

Closing the Gap in Nutrition Care at Outpatient Cancer Centers: Ongoing Initiatives of the Oncology Nutrition Dietetic Practice Group



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LACK OF ACCESS TO NUTRITION care in outpatient cancer centers is a critical issue in the US health care system. It is well documented that malnutrition adversely affects key outcomes, including morbidity and mortality, as well as hospitalizations, readmissions, and other variables that may increase cost of oncology care.¹⁻⁴ Based upon this evidence, the Oncology Nutrition Dietetic Practice Group (ON DPG), a practice group of the Academy of Nutrition and Dietetics (Academy), formulated a strategic plan to address nutrition-related gaps in cancer care. The ultimate goal of the strategic plan is to improve patient access to oncology nutrition care from the time of diagnoses, through treatment and into cancer survivorship, for whatever period of time survivorship may encompass.

A key outcome of this project will be to identify how the clinical and research oncology nutrition communities can work together to create the supporting data and build the body of evidence to ensure the cost of comprehensive nutrition care is universally reimbursed by insurers and/or consistently included in bundled payment models for the total oncology care experience. Improved access to oncology nutrition care can be realized through improved payment models, and this process can serve as a framework and a model for securing consistent nutrition care for additional chronic disease states. All registered dietitian nutritionists (RDNs) must be committed to a future in which

compensation for specialized nutrition care is the expectation rather than the exception.

This paper describes accomplishments to date in the process of identifying and addressing gaps in oncology nutrition care, and details future plans for moving toward universal access to nutrition care in outpatient oncology treatment facilities. In 2012, ON DPG engaged in conversations with the National Academies of Sciences, Engineering and Medicine (NASEM) with a resultant concept paper describing the rationale for investigating the consequences of inadequate access to nutrition care in outpatient cancer centers. This paper formed the basis for the 2016 NASEM-sponsored public workshop, which was convened in Washington, DC. Shortly thereafter, the proceedings of the workshop were published in the report, *Examining Access to Nutrition Care in Outpatient Cancer Centers*.⁵ We present next steps in the strategic planning and implementation process and share a framework for moving toward universal access to oncology nutrition care.

BACKGROUND AND SIGNIFICANCE

Access to Medical Nutritional Care

With the advent of more effective options for managing cancer symptoms and treatment side effects, approximately 90% of oncology patients now receive treatment in outpatient cancer centers and clinics.⁶ This paradigm shift, from an inpatient to an outpatient treatment model, affects quality of care for oncology patients and has important implications impacting the delivery of nutrition services. Previous

standards set by The Joint Commission directed hospitals to define criteria for nutritional screening, which is to occur within 24 hours of admittance into the hospital.⁷ Nutritional screening on an inpatient basis generally is employed nationwide. Yet ambulatory standards of nutritional care, including screening, remain ambiguous and inconsistently applied across health care settings. Therefore, access to oncology nutrition care is left to the discretion of individual ambulatory entities or health care providers. As a result, the vast majority of cancer patients treated in outpatient cancer centers do not have access to oncology nutrition services.

The subsequent loss of access to ambulatory oncology nutrition services coincides with growing evidence supporting the role of nutrition in optimizing treatment outcomes and maximizing patient quality of life (QOL). Indeed, numerous mainstream professional organizations, including the American College of Surgeons Commission on Cancer,^{8,9} the Association of Community Cancer Centers,¹⁰ the American and European Societies of Parenteral and Enteral Nutrition,^{2,11} the National Institute for Health and Care Excellence of Great Britain,¹² and the Victorian Department of Health in Australia^{13,14} fully endorse and recognize nutrition services as an essential component of cancer care. These organizations advocate for formalized nutrition screening and assessment, nutrition care plans, and early medical nutrition therapy (MNT) when deficits are detected among patients with cancer. In the United States, there is a need for RDNs to have a more prominent role as key members of the oncology health care team.

Although benchmarking data on access to nutritional care remain limited,

it is estimated that RDNs provide 0.5 full-time equivalents in inpatient cancer centers and 0.2 full-time equivalents for ambulatory chemotherapy and radiation areas even though the vast majority of patients are treated in outpatient settings.¹⁵ Sixty-four percent of oncology RDNs report working in inpatient settings, and 36% report working in outpatient settings.¹⁶ These data, however, do not provide insight into the full-time equivalents in outpatient cancer centers or the patient-to-nutrition care provider ratio. Colleen Gill, who surveyed National Cancer Institute (NCI) Comprehensive Cancer Centers, found an average RDN-to-patient ratio of 1 RDN to 2,674 patients (personal communication, 2014). In another survey of NCI Comprehensive Cancer Centers, 30 centers (94%) reported offering RDN referrals or consult-based services. Yet these results provide no assurance that a patient needing or requesting clinical nutrition interventions will actually be referred or eventually seen by an RDN.¹⁷ Important barriers, including lack of Medicare reimbursement for referral-based nutrition consultation and out-of-pocket patient expenses, continue to permeate throughout oncology ambulatory settings and negatively impact patient outcomes.⁵

