A Clinical Guide to
Nutrition Care in Kidney Disease
Second Edition

Edited by
Laura Byham-Gray, PhD, RD,
Jean Stover, RD, LDN, and
Karen Wiesen, MS, RD, LD

Renal Dietitians Dietetic Practice Group
of the Academy of Nutrition and Dietetics
and the Council on Renal Nutrition
of the National Kidney Foundation
Contents

Editors and Contributors \hspace{1em} v
Reviewers \hspace{1em} vii
Foreword \hspace{1em} xi
Preface \hspace{1em} xiii

1. Overview: Pathophysiology of the Kidney \hspace{1em} 1
2. Nutrition Assessment in Chronic Kidney Disease \hspace{1em} 7
3. Nutrition Management in Chronic Kidney Disease Stages 1 Through 4 \hspace{1em} 25
4. Nutrition Management in Acute Kidney Injury \hspace{1em} 39
5. Nutrition Management of the Adult Hemodialysis Patient \hspace{1em} 53
6. Nutrition Management of the Adult Peritoneal Dialysis Patient \hspace{1em} 69
7. Nutrition Management of the Adult Renal Transplant Patient \hspace{1em} 87
8. Nutrition Management of HIV/AIDS in Chronic Kidney Disease \hspace{1em} 103
9. Nutrition Management of Diabetes in Chronic Kidney Disease \hspace{1em} 111
10. Cardiovascular Disease in Chronic Kidney Disease \hspace{1em} 141
11. Pregnancy and Chronic Kidney Disease \hspace{1em} 151
12. Nutrition Management of Chronic Kidney Disease in the Pediatric Patient \hspace{1em} 157
13. Enteral Nutrition in Kidney Disease \hspace{1em} 189
14. Parenteral Nutrition in Kidney Disease \hspace{1em} 197
15. Medications Commonly Prescribed in Chronic Kidney Disease \hspace{1em} 217
16. Chronic Kidney Disease: Mineral and Bone Disorders \hspace{1em} 239
17. Management of Anemia in Chronic Kidney Disease \hspace{1em} 263

Appendices
A. Practice Guidelines, Reimbursement, and Continuous Quality Improvement in Chronic Kidney Disease \hspace{1em} 269
B. Counseling Skills for the Renal Dietitian \hspace{1em} 275
C. Nocturnal Home Hemodialysis \hspace{1em} 279
D. Emergency Meal Planning for Dialysis Patients \hspace{1em} 285
E. Dietary Supplements \hspace{1em} 291
F. The Nutrition Care Process Model in Nephrology Nutrition \hspace{1em} 311
G. Internet Resources \hspace{1em} 319

Index \hspace{1em} 325
Editors and Contributors

Editors
Laura Byham-Gray, PhD, RD
University of Medicine and Dentistry of New Jersey
School of Health Related Professions
Stratford and Newark, NJ

Jean Stover, RD, LDN
DaVita Inc
Philadelphia, PA

Karen Wiesen, MS, RD, LD
Barnes-Jewish Dialysis Center
Washington University School of Medicine
St Louis, MO

Contributors
Christine Aramburu Alegría, PhD, RN, FNP-BC
Orvis School of Nursing
University of Nevada, Reno
Reno, NV

Ann Beemer Cotton, MS, RD, CNSC
IU Health Methodist Hospital
Indianapolis, IN

Mary Ellen Beindorff, RD, LD
Barnes-Jewish Hospital
St Louis, MO

Deborah Brommage, MS, RD, CSR, CDN
National Kidney Foundation
New York, NY

Jerrilynn D. Burrowes, PhD, RD, CDN
Long Island University, CW Post Campus
Brookville, NY

