ADVANCED MEDICAL NUTRITION THERAPY

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Dedication

To Dana, Patrick, and Jake for their unending patience and support, and to the staff and students of the Frances Stern Nutrition Center for their insight and encouragement.
—Kelly

To my students who inspire me to work hard every day; to my colleagues and mentors who bring me perspective and keep me humble; and to my family who gives me strength, love, and purpose.
—Kathy

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Foreword

It is a pleasure to introduce *Advanced Medical Nutrition Therapy* by Kelly Kane, MS, RD and Kathy Prelack, PhD, RD to readers. I can testify that they are both master clinicians who bring readers the wisdom they have accumulated after several decades of clinical experience in academic medical centers in Boston. I am also well-acquainted with their ability to teach at both the graduate and undergraduate level.

The setting in which the authors practice is unique; Boston has long been known for the excellence of its education in the health sciences, and the book draws heavily on the resources of colleagues in the city. Among their many affiliations, both of the authors are faculty members of the Friedman School of Nutrition Science and Policy at Tufts University and the Department of Nutrition, Simmons College, which sponsors a didactic program in dietetics and combined dietetic internship/Master's degree programs. Their clinical associations include Shriners Hospitals for Children, a pediatric burn and surgical specialty hospital; Massachusetts General Hospital; and the Frances Stern Nutrition Center at Tufts Medical Center, the oldest ambulatory nutrition service in the United States. The authors have used their access to excellent resources in the nutritional aspects of clinical medicine at both theoretical and practical levels to produce a textbook that is unique in that it reflects both the science and the art of the nutritional care of patients and members of the larger community.

Their book uses a practice-oriented, case-based approach that draws heavily on problem-based learning to engage the reader. The chapters include *Clinical Controversies* and *Clinical Roundtable* features on difficult topics. At the end of each chapter the reader will have mastered both the theoretical basis and the core clinical skills needed to deliver medical nutrition therapy and treat the patient.

The first section of the book provides a review of core concepts of clinical nutrition that are relevant to nutrition screening, assessment, and nutrition support. This is followed by a number of chapters that focus on various organ systems as well as infectious disease and the complications that are involved in critical illness. Chapters on various points during the lifecycle are also included.

The great strength of the book is that it is written by clinicians for clinicians. While it does not stint to provide the pathophysiology of the diseases and illnesses discussed, it spends most of its time in helping the reader develop and apply practical clinical nutrition expertise.

The chapter on nutrition in oncology and transplantation offers a good example of the strengths of the approach the authors have taken. The chapter begins with a brief review of why the topic is important and clearly states learning objectives. Next, core concepts and some background on the epidemiology and causation of common cancers are presented, along with methods for cancer staging and typical medical treatments of cancer. This is followed by an extensive section on clinical nutrition that includes screening and assessment of the cancer patient and nutritional support of different forms of cancers, including solid tumors, hematological cancers, and advanced cancers, as well as cancer cachexia. Complementary and alternative medicine is discussed in an evidence-based context. The chapter is interlarded with practical points and clinical case studies, heavily referenced with up-to-date citations, and concludes with a brief summary.

Instructors will welcome the Instructor's Manual, a Test Bank with examination questions, and slides in PowerPoint format that may ease their teaching burdens.

I am acquainted with most of the authors of this textbook, and I can assure readers that they will find that this distillation of their wisdom is a welcome guide to mastering medical nutrition therapy.

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Preface

Advanced Medical Nutrition Therapy is designed as the primary text for an upper-level undergraduate or graduate-level Medical Nutrition Therapy or Clinical Nutrition course for nutrition majors. The text is designed to be a current, evidence-based, and practical nutrition resource for nutrition students, dietetic interns, nutrition professionals, and nonnutrition clinicians. Other trainees such as medical students or students enrolled in graduate programs in biomedical science may also have an interest in such a text. This text will present information that meets the needs of those at the graduate nutrition level, as well as those who have advanced academic backgrounds, but limited clinical experience, or clinicians of other disciplines (nurses, physicians, physician assistants, etc.).