Nutrition Status and Treatment Outcomes

Malnutrition occurs in up to 80% of cancer patients at some point during cancer care, with the majority (>50%) of cancer patients exhibiting nutritional impairments at their initial oncology visit.¹⁸⁻²⁰ It is well documented that malnutrition negatively affects outcomes; involuntary weight loss of just 5% of body weight decreases survival in cancer patients.^{21,22} The Academy's Evidence Analysis Library (EAL) on Oncology found conclusive evidence (grade I and II) that poor nutritional status is associated with increased morbidity and mortality.²³ Furthermore, weight loss, malnutrition, sarcopenia, cachexia, and fatigue, all nutrition-related outcomes associated with cancer, were associated with increased mortality.²³⁻²⁶ Other analyses demonstrate that markers of malnutrition, such as weight loss, low

muscle mass index, and muscle attenuation, independently predict shorter survival.²⁷⁻³²

In addition to increased mortality and reduced survival, malnutrition increases treatment interruptions, readmission rates, and the risk of cancer recurrence while reducing patient QOL.^{1,33-36} Patients receiving multimodal treatments are especially vulnerable while often experiencing multiple side effects that result in inadequate nutrient intake and subsequent weight loss leading to treatment interruptions, unplanned hospital admissions, lengthier hospitalizations, greater and more severe treatment side effects, dose-limiting toxicities, and reduced functional performance.³⁷⁻⁴⁴

Evidence shows that MNT improves treatment tolerance, reduces treatment breaks, decreases unintentional weight and lean body mass losses, increases QOL, decreases unplanned hospitalizations by >50%, reduces length of hospital stay (LOS), and improves overall survival.^{23,33,34,45-55} Yet despite data documenting a high prevalence of malnutrition in cancer patients during treatment, fewer than 60% of at-risk individuals received any nutrition interventions.⁵⁶

Historically, nutrition-related clinical trials have not focused on early MNT or intensive nutrition interventions at varying stages of malnutrition or standardized times in ambulatory oncology settings.⁵⁷⁻⁶⁰ Although systematic reviews and meta-analyses document benefits for increased macronutrient intake during treatment, gaps in research continue to exist.^{60,61} Unfortunately, the few studies that have attempted to measure nutritional interventions during outpatient oncology care have been plagued by poor study design and methodological and implementation flaws. Examples include poor adherence,⁵⁷ inappropriate interventions for late-stage disease or malnutrition,⁵⁸ confounding comorbidities such as cachexia,⁵⁹ inadequate comparisons of intensive nutrition interventions against established interventions for QOL maintenance,⁶⁰ underpowered studies exhibiting significant heterogeneity, and disparate standardization for confounders being included in meta-analyses.⁶¹ In many nutrition intervention studies, the nutrition interventionist is not clearly

defined. It is critical to describe the professional qualifications of those that deliver nutrition education and interventions to vulnerable cancer patients needing specialized MNT. Lack of agreement also persists and must be resolved on which malnutrition measurement tool most accurately and precisely captures malnutrition risk, in which populations, and over which times.⁶²⁻⁶⁵

At the other end of the spectrum, excess energy intake leading to overweight and obesity has negative health consequences for cancer patients.⁶⁶ In certain cancer types, obesity at diagnosis and weight gain during and after treatment—common among cancer survivors—are associated with poorer outcomes, decreased disease-free and overall survival, and possibly accelerated cancer progression.⁶⁶⁻⁷⁷ Advanced pancreatic cancer patients with sarcopenic obesity—those that are overweight or obese with high fat mass yet low skeletal muscle mass—have the shortest survivals.⁷⁸ In patients with solid tumors of the respiratory or gastrointestinal tract, sarcopenic obesity was associated with poorer functional status compared with obese patients who did not have sarcopenia; sarcopenia was an independent predictor of survival.⁷⁹ Despite the evidence of poorer health outcomes in cancer patients who are overweight and obese, an *obesity paradox*—cancer patients with elevated body mass indexes have improved survival compared with normal-weight patients—may be occurring in patients with certain types of cancer. The obesity paradox may be a reflection of methodological mechanisms including the crudeness of body mass index as an obesity measure, confounding, detection bias, reverse causality, and collider bias.⁸⁰ It is imperative that overweight and obesity in cancer patients not be labeled “protective” or “harmful.” It is imperative that oncology RDNs screen for malnutrition to facilitate the early identification of patients who are malnourished or who are at risk for malnutrition, regardless of their body mass index.

