia Nahikian-Nelms

For my supportive and loving husband
Peter, and my son Alexander
Kathryn Sucher

Brief Table of Contents

Table of Contents

Preface

The authors of this text are educators, clinicians, and researchers. Therefore, our purpose in the fourth edition of this text is to continue our original goals to provide the most up-to-date research and application of evidence-based nutritional care for students, clinicians, and researchers as they seek to understand and treat nutrition-related disease. Most of us look to primary reference texts as the cornerstone of our practice. Many names come to mind—*Modern Nutrition in Health and Disease*, the ASPEN Nutrition Support Core Curriculum, and Harrison's *Book of Internal Medicine*. We continue to strive for this text to be one of those reference texts not only to provide the information necessary to understand nutrition practice but also provide it in such a way that the learning environment will support students' development of critical thinking, clinical reasoning, and decision-making skills. This edition places additional emphasis on the interprofessional team where we explicitly emphasize that optimal patient care will require all members of the health care team to work together to provide the most efficient and accurate care for the public.

What continues to make *this* text different from other clinical nutrition therapy texts? The clinical environment evolves as a result of the impacting forces of research, health care funding, evidence-based nutrition practice, and development of the nutrition care process, standardized language, and standardized nutrition diagnoses. To meet the demands of these evolving forces, this text includes not only the most current research and integration of evidence-based practice within the context of the nutrition care process but also an overview of health care systems and the dietitian's role within these systems as a member of the health care team; guidelines for documentation and other professional writings; and coverage of emerging fields such as nutrigenomics. Furthermore, as the framework for the nutrition care process has progressed over the previous seven years, the structure for our text has organized its pedagogy to be consistent with each step of the nutrition care process. This text incorporates standardized language, the Evidence Analysis Library, the Academy of Nutrition and Dietetics Nutrition Care Manual, the Standards of Practice for the Registered Dietitian Nutritionist, and the professional Code of Ethics.

The text begins with a discussion of the dietitian's role as a nutrition expert, and then proceeds through the nutrition care process, introducing the basics of assessment, diagnosis, intervention, and monitoring/evaluation. Next, a comprehensive review of physiological concepts required to integrate nutrition therapy as a component of medical care is presented. These foundational chapters cover physiological response to injury, the immune system, fluid and electrolyte balance, pharmacology, and genetics—focusing specifically on the application of each of these topics to clinical nutrition practice.

The final section of this text is organized using a systems approach consistent with other medical texts. Each nutrition therapy chapter discusses normal structure and function of a body system, explains how the disease process interrupts normal functioning, and then describes appropriate medical and nutrition interventions. This edition has retained the pedagogical features students and educators found especially helpful—Clinical Applications boxes, nutrition assessment summary tables, sample documentation, PES statements, case studies, overviews of common medical care and drug–nutrient interactions, and interviews with current clinical practitioners. New features for this edition include many additional Life Cycle Perspectives boxes for applications of nutritional care for pediatrics and older adults. This approach allows any health care professional to benefit from this text.

Though every effort has been made to address the most recent research and the most common clinical and medical practices, this text has the same limitation any medical textbook will have: new diagnoses, new drugs, new treatments, and a new understanding of the relationship between nutrition and disease will inevitably continue to be cultivated after publication. Thus, this book strives to educate students about not only facts and theories that comprise current medical knowledge but also the process of skill development that empowers students to grow in expertise within their field. As practitioners of the future utilize the nutrition care process, it will be refined even as their knowledge of disease and its treatment evolves.

As clinical practitioners and current dietetic educators, we have experienced a need for not only this different approach to a clinical nutrition text but also a reference for clinical practitioners. We believe that this fourth edition continues to serve this purpose.

NEW TO THIS EDITION

The fourth edition of *Nutrition Therapy and Pathophysiology* has built upon the strengths of prior editions to include a comprehensive focus on pathophysiology and medical treatment with a thorough review of the most current research. Throughout this fourth edition, the need for the interprofessional health care team is emphasized. Specific diets and food recommendations are covered within each chapter, and new research and life-cycle perspectives are integrated throughout. This book's chapter organization will allow the student and practitioner to follow the steps of the nutrition care process. Nutrition therapy within each systems chapter

emphasizes real-life application of the standards in patient care and has been updated with the latest evidence-based practice. Figures and tables have been modified to provide visual explanations of concepts within the text. New photos of wholesome foods and real clinical settings have been added to both enhance chapters pedagogically and add visual appeal.

Specific changes for the fourth edition include the following:

PART 1

The Role of Nutrition Therapy in Health Care

- ***Chapter 1 Role of the Dietitian in the Health Care System*** provides updated information on the nutrition care process, evidence-based practice, Code of Ethics and 2017 Standards of Professional Practice, updates for dietetic education, as well as new information on the Academy of Nutrition and Dietetics *Scope of Practice.* There is a specific emphasis on the interprofessional core competencies and need for interprofessional care. This chapter continues to have a significant discussion on evidence-based practice and its role as the foundation of dietetic's practice.