Sara Carlson, RD, CDE
DaVita.com Nutrition Project Specialist
DaVita Inc

Pamela Charney, PhD, RD
Consultant
Mercer Island, WA

Patricia DiBenedetto Barbá, MS, RD, CSR
Ko’olau Dialysis Center
Kaneohe, HI

Paula Frost, RD, CSR, LD
DaVita Inc
Washington, DC
Trisha Fuhrman, MS, RD, LD, FADA
St Louis, MO

Jordi Goldstein-Fuchs, DSc, RD
Sierra Nevada Nephrology
Reno, NV

Janelle Gonyea, RD, LD
Mayo Clinic
Rochester, MN

Jane H. Greene, RD, CSR, LDN
Vanderbilt University Medical Center
Nashville, TN

Lisa Gutekunst, MSEd, RD, CSR, CDN
Cleve-Hill Dialysis
Buffalo, NY

Kathleen Hunt, RD, CSR
Castro Valley, CA

Barbara Hutson, RD, LD
Ozarks Dialysis of Cox Health
Springfield, MO

Marcia Kalista-Richards MPH, RD, LD, CNCS
Cedar Crest College
Department of Nutrition
Allentown, PA

Linda McCann, RD, CSR
Satellite Healthcare, Inc
San Jose, CA

Maureen McCarthy, MPH, RD, CSR, LD
Oregon Health Sciences University
Portland, OR

Lesley McPhatter, MS, RD, CSR
UVA-Lynchburg Dialysis
Lynchburg, VA

Kathryn Norwood, MS, RD, LD
Washington University School of Medicine
St Louis, MO

Joni J. Pagenkemper, MS, MA, RD, LMNT, CDE
Creighton Dundee Clinic
Omaha, NE

Jessie Pavlinac, MS, RD, CSR, LD
Oregon Health Sciences University
Portland, OR

Sharon R. Schatz, MS, RD, CSR, CDE
DaVita Inc
Lumberton, NJ

Kathy Schiro Harvey, MS, RD, CSR
Puget Sound Kidney Center
Mountlake Terrace, WA

Donna Secker, PhD, RD, FDC
Toronto, ON

Alison Steiber, PhD, RD, LD
Case Western Reserve University
Cleveland, OH

Jean Stover, RD, LDN
DaVita Inc
Philadelphia, PA

Naomi Stuart, MS, RD
Stuart Nutrition Services LLC
Greenville, NC

Linda M. Ulerich, RD
Indiana University Health Methodist Hospital
Indianapolis, IN

Karen Wiesen, MS, RD, LD
Barnes Jewish Dialysis Center
Washington University School of Medicine
St Louis, MO
Reviewers

Chapter 1: Overview: Pathophysiology of the Kidney
Laura Byham-Gray, PhD, RD
University of Medicine and Dentistry of New Jersey
School of Health Related Professions
Stratford and Newark, NJ

Karen Wiesen, MS, RD, LD
Barnes Jewish Dialysis Center
Washington University School of Medicine
St Louis, MO

Jean Stover, RD, LDN
DaVita Inc
Philadelphia, PA

Chapter 2: Nutrition Assessment in Chronic Kidney Disease
Louise Clement, MS, RD, CSR, LD
Fresenius Medical Care
Lubbock, TX

Kathy Steppacher, MS, RD, CSR, LDN
Consultant
Barnegat Light, NJ

Chapter 3: Nutrition Management in Chronic Kidney Disease Stages 1 Through 4
Maria Karalis, MBA, RD, LDN
Abbott Nutrition International
Chicago, IL

Lori Fedje, RD, LD
Consultant
Portland, OR

Chapter 4: Nutrition Management in Acute Kidney Injury
Maureen McCarthy, MPH, RD, CSR, LD
Oregon Health Sciences University
Portland, OR

Andrea Dothage, RD, CSR, LD
University of Missouri Hospital
Columbia, MO

Chapter 5: Nutrition Management of Adult Hemodialysis Patient
Karla Giles, RD, LD
Washington University School of Medicine
St Louis, MO