Body fat management is key to controlling prevalent comorbid conditions,^{81,82} and RDN-led weight management programs have proven to be much more effective at achieving appropriate body weight and improved

metabolic parameters compared with usual care or access to weight control programs.⁸³ In primary care settings, RDN-led weight management interventions have proven effective for achieving measurable weight loss goals.⁸⁴ Weight management interventions for survivors that include behavioral adaptations are found to be the most effective.⁸⁵ RDNs are uniquely qualified to deliver such interventions. Unfortunately, as documented in the NASEM Workshop Summary on *The Role of Obesity in Cancer Survival and Recurrence*, quality nutrition care for cancer survivors, delivered by an RDN, is difficult to procure.⁸⁶ Additional research is needed to confirm the ability of these interventions to achieve and maintain clinically meaningful weight loss.

The use of dietary supplements in the cancer population is also a concern. According to the Dietary Supplement Health and Education Act (DSHEA) of 1994, a dietary supplement is a product taken by mouth intended to supplement the diet that bears or contains one or more of the following dietary ingredients: vitamins, minerals, herbs, or other botanicals; amino acids, dietary substances for use by humans to supplement the diet by increasing the total dietary intake; or a concentrate, metabolite, constituent, extract, or combination of any ingredient described.⁸⁷ Dietary supplement use is underreported to the oncology care team and may interfere with treatment effectiveness and even prove detrimental.⁸⁸ Over 60% of cancer patients and over 80% of long-term survivors report using vitamin or mineral dietary supplements.⁸⁹ Data from the National Health and Nutrition Examination Survey confirm that cancer survivors consume more botanical dietary supplements than the general US population.⁹⁰ The current knowledge of the

effectiveness of dietary supplements in cancer care is limited. A report from the US Preventive Services Task Force concluded that the evidence is insufficient to assess the balance of benefits and harms from the use of multivitamins and single or paired nutrient supplements for the prevention of cancer, except for beta carotene and vitamin E, for which the findings are negative.⁹¹ Given the extensive array of dietary supplement products on the market, lack of enforced quality control in manufacturing, variations regarding recommended dosing, availability of combined formulations, bioactive heterogeneity, paucity of evidence of efficacy, and conflicting reports of safety, it is imperative that RDNs carefully assess the patient's need for dietary supplements to optimize cancer treatment and care.

Costs of Malnutrition

In adult oncology patients, malnutrition—both over- and undernutrition—is associated with higher hospital costs, primarily related to increased rates of hospital admissions and readmissions as well as increased LOS.⁹²⁻⁹⁶ Other parameters that may increase costs due to malnutrition include additional primary care provider consultations and increased medication utilization.⁹⁷

Few studies have directly examined the cost-effectiveness of nutritional interventions; however, data support oncology nutrition interventions are effective at reducing costly complications of cancer care, including longer LOS, hospital admissions and readmissions, and frequent and more severe chemotherapy and radiation therapy side effects.²³ Establishing consistent use of electronic medical records (EMRs) across the United States would provide a means of aggregating large data sets of key

outcome measures, such as hospital readmission rates, emergency room visits, and treatment breaks, which could be used to identify cost savings that arise from systematically applied oncology nutrition interventions delivered by RDNs.

The cost of failing to address overnutrition is staggering. The estimated annual health care costs of overweight- and obesity-related illnesses are \$190 billion or almost 21% of annual medical spending in the United States.⁹⁸ Recent analysis indicates the cost of obesity and obesity-related treatments was approximately \$427.8 billion in 2014.⁹⁹ Intensive lifestyle interventions reduce the risk of conversion from prediabetes to diabetes by 58%, and weight loss of just 5% to 10% of body weight reduces cardiovascular risk factors.¹⁰⁰ Because overweight and obese cancer survivors are at higher risk for cardiometabolic complications compared with those maintaining a healthy body weight, addressing overnutrition is essential in maximizing health outcomes and decreasing the overall cost of care.

ISSUES AND CHALLENGES

The NASEM Workshop, “Examining Access to Nutrition Care in Outpatient Cancer Centers” was instrumental for the ON DPG to explore how health outcomes and cancer survival in outpatient cancer centers are affected by current standards for nutritional services, nutritional interventions, and patient access to MNT.⁵ The specific NASEM Workshop objectives are outlined in Figure 1.

Premeeting workshop preparation by NASEM included forming a planning committee of experts in the fields on oncology nutrition, who, over the course of several months, developed the workshop agenda and coordinated the speakers and presentations.