Conceptual Approach

Advanced Medical Nutrition Therapy utilizes a practice-oriented, case-based approach that incorporates problem-based learning and engages the reader in various clinically based scenarios that guide the narrative text. This approach is designed to encourage the reader to digest the didactic scientific information while applying it to a patient-based clinical situation. The cases in the text provide the framework around which the didactic information is presented. By understanding the importance of the subject matter through application, the reader will look beyond the rote memorization approach that can be typical of science courses and integrate the science with the clinical scenario to gain a more complete understanding.

The text is practice-oriented with a strong clinical focus highlighting the treatment of the medical condition while incorporating the latest guidelines and research, with an emphasis on current topics. Commonly used formulas and equations are included to emphasize clinical application.

Organization

The first section of the text introduces the core concepts of nutrition, highlighting nutrition and biochemical assessment, nutrition support, and energy expenditure. These chapters provide the framework of the book. The next section provides an overview of various disease states, including critical illness, wound healing, obesity, diabetes mellitus, cardiovascular disease, oral health, gastrointestinal conditions, kidney disease, liver disease, pulmonary disease, cystic fibrosis, solid organ transplantation, oncology/bone marrow transplantation, and HIV/AIDS. The last section provides an overview of nutrition in the lifecycle, outlining content on pregnancy, lactation, neonatology, pediatrics, pediatric obesity, eating disorders, developmental disabilities, and geriatrics, thus providing a comprehensive overview of medical nutrition therapy.

Features

Each chapter is designed to provide the reader the comprehension and skills to render effective nutrition care plans based on the fundamentals of diet and disease and existing research evidence. Each chapter introduces *Core Concepts*, which are important principles or themes that will be identified and highlighted to encourage functional learning. *Learning Objectives* are included at the beginning of each chapter to better assess student learning. A *Case Study* or clinical scenario introduces each topic and stimulates critical thinking by developing questions that are subsequently expanded upon on in the text. Reliance on evidence-based practice via a *Clinical Controversy* is fostered through the introduction of research concepts in journal review. Discussion of clinical scenarios that do not have one clear, correct answer is covered in the *Clinical Roundtable*. *Practice Points* of useful clinical information are presented throughout each chapter to identify how it works "in the real world." *Key Terms* also help to familiarize the reader with new concepts in an organized fashion.

Benefits

The text is designed for students and practitioners who are fairly new to the clinical environment, as well as those who are new to addressing nutrition in the clinical environment and who have more recently studied and learned the basics of metabolism (anatomy; physiology; and carbohydrate, protein, and fat metabolism, for example). It incorporates a clinical case presentation, with discussion throughout each chapter calling upon details of the case in order to reinforce the didactic science information, thus challenging the student to think outside of the classroom. This approach will allow the student to apply this information and reinforce learning.

The text more broadly covers nutrition in the lifecycle by integrating aspects of both adult and pediatric nutrition. This strong pediatric focus is reflected in chapters on general pediatrics, neonatology, pediatric obesity, developmental disabilities, and eating disorders. Presentation of both states allows for a more complete reference, and it provides an opportunity to better discuss the similarities and difference in various adult and pediatric states. The text also incorporates more specialized chapters on topics such as oral health, and it also features chapters on maldigestion and malabsorption, historically covered through content related to "upper gastrointestinal" and "lower gastrointestinal" disorders.

The text offers the versatility for use as both a classroom text as well as a clinical practice resource to integrate lectures with application and journal review. The text

ties the clinical information directly with instruction in one book. Reliance on evidence-based practice is fostered through introduction of research concepts and exercises in journal review.

Supplement Package

Instructors using *Advanced Medical Nutrition Therapy* will have access to a full suite of supplemental resources, including the following:

- Test Bank, providing examination questions for each chapter as well as Midterm and Final Exams
- Slides in PowerPoint format, including bulleted notes that can be easily customized
- Instructor's Manual, containing an array of useful instructor tools
- Image Bank, collecting photographs and illustrations that appear in the text