PART 2

The Nutrition Care Process

- ***Chapter 2 The Nutrition Care Process*** has been updated to include the most current terminology for all steps of the NCP. The 2017 updated model more clearly depicts the interrelationships of the steps of the NCP.
- ***Chapter 3 Nutrition Assessment: Foundation of the Nutrition Care Process*** integrates the adult and pediatric malnutrition guidelines within the tools for nutrition assessment as well as the use of the nutrition-focused physical examination. This chapter includes newer screening tools including NRS 2002 and NUTRIC score as well as the use of screening for food insecurity within the overall nutrition assessment process. There is a thorough coverage of anthropometric measurements including the use of pediatric growth charts, pediatric midarm muscle circumference, and z-scores. Newer research regarding sarcopenia and use of portable ultrasound and DXA is additionally reviewed. There is a thorough review of protein assessment with a clear discussion of the impact of inflammation on acute-phase protein synthesis and its' impact on assessment interpretation. Up-to-date reference standards are used throughout this chapter and the text with an emphasis on the use of dietary patterns and the 2015–2020 U.S. Dietary Guidelines.
- ***Chapter 4 Nutrition Intervention and Nutrition Monitoring and Evaluation*** builds on the updated intervention terminology from Chapter 2 to explain the process of developing interventions, beginning with oral diets as examples of interventions within the acute care setting. This chapter includes a new section discussing the monitoring and evaluation step of the nutrition care process.
- ***Chapter 5 Enteral and Parenteral Nutrition Support*** has been extensively revised to incorporate the most recent ASPEN and evidence-based guidelines for prescribing nutrition support. All calculation examples have been revised for simplification of student use.
- ***Chapter 6 Nutrition Informatics and Documentation of the Nutrition Care Process*** has a new emphasis on the importance of informatics and its application to the dietetics profession.

PART 3

Introduction to Pathophysiology

- ***Chapter 7 Fluid and Electrolyte Balance*** and ***Chapter 8 Acid-Base Balance*** have been updated with the latest research to provide a thorough review for the student and comprehensive reference for the practitioner.
- ***Chapter 9 Cellular and Physiological Response to Injury: The Role of the Immune System*** features additional information on both the acute and chronic inflammatory response and its application to the disease process. This edition has increased references to food allergies, diagnostics, and treatment.
- ***Chapter 10 Nutritional Genomics*** presents new research on the genetics of nutrition-related diseases and a snapshot of the nutritional genetics marketplace. Nutritional genomics in disease is emphasized within the topics of cancer, obesity, diabetes, cardiovascular disease incorporating the latest nutrition related research in this fast-growing field. The chapter additionally covers the role of nutritional genomics and the practice of nutrition and dietetics.
- ***Chapter 11 Pharmacology*** provides the framework for the dietetic student to learn to evaluate the role of pharmacology within the nutrition care process. This explicit framework in the chapter provides the foundation to meet the latest update for dietetic education performance indicators within this competency area.

PART 4

Nutrition Therapy

Each chapter in Part 4 provides updated coverage of common diagnostic procedures and medications—with improved information on nutrition assessment and nutrition therapies.

- ***Chapter 12 Diseases and Disorders of Energy Imbalance*** explains the application of the most recent evidence-based guidelines for assessment, treatment, and prevention of overweight and obesity for both pediatric and adult populations. Nutrition therapies for weight loss and for postbariatric surgeries are covered within this updated chapter. Behavioral assessment, physical activity readiness, and nutrition counseling strategies for behavior change are also addressed within the chapter. Malnutrition is additionally emphasized in this chapter

with discussion of both adult and pediatric malnutrition guidelines.

- ***Chapter 13 Diseases of the Cardiovascular System*** has been reorganized and includes updated information on epidemiology, pathophysiology, and risk factors, along with the most recent treatment guidelines and medications. The chapter includes a new section on heart transplantation and three new boxes discussing aging and heart disease, congenital heart defects, and food safety for immune-compromised patients.
- ***Chapter 14 Diseases of the Upper Gastrointestinal Tract*** has been updated with the latest research with discussion for eosinophilic esophagitis (EoE), a comparison between the National Dysphagia Diet and the International Dysphagia Diet Standardization Initiative. The updated chapter also includes steps for physical assessment of the oral cavity and its' role within the nutrition-focused physical exam. Additionally this new chapter incorporates discussion of the microbiome, ERAS protocols, and the most recent nutrition therapies for gastroparesis and EoE.
- ***Chapter 15 Diseases of the Lower Gastrointestinal Tract*** has been revised to incorporate more in-depth coverage of the microbiome, use of probiotics, and the role of nutrition therapies for diarrhea, constipation, malabsorption, inflammatory bowel disease, short bowel syndrome, irritable bowel syndrome (IBS), small intestinal bacterial overgrowth (SIBO), and celiac disease. A new section covering intestinal rehabilitation and transplant has been added. The use of nutrition support is integrated throughout the nutrition therapy sections and supported with the most recent evidence-based guidelines including ERAS protocols.
- ***Chapter 16 Diseases of the Liver, Gallbladder, and Exocrine Pancreas*** has been extensively revised and reorganized with more in-depth coverage of nonalcoholic fatty liver disease, acute and chronic pancreatitis, and the appropriate nutrition assessment and interventions. Protocols for use of micronutrient supplementation and pancreatic enzymes are additionally covered within this chapter. Pancreatic surgical procedures, ERAS protocols, and postoperative nutrition therapy are included. A new practitioner interview discusses the role of the dietitian on the transplant team.
- ***Chapter 17 Diseases of the Endocrine System*** has been revised to reflect the American Diabetes Association's 2018 standards of medical care in diabetes with updates for diagnosis, medication protocols, medical nutrition therapy, and lifestyle interventions. Practical examples incorporating carbohydrate counting, insulin dosing, and correction factors are provided. New to this addition is the discussion of bariatric surgery and pancreatic and islet cell transplantation as treatments for diabetes.
- ***Chapter 18 Diseases of the Renal System*** continues to update medical care and nutrition therapies for both acute kidney injury and chronic kidney disease with the latest research and evidence-based guidelines.
- ***Chapter 19 Diseases of the Hematological System*** has been thoroughly updated and can continue to be used as an important reference to support all of the nutrition therapies within this text.
- ***Chapter 20 Diseases and Disorders of the Neurological System*** incorporates the most recent research through enhanced discussions of the ketogenic diet and interventions for prominent nutrition problems such as dysphagia and drug–nutrient interactions.
- ***Chapter 21 Diseases of the Respiratory System*** update brings a new author who is a professor of respiratory therapy. Her knowledge of pulmonary anatomy and mechanical ventilation brings a significant update to this chapter. There are additionally important and significant updates to the sections for bronchopulmonary dysplasia, cystic fibrosis, and nutrition support in respiratory failure. A new practitioner interview from a dietitian with 30 years of experience in cystic fibrosis adds a historical value to the changes in the care for individuals with CF.
- ***Chapter 22 Metabolic Stress and the Critically Ill*** incorporates the ASPEN critical care guidelines, ERAS protocols, and a thorough integration of new research and its application to surgery, trauma, sepsis, traumatic brain injury, burns. HIV and AIDS. Updated figures and protocols for prescribing nutrition support are provided.
- ***Chapter 23 Neoplastic Disease*** has been significantly reorganized. The discussions of cancer-related genetics, nutrigenomics, cancer risk, and cancer prevention have been expanded. The information on epidemiology, pathophysiology, medical treatments, medications, and nutrition care guidelines has been updated.
- ***Chapter 24 Diseases of the Musculoskeletal System*** has been updated with a focus on osteoporosis, osteoarthritis, and gout, and features new boxes covering pediatric muscular dystrophy and the use of alternative treatments for arthritis among older adults.
- ***Chapter 25 Metabolic Disorders'*** new author brings an excellent organization and writing style to a difficult topic. The chapter has been thoroughly updated with the latest treatment guidelines, and case discussion examples for the most common inborn errors of metabolism are provided.