Objectives

- Describe the current status of nutritional care for oncology outpatients, including the availability of data during treatment and long-term survivorship.
- Describe the ideal care setting, including models of care within and outside the United States.
- Describe the potential benefits of outpatient nutritional care on morbidity, mortality, and long-term survival.
- Describe the issues relating to cost-benefit assessment for both recent diagnosis and post-treatment care.
- Describe the barriers to achieving an ideal care setting and the information resources available to patients.

Figure 1. Objectives of the National Academies of Sciences, Engineering and Medicine Workshop, *Examining Access to Nutrition Care in Outpatient Cancer Centers*.⁵ Republished with permission of the National Academy of Sciences from: National Academies of Sciences Engineering and Medicine. *Examining Access to Nutrition Care in Outpatient Cancer Centers: Proceedings of a Workshop*. Washington, DC: The National Academies Press; 2016⁵; permission conveyed through Copyright Clearance Center, Inc.

Various experts, including oncology researchers, RDNs, medical oncologists, health care economists, and policy makers, partook in the NASEM Workshop as planning committee members, speakers, and attendees. Presentations and discussions focused on data demonstrating enhanced therapeutic efficacy, reduced complications, improved QOL and health for cancer survivors, reduced risk of recurrence that may be realized when dietary and nutritional strategies are integrated into patient care plans, and the impact of integrating nutrition services on health care expenditures. The report generated from the NASEM Workshop outlines the state of the science and the existing gaps.⁵ Gaps include the following.

Insufficient Funding for Nutrition and Cancer Research

A call was made for more grants to be awarded to institutions with the infrastructure to offer combined degree training programs, particularly focused on PhDs/RDNs. The dietetic profession would benefit from advanced oncology training grants aimed at providing strong mentorship, leadership and professional development training, and nutrition-specific translational oncology research to inform clinical recommendations, measure impact, and disseminate results.⁵ The long-term goal of filling this gap is to position PhDs and RDNs to serve in nationally recognized leadership roles to advocate for RDN reimbursement and evidence-based practice.

Lack of Standards of Care Supporting Evidence-Based Nutrition Care

The ON DPG, with guidance from the Academy's Quality Management Committee, developed Standards of Practice (SOP) and Standards of Professional Performance (SOPP) as tools for RDNs currently in practice or interested in working in oncology nutrition to address their current skill level and to identify areas for additional professional development in this practice area.¹⁰¹ Furthermore, many organizations have developed generic recommendations guiding when to refer patients for nutrition care. However, there are no consistent evidence-based

protocols dictating standardized oncology nutrition care. The oncology organizations that provide the framework for cancer care in the United States must collaboratively develop and implement peer-reviewed standards for cancer centers. For example, the National Comprehensive Cancer Network (NCCN), an alliance of leading cancer centers devoted to patient care, research, and education, creates and routinely updates guidelines for cancer therapy, profoundly influencing the quality of cancer therapy in the United States. The integration of MNT and nutrition services into the specific NCCN guidelines is needed to set the standards of nutritional care. For example, evidence supporting positive outcomes for head and neck and oral cancer after receiving MNT is strong.¹⁰² Given the severe and often debilitating treatment effects of therapy, MNT could greatly improve dietary intake and the likelihood that patients receive the most effective therapies and at prescribed doses and frequency.^{103,104} Indeed, international nutrition support guidelines already exist for head and neck cancer treatment.¹⁰⁵ It would be beneficial if the NCCN and other US agencies advocate for nutrition-specific guidelines that include nutrition screening and MNT to promote optimal outcomes for all cancer diagnoses.^{5,106}

Inconsistent Implementation of Evidence-Based Standards of Care

The American Institute for Cancer Research/World Cancer Research Fund and the American Cancer Society have released evidence-based dietary and physical activity guidelines for cancer prevention and survivorship.^{107,108} Yet the messaging surrounding these guidelines are not promoted effectively in cancer centers, survivorship clinics, or to the public. The 2017 European Society for Clinical Nutrition and Metabolism expert group created and described evidence-based recommendations for the implementation of a multi-disciplinary team approach to prevent malnutrition during cancer treatment.² These recommendations note the following steps to ensure optimal nutrition care of oncology patients:

1. screen all patients with cancer for nutritional risk early in the

course of their care, regardless of BMI and weight history;

2. expand nutrition-related assessment practices to include measures of anorexia, body composition, inflammatory biomarkers, resting energy expenditure, and physical function; and
3. use multimodal nutritional interventions with individualized plans, including care focused on increasing nutritional intake, lessening inflammation and hypermetabolic stress, and increasing physical activity.