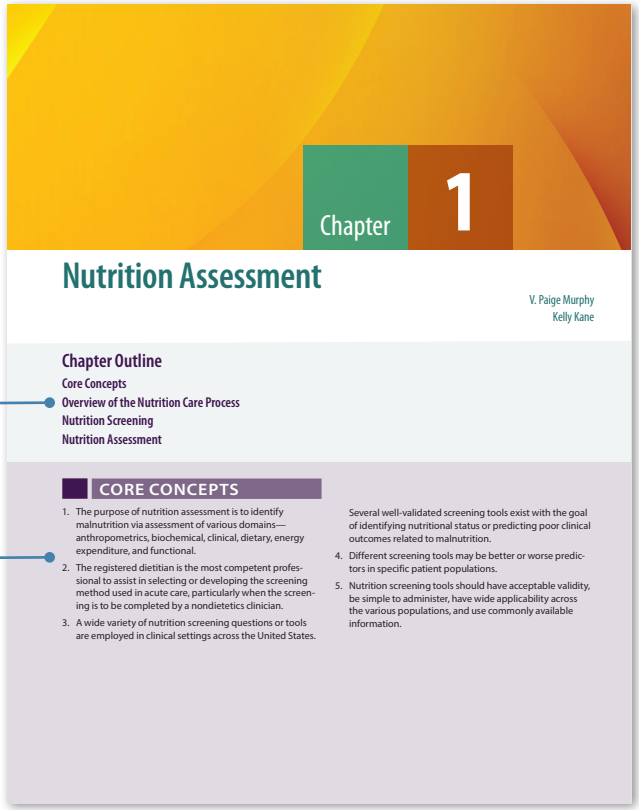
Kelly Kane
Kathy Prelack

Features of This Text

Advanced Medical Nutrition Therapy incorporates a number of engaging pedagogical features in order to emphasize how the content can be applied in practice.

Each chapter opens with a **Chapter Outline** previewing the topics to be covered.

Core Concepts establish important principles that will be explored in the chapter; they later reappear within the chapter text once the relevant content has been broached.



Chapter 1

Nutrition Assessment

V. Paige Murphy
Kelly Kane

Chapter Outline

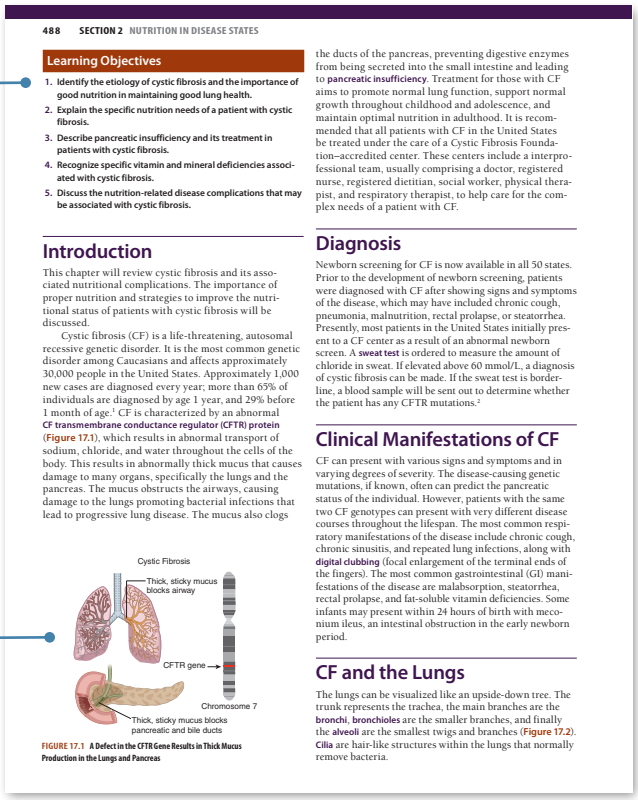
Core Concepts
Overview of the Nutrition Care Process
Nutrition Screening
Nutrition Assessment

CORE CONCEPTS

1. The purpose of nutrition assessment is to identify malnutrition via assessment of various domains—anthropometrics, biochemical, clinical, dietary, energy expenditure, and functional.
2. The registered dietitian is the most competent professional to assist in selecting or developing the screening method used in acute care, particularly when the screening is to be completed by a nondietetics clinician.
3. A wide variety of nutrition screening questions or tools are employed in clinical settings across the United States. Several well-validated screening tools exist with the goal of identifying nutritional status or predicting poor clinical outcomes related to malnutrition.
4. Different screening tools may be better or worse predictors in specific patient populations.
5. Nutrition screening tools should have acceptable validity, be simple to administer, have wide applicability across the various populations, and use commonly available information.