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Part 1

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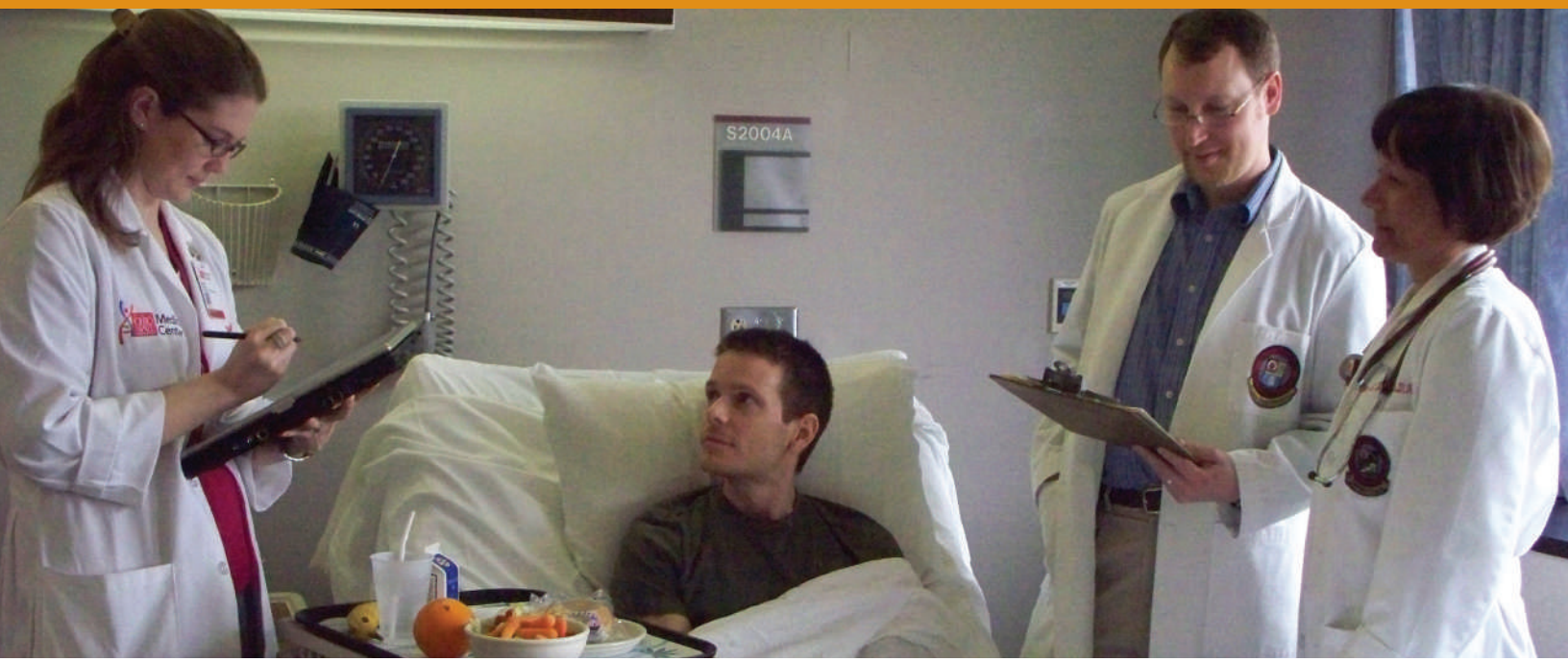
The Role of Nutrition Therapy in Health Care

IN THIS PART

CHAPTER 1



Source: Courtesy of Marcia Nelms.

Role of the Registered Dietitian Nutritionist in the Health Care System

Kathryn Sucher, ScD, RDN
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LEARNING OBJECTIVES

LO 1.1 Describe the three categories of the Scope of Practice developed by the Academy of Nutrition and Dietetics.

LO 1.2 Differentiate between the four clinical nutrition team members.

LO 1.3 Identify other health professionals that are part of the Interprofessional team.

LO 1.4 Explain why nutrition services are expected to expand under the Affordable Care Act (ACA).

LO 1.5 Describe the five components of critical thinking and their applications in providing nutrition care.

LO 1.6 Define evidence-based practice and its relevance.