Anika Avery-Grant, MS, RD, LD
Roaming Shores, OH
Chapter 6: Nutrition Management of Adult Peritoneal Dialysis Patient
Kathleen Hunt, RD, CSR
Kaiser Permanente
Hayward, CA

Chapter 7: Nutrition Management of Adult Renal Transplant Patient
Margaret Baker, RD, LD
Mayo Clinic
Rochester, MN

Chapter 8: Nutrition Management of HIV/AIDS in Chronic Kidney Disease
Jill Strejc, RN, MSN, MS, RD, CSR
UCLA Kidney and Pancreas Transplant Program
Los Angeles, CA
Satindar Dua, MSc, RD, CDE
Los Angeles, CA

Chapter 9: Nutrition Management of Diabetes in Chronic Kidney Disease
Patricia Weber, MS, RD, CSR, LDN, CDE
Veterans Health Administration
Birmingham, AL
Janelle Gonyea, RD, LD
Mayo Clinic
Rochester, MN

Chapter 10: Cardiovascular Disease in Chronic Kidney Disease
Judy Beto, PhD, RD, FADA
Loyola University Medical Center
Maywood, IL
Jean Stover, RD, LDN
DaVita Inc
Philadelphia, PA

Chapter 11: Pregnancy and Chronic Kidney Disease
Susan Hou, MD
Loyola University Medical Center
Maywood, IL

Chapter 12: Nutrition Management of Chronic Kidney Disease in the Pediatric Patient
Christina Nelms, MS, RD, CSP, LD, CNSC
Clarkson College
Kearney, NE
Nancy Spinozzi, RD, LDN
Children’s Hospital Boston
Boston, MA

Chapter 13: Enteral Nutrition in Kidney Disease
Eileen Moore, RD, LD, CNSC
Pentech Health Inc
Boothwyn, PA

Chapter 14: Parenteral Nutrition in Kidney Disease
Suzanne Gore, MS, RD, CNSC
Department of Veterans Affairs
Lexington, KY
Beth Taylor, MS, RD, CNSD
St Louis, MO

Chapter 15: Medications Commonly Prescribed in Chronic Kidney Disease
Jennifer M. Kernc, RD, CSR, LD
Adjunct Instructor, Case Western Reserve University
Cleveland, OH
Chapter 16: Chronic Kidney Disease: Mineral and Bone Disorders
Jennifer M. Kernc, RD, CSR, LD
Adjunct Instructor, Case Western Reserve University
Cleveland, OH

Linda Roberto, MA, RD, LDN
Philadelphia, PA

Chapter 17: Management of Anemia in Chronic Kidney Disease
Connie Cranford, MS, RD
DaVita Inc
Springfield, IL

Cathy Goeddeke Merickel, MS, RD, LD
Consultant
Lincoln, NE

Appendix A: Practice Guidelines, Reimbursement, and Continuous Quality Improvement in Chronic Kidney Disease
Debbie Benner, MA, RD, CSR
DaVita Inc
Irvine, CA

Appendix B: Counseling Skills for the Renal Dietitian
Mary Kay Hensley, MS, RD, CSR
Schererville, IN

Appendix C: Nocturnal Home Hemodialysis
Karen Wiesen, MS, RD, LD
Barnes Jewish Dialysis Center
Washington University School of Medicine
St Louis, MO

Appendix D: Emergency Meal Planning
Laura Byham-Gray, PhD, RD
University of Medicine and Dentistry of New Jersey
School of Health Related Professions
Stratford and Newark, NJ

Karen Wiesen, MS, RD, LD
Barnes-Jewish Dialysis Center
St Louis, MO

Appendix E: Dietary Supplements
Cathy Goeddeke Merickel, MS, RD, LD
Consultant
Phoenix, AZ

Appendix F: The Nutrition Care Process Model In Nephrology Nutrition
Pamela Charney, PhD, RD
Consultant
Mercer Island, WA