Learning Objectives establish what the reader can expect to learn from the chapter.

A comprehensive and instructional **art package** includes color photographs and illustrations throughout this text to add a visual dimension to the content being presented.



Learning Objectives

1. Identify the etiology of cystic fibrosis and the importance of good nutrition in maintaining good lung health.
2. Explain the specific nutrition needs of a patient with cystic fibrosis.
3. Describe pancreatic insufficiency and its treatment in patients with cystic fibrosis.
4. Recognize specific vitamin and mineral deficiencies associated with cystic fibrosis.
5. Discuss the nutrition-related disease complications that may be associated with cystic fibrosis.

Introduction

This chapter will review cystic fibrosis and its associated nutritional complications. The importance of proper nutrition and strategies to improve the nutritional status of patients with cystic fibrosis will be discussed.

Cystic fibrosis (CF) is a life-threatening, autosomal recessive genetic disorder. It is the most common genetic disorder among Caucasians and affects approximately 30,000 people in the United States. Approximately 1,000 new cases are diagnosed every year; more than 65% of individuals are diagnosed by age 1 year, and 29% before 1 month of age.[1] CF is characterized by an abnormal **CF transmembrane conductance regulator (CFTR) protein** (Figure 17.1), which results in abnormal transport of sodium, chloride, and water throughout the cells of the body. This results in abnormally thick mucus that causes damage to many organs, specifically the lungs and the pancreas. The mucus obstructs the airways, causing damage to the lungs promoting bacterial infections that lead to progressive lung disease. The mucus also clogs the ducts of the pancreas, preventing digestive enzymes from being secreted into the small intestine and leading to **pancreatic insufficiency**. Treatment for those with CF aims to promote normal lung function, support normal growth throughout childhood and adolescence, and maintain optimal nutrition in adulthood. It is recommended that all patients with CF in the United States be treated under the care of a Cystic Fibrosis Foundation–accredited center. These centers include a interprofessional team, usually comprising a doctor, registered nurse, registered dietitian, social worker, physical therapist, and respiratory therapist, to help care for the complex needs of a patient with CF.

FIGURE 17.1 A Defect in the CFTR Gene Results in Thick Mucus Production in the Lungs and Pancreas

Diagnosis

Newborn screening for CF is now available in all 50 states. Prior to the development of newborn screening, patients were diagnosed with CF after showing signs and symptoms of the disease, which may have included chronic cough, pneumonia, malnutrition, rectal prolapse, or steatorrhea. Presently, most patients in the United States initially present to a CF center as a result of an abnormal newborn screen. A **sweat test** is ordered to measure the amount of chloride in sweat. If elevated above 60 mmol/L, a diagnosis of cystic fibrosis can be made. If the sweat test is borderline, a blood sample will be sent out to determine whether the patient has any CFTR mutations.[2]

Clinical Manifestations of CF

CF can present with various signs and symptoms and in varying degrees of severity. The disease-causing genetic mutations, if known, often can predict the pancreatic status of the individual. However, patients with the same two CF genotypes can present with very different disease courses throughout the lifespan. The most common respiratory manifestations of the disease include chronic cough, chronic sinusitis, and repeated lung infections, along with **digital clubbing** (focal enlargement of the terminal ends of the fingers). The most common gastrointestinal (GI) manifestations of the disease are malabsorption, steatorrhea, rectal prolapse, and fat-soluble vitamin deficiencies. Some infants may present within 24 hours of birth with meconium ileus, an intestinal obstruction in the early newborn period.

CF and the Lungs

The lungs can be visualized like an upside-down tree. The trunk represents the trachea, the main branches are the **bronchi**, **bronchioles** are the smaller branches, and finally the **alveoli** are the smallest twigs and branches (Figure 17.2). **Cilia** are hair-like structures within the lungs that normally remove bacteria.