GLOSSARY

Affordable Care Act (ACA)—federal legislation meant to ensure that all Americans have access to affordable health care while containing U.S. health care costs

critical thinking—the act of thinking using the mind to organize and integrate information, identify relationships, make inferences, form conclusions, and make decisions

evidence-based dietetics practice—dietetics practice in which systematically reviewed scientific evidence is used to make food and nutrition practice decisions

health insurance—financial protection against health care costs associated with treatment of disease or accidental injury

nurse—a health care professional who has earned at least an associate's degree in nursing, has been licensed by the state, and assists patients in activities related to maintaining or recovering health. Examples of advanced practice nursing include nurse practitioner, clinical nurse specialist, nurse midwife, and nurse anesthetist

occupational therapist—A health professional who has obtained a master's or doctoral degree from an accredited OT educational program and passed a national registration exam. OTs evaluate and provide intervention in collaboration with the client, family, caregiver; develop, improve, sustain, or restore skills in activities of daily living (ADL), work or productive activities, and play or leisure; identify and facilitate engagement in meaningful and healthy occupations; develop, remediate, or restore sensorimotor, cognitive, or psychosocial components of performance; educate the client, family, caregiver, or others in carrying out appropriate nonskilled interventions; and consult with groups, programs, organizations, or communities to provide population-based services

outcomes research—evaluation of care that focuses on the status of participants after receiving care

pharmacist—a licensed health professional with a doctorate of pharmacy who compounds and dispenses medications, provides direct patient care by assessing tolerance to medications, and provides education on health and wellness

physical therapists—health care professionals who can help patients reduce pain and improve or restore mobility; teach patients how to prevent or manage their condition so that they will achieve long-term health benefits; work with individuals to prevent the loss of mobility before it occurs by developing fitness- and wellness-oriented programs for healthier and more active lifestyles. Physical therapists can further specialize in these areas: cardiovascular and pulmonary, clinical electrophysiology, geriatric, neurology, orthopedic, pediatric, and sports

physician—health care professional who practices medicine, which is concerned with promoting, maintaining, or restoring health through the study, diagnosis, and treatment of disease, injury, and other physical and mental impairments

physician assistant—health care professionals who diagnose illness, develop and manage treatment plans, prescribe medications, and often serve as a patient's principal health care provider

respiratory therapist—health care professionals who have earned a minimum of an associate's degree in respiratory therapy from an accredited educational program. These individuals provide testing, treatment, and care to patients who have difficulty breathing caused by cardiopulmonary disorders such as heart failure or pulmonary hypertension; chronic respiratory issues like asthma, COPD, or cystic fibrosis; and medical emergencies

social worker—a professional with at least a master's degree in social work who provides persons, families, or vulnerable populations with psychosocial support, advises family caregivers, counsels patients, and helps plan for patients' needs after discharge

speech-language pathologist—a health professional who has earned a master's degree and passed a national examination, who assesses, diagnoses, treats, and helps to prevent speech, language, cognitive, communication, voice, swallowing, fluency, and other related disorders

1.1 INTRODUCTION

The connection between diet and health has long been recognized. The profession of dietetics was first defined in 1899 by the American Home Economics Association as "individuals with knowledge of food who provide diet therapy for the medical profession." After 1917, dietitians were affiliated with the Academy of Nutrition and Dietetics (AND),[1] formerly known as the American Dietetic Association (ADA). Dietitians who were employed in hospitals became known as *clinical dietitians*. Over time, the clinical dietitian's role became the provision of specialized care and modification of diets to treat various medical conditions.

In the early 1970s, after high levels of malnutrition in hospitalized patients were reported[2] and new and improved procedures for delivering enteral and parenteral nutrition were developed, clinical dietitians began to take a leadership role in screening patients and monitoring their needs for adequate nutrition support. In addition, as research pointed to the role of diet in the development of chronic disease, clinical dietitians began to provide primary and secondary disease prevention for such diseases as atherosclerosis, cancer, and type 2 diabetes mellitus.[3] The information provided in this chapter is meant to help you understand where you might find potential sources of employment, your contribution to the nutrition care of a patient as part of the heath care team, reimbursement issues that you might encounter, and your professional responsibilities, and to help you develop skills that are necessary for the nutrition care process (NCP).

1.2 THE REGISTERED DIETITIAN NUTRITIONIST[1] IN CLINICAL PRACTICE

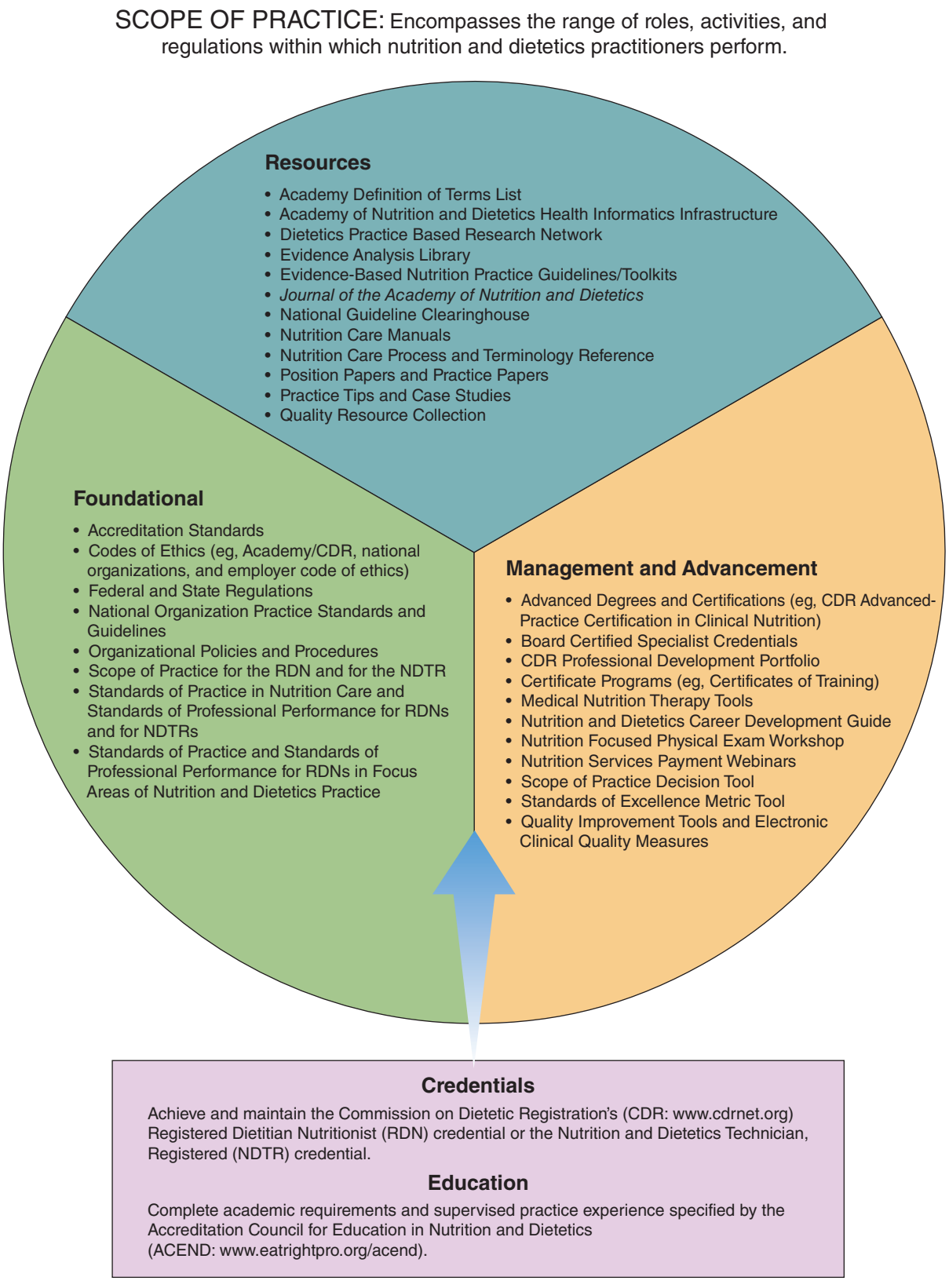
The Role of the Registered Dietitian Nutritionist