The guidelines emphasize the importance of preserving adequate nutritional status for cancer patients to improve tolerance of antineoplastic therapy, reduce treatment complications, minimize treatment cost, and protect patient QOL.²

Malnutrition Screening to Identify At-Risk Patients Is Not Required or Consistently Completed

More than half of medical oncology patients exhibit malnutrition at their first oncology visit.¹⁹ Those presenting with cancer of the head or neck, gastrointestinal tract, or lung are at greater risk of precachexia and malnutrition at diagnosis. Early identification of malnutrition and rapid implementation of MNT would improve treatment tolerance and protect QOL. Although consistent malnutrition screening is recommended by many national and international organizations, it is not a required or a standardized component of oncology care.

Many of the facilities that perform systematic malnutrition screening use nonvalidated screening tools, preventing standardized care practices and consistent data collection between cancer centers. Validated malnutrition screening tools reviewed by the Academy in the outpatient oncology setting include the Patient-Generated Subjective Global Assessment, the Subjective Global Assessment, and the Malnutrition Screening Tool (MST).²³ The Patient-Generated Subjective Global Assessment involves a physical examination and triage questions to determine the treatment plan.^{109,110} The MST consists of two questions about appetite and weight loss to determine

a score aligning with nutritional risk.^{111,112}

Lack of Integration of Nutrition Services into the Health Care System

Many experts think the failure of nutrition integration lies with the primary care providers who are not adequately trained in nutrition nor educated in the evidence supporting nutrition.⁵ Oncology MNT is a specialized dietetic practice that requires extensive counseling and training, national registration, certification, and often licensure. Increasing overall awareness of the beneficial roles of RDNs in oncology settings is essential to promote the profession and remind health care providers that MNT provided by RDNs improves patient outcomes and QOL.⁵

Inadequate RDN Staffing in Cancer Centers

Additional RDN staffing in cancer centers is required to meet oncology patient demands. Most cancer centers are grossly understaffed in RDN services. Many oncology RDNs also provide coverage for other services, at multiple clinics, in different locations, often serving up to 4,000 outpatients per day. Lack of institutional infrastructure is a barrier to RDN staffing. RDNs need a dedicated space to adequately and confidentially counsel patients. In addition, relevant data should be integrated directly into EMR systems, so data are accessible to all members of the health care team.

Lack of Reimbursement for RDN Services

The greatest barrier to adequate oncology RDN staffing involves the lack of reimbursement for professional services. Hospitals and other institutions do not invest in a service unless they can see a tangible return on investment.⁵ Until Centers for Medicare and Medicaid Services and private insurers reimburse RDN services, hospitals and oncology clinics are unlikely and unable to adequately staff their nutrition departments. Future bundling of payments for oncology care may further reduce access to oncology nutrition care.

Utilization of Dietary Supplements Is High in Cancer Patients and Often Underreported

Although some supplements may be beneficial when deficiencies are present, others may cause serious side effects or have the potential to interfere with cancer treatment. Several large NCI-sponsored clinical trials of dietary supplements have found them to be harmful.^{113,114} There was a recommendation from the NASEM Workshop participants for more careful and precise use of language and a need to encourage consumers to be conscious about products being marketed with vague and nonspecific names.⁵

Research Gaps

More research is warranted related to standardized malnutrition screening and validation of nutrition-related prognostic indicators. These data, once obtained, must be incorporated into predictive models, so malnutrition risk can be identified earlier and treated more aggressively. Cancers have definitive treatments based upon cancer site, stage, genetics, and patient comorbidities. The same framework should be applied with MNT to improve patient outcomes. Risk needs to be modeled and nutrition care pathways developed, implemented, and evaluated.⁵

Research on viable models for reimbursement and best practices for securing reimbursement is sorely lacking. More data are needed to identify the most effective screening tools and ongoing assessments required for quality improvement initiatives and outcomes tracking, with an eye toward cost-benefit analysis. Investigations of the costs and benefits of RDN-delivered MNT should be expanded to include a wide variety of outcomes. For example, by keeping patients well nourished, we may be able to limit or eliminate costly interventions, such as intravenous fluids, hospital admissions and readmissions, and emergency room visits. The cost savings realized should be considered in the organization's fiscal analyses to determine adequate RDN staffing patterns.

Existing literature does not address disparities in outcomes when nutrition interventions are delivered by an RDN vs a non-nutrition-trained health care

provider. In many publications, a thorough examination of the study methodology section fails to yield a definitive description relating to the provider implementing nutrition services. This is especially problematic given that RDNs are the only professionals qualified, competent, and licensed to perform MNT.

Standardization of translatable, effective nutrition messaging tailored to individual patients can address the heterogeneity that plagues many nutrition intervention study designs and generic counseling sessions. Continuing to focus on lifestyle behaviors that include dietary and physical activity patterns, rather than a reductionist approach (eg, one nutrient, one outcome), is required to move the field forward.