Each chapter begins with a **Case Study**, illustrating how topics discussed in the text might appear in practice. These case studies are revisited throughout the chapter, building in concert with the foundational material. Questions are incorporated to encourage active engagement with the scenarios.

CASE STUDY INTRODUCTION

Mary is a 73-year-old female who presents to her primary care physician with weakness and reduced oral intake for the past 3 months. Mary is admitted to the medical inpatient unit. Due to her recent admission, there is limited information in the medical record.

Anthropometric Data:
Height: 160 cm (63")
Weight: 65 kg (143 lbs)
BMI: 25.4 kg/m^2
Weight history
66.5 kg (145 lbs) 1 month ago
70 kg (154 lbs) 3 months ago
77 kg (169 lbs) 6 months ago (usual body weight)

Biochemical Data:
Sodium 149 (135-145 mEq/L)
Potassium 3.4 (3.6-5.0 mEq/L)
Blood urea nitrogen 28 (6-24 mg/dL)
Creatinine 0.5 (0.4-1.3 mg/dL)
Glucose 105 (70-99 mg/dL)
Albumin 2.9 (3.5-5.0 g/dL)
Total cholesterol 150 mg/dL (Desirable<200 mg/dL)

Clinical Data:
Past Medical History: Hypertension, osteoporosis
Medications: Lisinopril, alendronate
Vital Signs: Blood pressure 100/70 mm Hg, Temperature 99°F, Heart rate 85 beats/min

Questions

1. **To determine whether Mary warrants immediate nutrition assessment, what additional information from the patient or the medical record would you like to consider?**
2. **What validated screening tool(s) would be appropriate to use to determine Mary's nutrition risk?**
3. **What specific information do you need to determine whether Mary has malnutrition?**

Clinical Controversy boxes emphasize engagement with evidence-based content by highlighting areas where there may be disagreements in the literature.

⚠ Clinical Controversy

Is BMI a reliable indicator of cardiometabolic risk across various racial and ethnic groups?

Obesity as measured by BMI is associated with increased cardiometabolic risk, such as increased risk of cardiovascular disease and type 2 diabetes mellitus. BMI is an imperfect tool; it is limited in its ability to differentiate body composition or body fat distribution. The applicability of BMI as a disease risk indicator across different racial and ethnic groups has been more closely examined. In a study of a cardiometabolic risk phenotype described as "metabolic abnormality but normal weight" (MAN), Gujral et al. conducted a cross-sectional analysis of two community-based normal-weight cohorts to evaluate the prevalence of MAN in five racial/ethnic groups. BMI classification cut-offs can be noted in Table 1.7. BMI for South Asian and Chinese American participants was classified according to WHO Asian cut-off points: normal weight BMI 18.5 to 22.9 kg/m^2; overweight BMI 23.0 to 24.7 kg/m^2; obese BMI ≥27.5 kg/m^2. The authors found that Indians and other South Asians had more than double the prevalence of MAN, followed by Hispanics, Chinese Americans, and African Americans, who had greater prevalence of MAN compared to whites. It was estimated that the BMI values at which the expected equivalent numbers of metabolic abnormalities would equal those among whites at an overweight BMI of 25 kg/m^2, after adjusting for age, sex, and race-BMI interactions, were as follows:

1. >22.9 kg/m^2 for African Americans
2. 21.5 kg/m^2 for Hispanics
3. 20.9 kg/m^2 for Chinese Americans
4. 19.6 kg/m^2 for South Asians

These findings suggest that standard BMI categories may not be a useful screen for cardiometabolic risk in the non-white population.

Questions

1. How might BMI confound cardiometabolic screening in racial/ethnic minority groups?
2. What metabolic differences could be hypothesized to account for some of these risk variations?
3. How might these findings influence a clinician's ability to utilize BMI classification of overweight and obesity to identify cardiometabolic risk in a racially and ethnically diverse population?

References

1. Gujral UP, Vittinghoff E, Mongraw-Chaffin M, et al. Cardiometabolic abnormalities among normal-weight persons from five racial/ethnic groups in the United States: a cross-sectional analysis of two cohort studies. *Ann Intern Med*. 2017;166:628–636.
2. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*. 2004;363:157–163.