The practice of clinical nutrition is called *nutrition therapy*. Registered Dietitian Nutritionists are the educated and trained professionals who can best deliver nutrition therapy by using the NCP. The NCP consists of four major components: (1) nutrition assessment, (2) nutrition diagnosis, (3) nutrition intervention, and (4) nutrition monitoring and evaluation.[4,5]

Scope of Practice

The Scope of Practice (Figure 1.1) was developed by the AND and "focuses on food, nutrition and dietetics as well as related services." The Scope of Practice is divided into three categories, and all three are supported by the education and credentials you are now in the process of obtaining. The first area is Foundational that defines the roles, functions, responsibilities, and activities that dietetics practitioners are educated and authorized/proficient to perform within the boundaries of federal, state, and facility regulations. Practice Standards are used to evaluate a dietitian's job performance. The next area, Management and Advancement, provides tools, guides,

Figure 1.1 AND revised 2017 Scope of Practice for the Registered Dietitian Nutritionist



Source: Journal of the Academy of Nutrition and Dietetics, 2018: 18(141–65). 201810.1016/j.jand

BOX 1.1 CLINICAL APPLICATIONS

AND Scope of Practice for the Profession of Nutrition and Dietetics: A Roadmap and Resource for Your Current Education and Training and Future Career

When you look at the Scope of Practice diagram (Figure 1.1), the first thing you notice is probably the education block since you are likely taking a course to complete the academic requirements for becoming a credentialed registered dietitian nutritionist (RDN) or dietetic technician, registered (NDTR). You are probably less familiar with the three sections of the circle—Foundational, Management, and Resources, but they provide the roadmap and resources for your education, training, and future career.

1. **Foundational** includes the *Scope of Practice for the RDN and NDTR, Standards*, and *Standards of Professional Practice*, along with other documents. The Practice standards is used by licensing or certifying boards to define the procedures, actions, and processes that are permitted for practice. The AND Scope of Practice is the guide for dietetics education requirements at your college or university and demonstrated competency for supervised practice sites (e.g., dietetic internships). Your dietetics education and supervised practice are accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND), whose mission is to ensure educational quality that "prepares graduates with the foundation knowledge, skills and/or competencies for current dietetics practice and lifelong learning."

   The Standards of Professional Practice are developed by the AND to ensure that RDNs or NDTRs are competent to provide safe, ethical, and high-quality nutrition care; plus, they provide criteria for evaluating care. The standards may be used to develop job descriptions or evaluate your performance. Practice Standards also require continued education for RDNs and NDTRs for maintenance of their credentials and nutrition care competencies.

2. After you become an RDN or NDTR, **Management and Advancement** will provide tools to assist you in determining whether (1) a new work activity is within your scope of practice, and (2) this activity will require you to obtain additional training or education. These tools are meant to help you expand your practice as food and nutrition opportunities, roles, and services evolve. In addition, any education and training you complete, which you will document in the online Commission on Dietetic Registration (CDR) Professional Development Portfolio, will help you maintain your credential.

3. **Resources** provide materials to support quality nutrition care. You may already be familiar with some of the resources, such as the AND Evidence Analysis Library (www.adaevidencelibrary.com), from your dietetics coursework. The AND's "Definition of Terms List" can be found at www.eatright.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=6442451086&libID=6442451082

   In your medical nutrition therapy course, you will learn the nutrition care process and use of the *eNutrition Care Process and Terminology* (eNCPT) (Chicago, IL: Academy of Nutrition and Dietetics; 2018) so you can appropriately document medical nutrition therapy in the medical record. You may also use the AND *Nutrition Care Manual* to increase your understanding of medical conditions that require nutrition support or dietary modification.

Source: Academy of Nutrition and Dietetics Quality Management Committee and Scope of Practice Subcommittee of the Quality Management Committee. Academy of Nutrition and Dietetics: Scope of Practice in Nutrition and Dietetics. *J Acad Nutr Diet.* 2018; 118(1).

and information to help an RDN determine whether she or he has the necessary knowledge and skills to take on a new job responsibility within her or his scope of practice. Career advancement may require obtaining additional credentials, certifications, and/or advanced degrees. The last area, Practice Resources, includes materials available to help the practitioner provide current, safe, ethical, and high-quality food/nutrition services. The Scope of Practice is meant to be flexible so that, as the profession changes or as an individual specializes or advances in her or his practice, evaluation resources and decision aids will also be modified. See Box 1.1 for more details.