Evidence continues to emerge that individual cancers may require their own nutritional prescriptions to elicit optimal outcomes.¹¹⁵ Given adequate staffing and support, RDNs will be in the best position to rapidly translate evidence-based guidelines into practice across a variety of outpatient settings. Research gaps also include applying risk-stratified guidelines not only tailored to specific cancers but translated to disparate populations (eg, pediatrics, food insecure populations). This includes the need for a better understanding of how widening gaps in health outcomes and insurance disparities impact patient behaviors and present system-level barriers to success.

Additional research also is needed related to the role of dedicated nutrition staffing for the prevention of cancer recurrence, secondary cancers, and comorbidities. RDN-delivered MNT is well accepted and reimbursed for treating diabetes and renal disease. Lifestyle therapies for prediabetes is becoming more widely accepted as a standard of care given the published successes of the Diabetes Prevention Program (DPP), a program fully endorsed and supported by the Centers of Disease Control and Prevention (CDC). All people with nutrition-related chronic diseases, including cancer, could benefit from professional nutrition counseling to improve QOL and disease-related health outcomes.

Given the severe shortage of practicing oncology-trained and credentialed RDNs, advanced technologies,

including telehealth and telenutrition, will likely play a greater role in MNT delivery. Remote technologies, especially for high-risk, rural patients with limited health care access, have the potential to reach a population that has been previously underserved. Moving forward, telenutrition delivery of the Nutrition Care Process (NCP), group sessions, and family interventions must be developed, implemented, and evaluated in oncology cohorts.¹¹⁶ RDNs can and should position themselves on the cutting edge of this growing area of research.

CORE CONCEPTS AND STRATEGIC PLAN

Core Concepts

As a direct result of the gaps identified at the NASEM Workshop, the ON DPG developed core principles to achieve improved health outcomes of cancer patients, as seen in Figure 2. These core concepts align with the mission of the ON DPG: *To empower ON DPG members*

as oncology nutrition leaders and experts through advocacy, education, and research. Translational research is the foundation upon which all other principles are based. Key concepts include evidence, policy, practice, leadership, advocacy, and precision of scientific and clinical language. These cores overlap and build upon each other as one principle informs the foundation for the next.

Research represents the backbone of dietetics, and since its inception, the Academy intended the dietetics profession be rooted in science.¹¹⁷

Per the Academy, research:

- provides the framework for discovering and verifying cause-and-effect relationships between nutritional variables and health outcomes;
- fosters development of new therapies to improve public health and care delivery;
- forms the basis for education, because it drives the core knowledge and competencies

RDNs are expected to understand and practice; and

- strengthens and sustains the knowledge base of the dietetics profession.¹¹⁸

All facets of medical research are important to guide evidence-based oncology nutrition practices; however, clinical research, including interventional and observational studies, is especially impactful for translation into clinical practice. In addition, data mining and add-on studies remain critical for the creation of more robust nutrition evidence.

Data mining, an investigational concept that emerged in the 1990s, provides the methodology and statistical tools to transform reams of data into information useful for clinical decision making. Data mining can generate scientific hypotheses from large experimental data sets, clinical databases, or biomedical literature.^{119,120}

Add-on studies allow for the data collection of nutrition-related variables within an existing study. For example, the Women's Health Initiative (WHI), a large clinical trial and observational study of heart disease, cancer, stroke, osteoporosis, and dementia in over 160,000 healthy postmenopausal women, has allowed for add-on studies investigating specific nutrition research questions, such as multivitamin use and its impact on health. Secondary research, such as systematic reviews and meta-analyses, are instrumental for delineating the state-of-the-science and the established evidence, and for identifying additional research questions. Quality assurance and quality improvement projects can be helpful in laying the foundation for future clinical trials.

Translational research provides the basis for evidence-based practice, education, and public policy.¹¹⁷ Evidence-based practice is a cornerstone of best practice in health care and is included in national health strategies. In addition, evidence-based care is recommended by the Academy and supported by the Academy's EAL.¹²¹ Continued evidence that oncology MNT positively impacts health outcomes will position oncology RDNs as the leaders in oncology nutrition care, serving as a trusted resource to educate and promote best practices for the public,



Figure 2. Oncology Nutrition Dietetic Practice Group Core Concepts for Improved Access to Oncology Nutrition Care. Translational research, whether, clinical studies, systematic reviews and meta-analyses, data mining, add-on studies, and quality assurance (QA)/quality improvement (QI) projects, is the fundamental concept and the foundation for which all other principles are based. Research outcomes provide the evidence necessary to develop oncology nutrition clinical practice guidelines and the potential for health policy development. Advocacy refers to oncology registered dietitian nutritionist taking a leadership role in communicating to the public, policy makers, practitioners, and all stakeholders about the value of medical nutrition therapy in improving access to oncology nutrition care and ultimately improving the health outcomes of cancer patients.

policy makers, practitioners, and all stakeholders.