Clinical Roundtable boxes highlight clinical scenarios that invite a multitude of possible approaches.

Clinical Roundtable

Topic: Nutrition Assessment in the Intensive Care Unit (ICU)[13,68,127,154-158]

Background: Patients treated in the intensive care units are some of the highest acuity patients in the hospital. Many of the typical assessment criteria (weight status, dietary intake, biochemical markers, etc.) are difficult to reliably obtain or are confounded by factors like metabolic stress. Anthropometric measurements, which are fundamental to any nutrition assessment, may not be easily acquired from the intubated and sedated critically ill patient who may be both unable to be moved for measurement and unable to provide self-reported data. Other factors related to clinical status, like fluid shifts or edema, will further confound this assessment.

To help clinicians better assess those who are critically ill, Heyland et al.[155] developed and validated a novel risk assessment tool based directly on the ICU patient population. This tool, the NUTrition Risk in the Critically ill (NUTRIC score), is based on variables that are easy to obtain in the critical care setting. Patients receive a score of 1 to 10 based on an algorithm that considers six variables: age; Acute Physiology and Chronic Health Evaluation scores (APACHE II); Sequential Organ Failure Assessment scores (SOFA); number of comorbidities; days from hospital to ICU admission; and serum interleukin-6 (IL-6). The following table outlines the NUTRIC score variables as they apply to the final evaluation:

Variable	Range	Points
Age (years)	<50	0
	50-74	1
	≥75	2
APACHE II	<15	0
	15-19	1
	20-28	2
	≥28	3
SOFA	<6	0
	6-9	1
	≥10	2
Number of Comorbidities	0-1	0
	≥2	1
Days from Hospital to ICU Admission	<1	0
	≥1	1
IL-6	0-399	0
	≥400	1

(continues)

Modified from Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. *Crit Care*. 2011;15(6):R268.

To be most clinically applicable, the NUTRIC score provides interpretation guidelines based on whether or not the IL-6 marker is available (the other markers are routinely obtainable from the medical record of an ICU patient):

If IL-6 is available:

- High score (6-10 points): associated with worse clinical outcomes (i.e., mortality); these patients are most likely to benefit from aggressive medical nutrition therapy
- Low score (0-5 points): low malnutrition risk

If IL-6 is *not* available:

- High score (5-9 points): associated with worse clinical outcomes (i.e., mortality); these patients are most likely to benefit from aggressive medical nutrition therapy
- Low score (0-4 points): low malnutrition risk

In general, the higher the sum of the scores from each component, the greater the likelihood of nutritional risk and anticipated benefit of nutrition intervention.

Roundtable Discussion

1. Given the difficulties with nutritional assessment in the critical care setting, how might the NUTRIC score be a valuable tool for clinicians in this setting?
2. Due to its validation, should the NUTRIC score supersede standard nutrition assessment in this setting? Why or why not?
3. What are the advantages and disadvantages of using a nutrition assessment tool, such as the NUTRIC score, in the critical care setting?

Brief **Practice Points** provide additional details relevant to clinical dietetics practice.

PRACTICE POINT

When considering the acutely ill inpatient population, assessing dietary intake prior to hospital admission and duration of poor oral intake will be particularly pertinent to the assessment. It is not unusual for patients in acute care to have had compromised dietary intakes for extended periods prior to admission.[13]

Key Terms appear in bold-face type throughout the text and are collected at the end of each chapter.

Key Terms

nutrition care process and model (NCPM), nutrition care process terminology (NCPT), malnutrition, nutrition screening, nutritional risk screening (NRS-2002), malnutrition universal screening tool (MUST), short nutritional assessment questionnaire (SNAQ), malnutrition screening tool (MST), anthropometry, height, stadiometer, self-reported height (SRH), knee-height, total arm span (TAS), half arm span (HAS), actual body weight, usual body weight (UBW), percent usual body weight (%UBW), percent weight change (%weight change), ideal body weight (IBW), percent ideal body weight (%IBW), adjusted body weight, dry weight, body mass index (BMI), skinfold anthropometry, triceps skinfold (TSF), mid-upper arm circumference (MUAC), mid-arm muscle circumference

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