The Clinical Nutrition Team

Health care is defined as the prevention, treatment, and/or management of illness. Registered Dietitian Nutritionists are employed in a number of acute and chronic health care facilities, as listed in Table 1.1. Depending on the institution, nutrition therapy services may be organized along different lines. The manager of the services may have the title of chief clinical manager or clinical nutrition manager. This person often reports to the director of nutrition services, who commonly supervises the clinical nutrition manager and food service manager/directors. In turn, inpatient and outpatient clinical dietitians usually report to the clinical manager. Other important personnel in nutrition therapy services are registered nutrition dietetic technicians (NDTRs), who assist dietitians in the nutritional screening of patients and provision of nutrition education in addition to other duties, and dietary assistants/diet clerks, who are often responsible for the documentation and processing of diet orders and assuring accuracy of the meals that are provided for patients. Table 1.2 provides common job specifications for clinical nutrition team members.

RDNs' services may be provided to general patient care units, such as those on a general medical or surgical floor, or may be based on a medical specialization, such as treatment of patients in intensive care units (e.g., burn/trauma unit or pediatric/neonatal intensive care units). Boxes 1.2 and 1.3

Table 1.1 Types of Acute and Chronic Health Care Facilities in the United States

Acute Care Facilities	
Hospitals	
Public not for profit	Often owned and managed by the county or state government
Private not for profit	Owned or managed by the community, a religious organization, district health councils, or their own hospital board
Private for profit	Investor-owned (for-profit) health care organizations
Veterans and military	Government-run health care facilities for veterans of the U.S. military service and active-duty enlisted men and women
Clinics	
Outpatient	For preventative, primary health care (e.g., treatment for ear infection) and secondary health care (e.g., treatment of type 2 diabetes)
Urgent care	Provide primary care
Post Acute-Care Facilities	
Skilled nursing facilities	Provide 24/7 nursing care for complex medical needs
Long-term acute care hospital	Provide care for those with complex medical needs who have a longer than average hospital admission
Residential/assisted living	Provide for activities of daily living (e.g., bathing)
Continuing care retirement community	Provides continuum of care from independent living, assisted living, and skilled nursing on one geographical site
Rehabilitation/restorative	Provide integrated, multidisciplinary assistance for recovery from acute or chronic illness and/or surgical procedures (e.g., stroke)
Adult day care	Facilities offer supervision, social and recreational activities, meals/snacks. Provides daily respite for family members
Hospice	Focus on relieving symptoms and supporting those with a life expectancy of 6 months or less

Source: © Cengage Learning; Adapted from: Academy of Nutrition and Dietetics. Position of the Academy of Nutrition and Dietetics: individualized nutrition approaches for older adults: long-term care, post-acute care, and other settings. *J Acad Nutr Diet*. 2018; 118:724–35

Table 1.2 Responsibilities and Tasks of Clinical Nutrition Team Members

Nutrition Team Member	Responsibilities	Major Tasks
Clinical nutrition manager	Directs the activities of RDN, NDTR, and dietetic assistants	Hiring, evaluating, and training employees; reviewing productivity reports, writing job descriptions, scheduling employees, developing policies and procedures, designing performance standards, and developing and implementing goals and objectives of the department*
Registered dietitian (RDN)	Provides nutritional care for patients	Nutritional screening/assessment of patients to determine the presence or risks of developing a nutrition-related problem, development of nutritional diagnosis, nutrition intervention, and monitoring and evaluation of the nutrition care plan
Dietetic technician (NDTR)	Assists the clinical dietitian	Gathering data for nutritional screening; assigning a level of risk for malnutrition according to predetermined criteria; administering nourishment and dietary supplements for patients and monitoring tolerance; and providing information to help patients select menus and giving simple diet instructions
Dietetic assistant/diet clerk	Assists the clinical dietitian and/or dietetic technician in some routine aspects of nutritional care	Processing diet orders, checking menus against standards, setting up standard nourishment, tallying special food requests; distributing and collecting patient menus and trays; may be involved in evaluating patient food satisfaction and helping to gather food records used to evaluate nutrient intake

*Howells A, Sauer K, Shanklin C. Evaluating clinical nutrition managers' involvement in key management functions. *J Acad Nutr Diet*. 2017; 117(9): 1339–48. http://dx.doi.org/10.1016/j.jand.2016.08.010, accessed August 1, 2017.

BOX 1.2 LIFE CYCLE PERSPECTIVES

The Role of the RDN in Post-Acute Care

Colette LaSalle, PhD, RDN *San Jose State University*

The aging population has resulted in an increased need for registered dietitian nutritionists in post-acute care. There are a variety of settings that include skilled nursing facilities, inpatient rehabilitation facilities, long-term care hospitals, intermediate care facilities for individuals with intellectual disabilities, assisted living facilties, senior housing, adult day care, hospice and care provided through home health care. The working environment for post-acute care has a few advantages over other settings because typically there is only one RDN on site and she or he has greater autonomy and can set flexible schedules. Though the residents tend to have multiple chronic and acute medical problems, which increases the complexity of care required, the RDN has time to get to know them and their families and can follow up regularly to monitor the outcomes of each nutrition intervention.