Oncology RDNs have always advocated for their patients, yet now they are called upon to advocate on a grander scale. By actively participating in the legislative and regulatory processes, RDNs can impact health care delivery and payment systems to maximize and support oncology nutrition services. Furthermore, by collaborating with national oncology organizations and established key alliances, RDNs will

obtain a larger voice to impact policy and health care reform.

ON DPG Strategic Plan

Figure 3 showcases the strategic plan, in which the core concepts were developed into a working plan. The strategic plan organizes the priority activities and describes the focus and processes needed to accomplish the goal of improved access to oncology nutrition care and, ultimately, overall

improved patient care and health outcomes.

MOVING FORWARD

The ON DPG is already taking steps to move this initiative forward. Since 2016, the ON DPG has initiated several targeted projects to address gaps as identified in the NASEM Workshop.

A Quality Assurance Performance Improvement Project (QAPI) was launched in 2017 to leverage EMR data

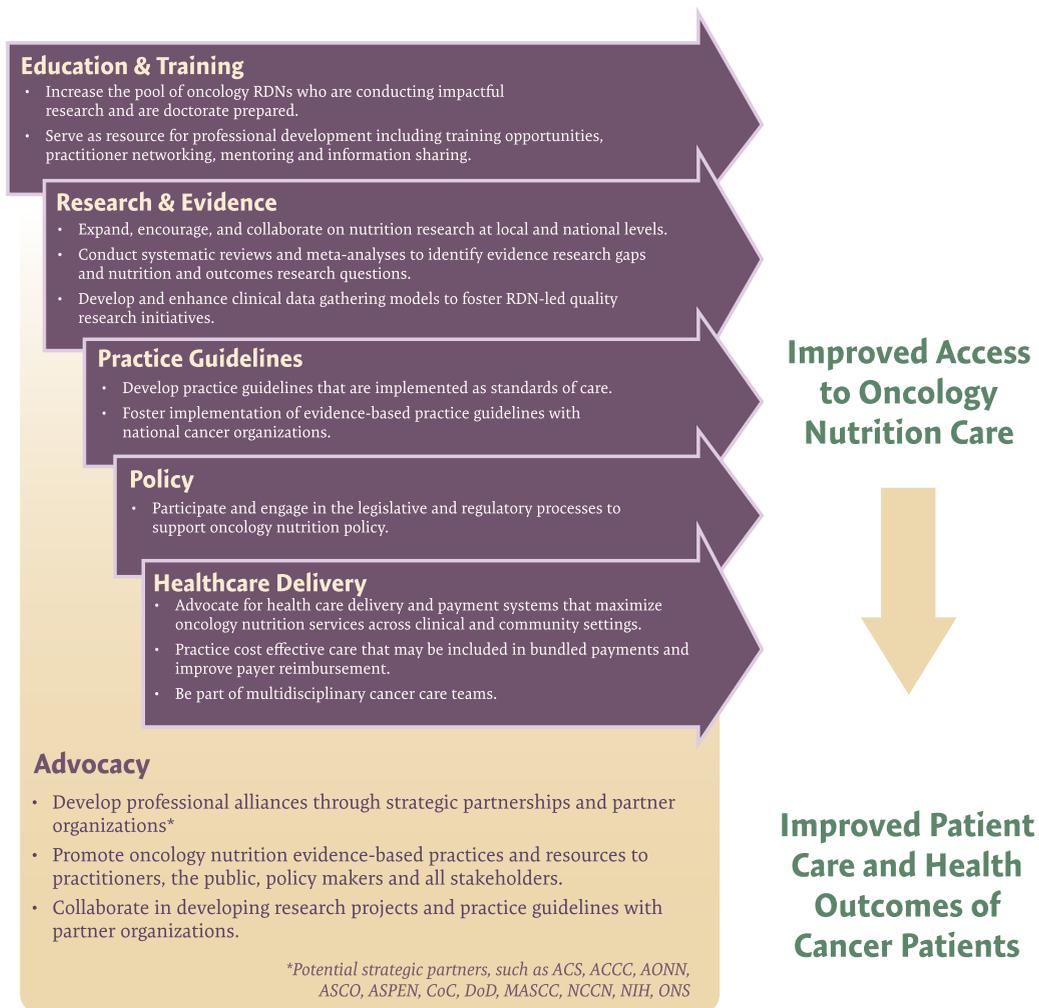


Figure 3. Oncology Nutrition Dietetic Practice Group Strategic Plan for Improved Patient Care and Health Outcomes of Cancer Patients. The plan begins with education and training, explains the types of research that should be employed by oncology registered dietitian nutritionists (RDNs) to produce the evidence to inform clinical practice recommendations. Evidence-based practice guidelines should lead to policy implementation and improved health care delivery. Advocacy should be interspersed throughout all facets of the strategic plan. The ultimate goal is to improve access to oncology nutrition care, patient care, and health outcomes of cancer patients. Abbreviations: ACCC=Association of Community Cancer Centers; ACS=American Cancer Society; AONN=Academy of Oncology Nurse and Patient Navigators; ASCO=American Society of Clinical Oncology; ASPEN=American Society for Parenteral and Enteral Nutrition; CoC=Commission on Cancer; DoD=Department of Defense; MASCC=Multinational Association of Supportive Care in Cancer; NCCN=National Comprehensive Cancer Network; NIH=National Institutes of Health; ONS=Oncology Nursing Society.

to systematically evaluate malnutrition risk in oncology care settings by implementing a validated MST nationwide. This QAPI was launched to address gaps in the literature regarding systematic screening for malnutrition risk with a validated malnutrition screening tool, appropriate oncology RDN staffing patterns to meet patient demand, and inconsistent financial and reimbursement models for outpatient nutrition care access across cancer care centers nationwide.

The objective of phase 1 is to assess the feasibility of implementing a validated MST within the EMR to describe the current status of nutritional care for oncology outpatients and define work standards, workflow, and frequency of MST utilization.