Appendix G: Internet Resources
Jean Stover, RD, LDN
DaVita Inc
Philadelphia, PA
Foreword

The constantly evolving environment of reimbursement for renal care has created numerous challenges for renal nutrition. Two major changes from this decade include the 2008 Center for Medicare and Medicaid’s Conditions for Coverage and the 2011 Medicare Improvements for Patient and Providers Act (MIPPA, aka “bundling”). The impact was not only on dialysis clinic dietitians but also in the private practice setting, where there are fluctuations in medical nutrition therapy (MNT) coverage and more stringent regulation of transplant follow-up. In addition to the preceding challenges, renal dietitians are striving to implement the Nutrition Care Process (NCP) as documentation for this disease state.

In light of these challenges, the Renal Practice Group (RPG) and the Council on Renal Nutrition (CRN) are committed to an ongoing partnership. Through working together, we are able to advocate with a larger voice for the renal dietitian. Some of our priority areas include responding to regulatory and legislative issues, supporting the advancement of nephrology nutrition, networking with other disciplines and organizations, and supporting research in renal nutrition. Through collaboration of these overlapping goals, we are able to produce maximum results for the members we serve.

One outcome of this collaboration is this newest edition of *A Clinical Guide to Nutrition Care in Kidney Disease*. Renal dietitians are increasingly viewed as experts in patient care and essential members of the health care team. As greater demands continue to be placed on the dietitians’ shoulders, the need for a reliable source of the most up-to-date, evidenced-based practice also grows. The *Clinical Guide* is the quintessential resource for any dietitian serving chronic kidney disease (CKD) patients. Whether providing care for early CKD, dialysis, or transplant patients, this resource will provide dietitians with the information they need to care for patients in any stage of CKD.

Jessie Pavlinac, MS, RD, CSR, LD
Chair (2013–2014), Council on Renal Nutrition of the National Kidney Foundation

Lisa Gutekunst, MEd, RD, CSR, CDN
Past Chair (2013–2014), Council on Renal Nutrition of the National Kidney Foundation

Sarah Kruger, MS, RD, CSR
Chair (2012–2013), Renal Dietitians Dietetic Practice Group of the Academy of Nutrition and Dietetics

Rachael R. Majorowicz, RD, LD
Immediate Past Chair (2012–2013), Renal Dietitians Dietetic Practice Group of the Academy of Nutrition and Dietetics
Preface

In 1983, the Renal Dietitians Dietetic Practice Group of the American Dietetic Association and the Council on Renal Nutrition of the National Kidney Foundation began an ambitious project to develop a clinical guide to assist dietetics professionals who manage the nutrition care of persons diagnosed with kidney disease. At the time, more than 300 renal dietitians were surveyed to determine the guide’s content. Respondents identified three key objectives. The Clinical Guide should be:

1. Practical, containing information that is useful in practice and having minimal theoretical information.
2. Representative of a consensus formed by clinical practitioners, on the basis of current scientific literature and experience.
3. Cognizant of unique patient population characteristics.

The previous editions were written with these objectives in mind. This edition of A Clinical Guide to Nutrition Care in Kidney Disease has considered these initial objectives while expanding the content to keep pace with the rapidly changing field of nephrology. Content areas have been broadened to reflect the widening scope of practice experienced by dietetics professionals employed in dialysis facilities, including nocturnal home hemodialysis, acute kidney injury, HIV and AIDS, medical nutrition therapy reimbursement, and dietary supplements. Unlike the earlier versions of the Clinical Guide, this edition aims to assist dietitians who are preparing to sit for the Board Specialist in Renal Nutrition credentialing examination.

Although experienced renal dietitians have contributed to this publication, the audience for A Clinical Guide to Nutrition Care in Kidney Disease is much broader. New renal dietitians, clinical dietitians working in acute care facilities, consultant dietitians in long-term care, and dietetics faculty and students will find this book to be a useful resource to guide their learning and experiences within the renal population.