The RDN is an integral part of the interdisciplinary health care team and works closely with other health professionals to optimize the nutritional status of the residents. The RDN has several important roles in post-acute care the first of which is related directly to patient care. Many residents have physical and cognitive limitations secondary to chronic disease that can impact intake; thus, the prevalence of malnutrition (both under- and overnutrition) in this population is high. The RDN is responsible for conducting a thorough nutrition assessment of the resident, evaluating the potential for functional problems during eating, such as impaired chewing ability, dental status, or swallow function, and disabilities such as the presence of contractures or postural impairments. RDNs also assess dietary intake by investigating dislikes and allergies, typical meal patterns at home, beverage preferences, diet knowledge, weight history, and previous diet restrictions. RDNs work to correct or attenuate nutrition-related problems by recommending diet changes and educating staff, families, and residents regarding the risks and benefits associated with therapeutic diet orders including restrictive diets, altered diet textures, and thickened fluid viscosities. RDNs also play a role in discussing end-of-life care, honoring advance directives, coordinating hospice care, and initiating and monitoring adequacy of enteral feeding orders. While it is of primary importance to honor the wishes of the residents, complicating factors arise related to issues of mental competency, conservatorship, and family dynamics, with family members sometimes desiring different levels of care for the resident.

The length of stay and required level of care vary widely; some residents are admitted for short-term injury rehabilitation or caregiver respite, whereas others are admitted long term with no expected discharge date. This means that the RDN is usually able to follow up with residents and evaluate the outcome of nutrition-related interventions by monitoring oral food and beverage intake, acceptance of snacks and supplements, wound status, laboratory values, and weekly or monthly weights. Also, because this population is often at risk for weight loss and decline, RDNs look not only for significant changes in weight but also for gradual, "insidious" weight loss.

In addition to providing direct clinical care, the RDN may also be responsible for overseeing all aspects of food service and food safety. The RDN conducts in-services for nurses, diet clerks, and all food service staff regarding safe food-handling practices (including HACCP) and preparing texture-modified and other therapeutic diets. Additionally, the RDN performs extensive food service inspections and monitors the tray line, the dish room, emergency menu, emergency food and water supplies, and cleaning, sanitizer, and temperature logs in order to ensure compliance with extensive federal, state, and city regulations.

References

1. Academy Quality Management Committee. Academy of Nutrition and Dietetics: Revised 2017 Standards of Practice for Registered Dietitian Nutritionists. *J Acad Nutr Diet*. 2018; 118:141–65.
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3. O'Sullivan Maillet J, Baird Schwartz D, Posthauer ME, Academy of Nutrition and Dietetics. Position of the Academy of Nutrition and Dietetics: ethical and legal issues in feeding and hydration. *J Acad Nutr Diet*. 2013 Jun; 113(6): 828–33. Erratum in: *J Acad Nutr Diet*. 2013 Jul; 113(7): 985.
4. Schwartz DB, Posthauer ME, O'Sullivan Maillet J. Practice paper of the Academy of Nutrition and Dietetics abstract: ethical and legal issues of feeding and hydration. *J Acad Nutr Diet*. 2013 Jul; 113(7): 981.
5. Touger-Decker R, Mobley C, Academy of Nutrition and Dietetics. Position of the Academy of Nutrition and Dietetics: oral health and nutrition. *J Acad Nutr Diet*. 2013 May; 113(5): 693–701.

BOX 1.3 LIFE CYCLE PERSPECTIVES

The Role of the RDN in Pediatric Care

Colette LaSalle, PhD, RDN *San Jose State University*

The role of the registered dietitian nutritionist (RDN) in pediatric care encompasses distinct challenges related to meeting the specialized needs of children. The primary role of the pediatric RDN is to optimize nutrient intake to promote growth and development in the presence of complicating factors such as acute or chronic illness or developmental delays. The RDN conducts a comprehensive nutrition assessment to obtain information related to medical and nutritional history, food preferences, typical eating patterns, and allergies while using pediatric guidelines to estimate nutritional requirements, analyze intake, and assess weight as compared to standards for age and length. One

The Role of the RDN in Pediatric Care (continued)

unique feature of pediatric practice is that, depending on the age of the child, some if not all of this information will be obtained from the caregivers. Pediatric RDNs design nutrition interventions to address feeding problems, behavior at mealtimes, and altered energy and nutrient needs. While these interventions focus on optimizing intake for the child, this cannot be accomplished unless the family or caregiver understands the recommendations and is willing and able to adhere. Thus, pediatric RDNs also educate family members and provide referrals to other health care providers such as speech-language pathologists, occupational therapists, and community food programs.

RDNs may work in intensive care units (ICUs) that are specialized to either neonates (NICU) or pediatrics (PICU). In each of these ICUs, the RDN plays a specialized role due to the increased level of nutritional risk associated with preterm birth, congenital defects, trauma, sepsis, and critical care. RDNs working in these settings screen patients for level of risk and develop early nutrition interventions for high-risk cases such as children who require enteral and parenteral feedings. Additionally, in the neonate unit, RDNs may educate mothers on how to breastfeed premature infants or, if necessary, supplement infant feeding with high-calorie breast milk fortifiers.

Pediatric dietitians work with diverse disorders in several specialized areas of practice encompassing a large variety of conditions that may impact nutritional needs or status, including the following:

- Metabolic disorders such as phenylketonuria, homocystinuria, tyrosinemia, disorders of the urea cycle pathways, methylmalonic and propionic acidemia, fatty acid oxidation disorders, mitochondrial disorders, disorders of carbohydrate metabolism
- Genetic disorders such as cystic fibrosis and fragile X syndrome
- Gastrointestinal diseases such as inflammatory bowel disease, Crohn's disease, and ulcerative colitis
- Chronic organ disease (kidney disease, heart disease)
- Respiratory diseases such as bronchodysplasia
- Feeding difficulties related to developmental delay or functional impairments such as cleft palate and eating disorders
- Infectious diseases such as HIV
- Cancers
- Endocrine disorders such as type 1 or type 2 diabetes mellitus

References

1. Academy Quality Management Committee. Academy of Nutrition and Dietetics: Revised 2017 Standards of Practice for Registered Dietitian Nutritionists. *J Acad Nutr Diet*. 2018; 118:141–65.
2. Academy of Nutrition and Dietetics. Position of the Academy of Nutrition and Dietetics: nutrition services for individuals with intellectual and developmental disabilities and special health care needs. *J Acad Nutr Diet*. 2015; 115:593–608.
3. Academy of Nutrition and Dietetics. Position of the Academy of Nutrition and Dietetics: nutrition guidance for healthy children ages 2 to 11 years. *J Acad Nutr Diet*. 2014; 114:1257–76.

discuss dietetics practice in a few common settings. In addition, clinical dietitians may be certified in a medical specialty and become, for example, diabetes educators, lactation consultants, or nutrition support specialists. Nutrition therapy practice certifications and their requirements are listed in Table 1.3.

1.3 OTHER HEALTH PROFESSIONALS—INTERDISCIPLINARY TEAMS

In the health care setting, individuals from different disciplines communicate with each other regularly in order to best care for their patients. Dietitians are integral members of the patient's health care team and collaborate with physicians, pharmacists, nurses, respiratory therapists, speech pathologists, occupational therapists, social workers, and many others when providing nutritional treatment see Figure 1.2. Dietitians must know the roles of the other team members in order to be effective and to ensure optimal patient care. Table 1.4 covers the education and training requirements for health professionals and the job roles with which a dietetics student should be familiar when first starting to practice dietetics.

The practice of medicine by **physicians** includes the diagnosis, treatment, correction, advisement, or prescription for any human disease, ailment, injury, infirmity, deformity, pain, or other condition, physical or mental. All physicians in the United States have advanced training and certification in a specialized area of medicine or surgery.[6] Table 1.5 lists the recognized board specialties and subspecialties. Nutritionally, physicians are responsible for prescribing nutrition support and nutrition prescriptions for their patients but typically work in collaboration with the RDN.

The largest group of health care workers in the United States is **nurses**. Registered nurses (RNs) assist in the treatment of patients, administer medications and intravenous

Figure 1.2 Collaboration

Nutritional care requires collaboration among members of the entire health care team. Interprofessional teams work together to provide optimal patient care.

Source: Courtesy of Marcia Nelms.

Table 1.3 Dietetics Practice Certifications Requirements

Specialty	Certifying Organization (webpage)	Requirements
Board Certified Specialist in Pediatric Nutrition (CSP)	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD, 2 years minimum length of RDN status, 2000 hours of pediatric practice within the past 5 years, and successful completion of the Board Certification as a Specialist in Dietetics examination
Board Certified Specialist in Renal Nutrition (CSR)	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD, 2 years minimum length of RDN or RD status, 2000 hours of renal practice within the past 5 years, and successful completion of the Board Certification as a Specialist in Dietetics examination
Board Certified Specialist in Gerontological Nutrition (CSG)	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD, 2 years minimum length of RDN or RD, 2000 hours of gerontological practice within the past 5 years, and successful completion of the Board Certification as a Specialist in Dietetics examination
Board Certified Specialist in Sports Dietetics (CSSD)	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD, 2 years minimum length of RD status, 1500 hours of sports dietetics practice within the past 5 years, and successful completion of the Board Certification as a Specialist in Dietetics examination
Board Certified Specialist in Oncology Nutrition (CSO)	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD, 2 years minimum length of RD status, 2000 hours of oncology dietetics practice within the past 5 years, and successful completion of the Board Certification as a Specialist in Dietetics examination
Advanced Practice Certification in Clinical Nutrition	Academy of Nutrition and Dietetics/ Commission on Dietetic Registration (http://cdrnet.org)	Current RDN or RD for 4 calendar years, graduate degree from a US-regionally accredited college or university, document 8000 hours post RDN or RD of clinical nutrition practice no older than the past 15 years (800 of the required hours must be within the past 2 years), and CDR Advanced Practice Certification in Clinical Nutrition Examination
Certified Diabetes Educator (CDE)	National Certification Board for Diabetes Education (www.ncbde.org)	Minimum of 2 years' experience working as a registered dietitian, minimum of 1000 hours of professional practice experience in diabetes self-management education with a minimum of 40% (400 hours) accrued in the most recent year preceding application, minimum of 15 clock hours of continuing education activities applicable to diabetes within the 2 years prior to applying for certification, and successful completion of the Certified Diabetes Educator examination
Certified Nutrition Support Clinician® (CNSC)	National Board of Nutrition Support Certification (www.nutritioncare.org/nbnsc)	Current RD, RDN, or Canadian equivalent, at least 2 years' experience in specialized nutrition support (parenteral and enteral nutrition) recommended for candidates, and successful completion of the Certification Examination for Nutrition Support Clinician
Lactation Consultant (IBCLC)	International Board of Lactation Consultant Examiners (http://iblce.org)	Minimum of 90 hours of continuing education in lactation, 1000 hours of lactation-specific clinical practice within 5 years, and successful completion of the certification examination

Table 1.4 Education and Certification Requirements of Selected Members of the Health Care Team

Health Profession	Education	Degree Initials	Credentialing
Physician	Doctoral or professional degree	MD; DO	State licensure exam
Nurse	Two-year degree Four-year degree Graduate degree	AA BSN Advanced Practice RN (Nurse Practitioner, Nurse Midwife, Nurse Anesthetist)	State licensure exam
Pharmacist	Four years graduate education	PharmD	State licensure exam and National exam (NAPLEX)
Occupational therapist	Clinical doctorate degree	OTD	National exam for registration (NBCOT)
Physical therapist	Clinical doctorate degree	DPT	National exam for registration (NPTE)
Speech-language pathologist	Master's degree plus a clinical fellowship	MS or MA	National exam for Certificate of Clinical Competence (CCC)
Social worker	Bachelor's degree or master's degree	BSW or MSW	State licensing, certification, or registration

Source: Occupational Outlook Handbook (OOH), April 13, 2018. Washington, DC: U.S. Bureau of Labor Statistics. http://www.bls.gov/ooh/