The objective of phase 2 is to collect data to assess the needs of patients, patient outcomes, and capacity to provide quality nutrition care with existing staffing. This phase will establish metrics to monitor the use of MST, workflow, utilization, and volumes at each center to determine RDN capacity and need. Developing and collecting metrics to measure the impact of nutritional care on patient outcomes (treatment tolerance, clinical quality indicators and hospital admissions, treatment interruptions, symptom management, weight loss or gain, cost-benefit assessment, emergency department visits and hospitalizations, extra visits for fluid repletion) and patient-reported QOL in the oncology patient population is an important goal of phase 2.

Current collaborators include Health Partners in Minnesota, The Ohio State University, and Dartmouth-Hitchcock, New Hampshire. At all three centers, the validated MST has been fully integrated into the EMR Epic flow sheet, thus providing ongoing discreet variable data reports. Data collection, analyses, and dissemination of results are ongoing. Preliminary results were published and awarded a Food & Nutrition Conference & Expo (FNCE) Top-Scoring Abstract Award.¹²¹ This award was granted by the Academy's Committee for Lifelong Learning (CLL) and Dietetics Practice Based Research Network (DPBRN) Oversight Committee. The second abstract, "Implementing and Evaluating the Malnutrition Screening Tool in Electronic Health

Records for Outpatient Cancer Centers," has been accepted for presentation at the 2018 NCCN Annual Conference.

In 2017, an online RDN Staffing Survey was developed and disseminated nationally to ON DPG members, Academy members, and oncology RDNs at various cancer centers. These data are intended to capture RDN staffing patterns at national cancer centers and will address gaps in the literature related to barriers to accessing nutrition services in outpatient cancer centers. This survey is a follow-up to an NCI-designated cancer center survey conducted in 2011 and 2013 (unpublished, Gill). In addition to general staffing patterns, the current survey will provide a real-time description of outpatient oncology RDN staffing patterns, patient volume and analytical cases, workload, referrals and billing, and oncology nutrition screening practices.

In 2017, nutrition care recommendations were added to the NCCN Clinical Practice Guidelines for Head and Neck Cancer and Pancreatic Cancer. The NCCN is a nonprofit alliance of 27 leading cancer centers that direct the NCCN Clinical Practice Guidelines in Oncology Care. The NCCN guidelines apply to 97% of cancer patients in the United States and remain the recognized standard for clinical practice policy in cancer care.¹²² The guidelines are the most thorough and frequently updated clinical practice guidelines available in any area of medicine and are provided in an effort to guide treatment decisions of people involved in cancer care including the medical care team, payers, patients, and their families. The guidelines advocate for a multidisciplinary approach that is evidence based and consensus driven and ensures "that all patients receive preventive, diagnostic, treatment and supportive services that will most likely lead to optimal outcomes." The NCCN guidelines are reviewed by an expert multidisciplinary panel on an ongoing basis and updated after critical review of the best evidence. Committee members of the ON DPG submitted recommendations for changes to the guidelines specific to head/neck cancer and pancreatic cancer to the NCCN review board. The changes included inclusion of MNT provided by RDNs as

part of the cancer care pathway for these tumor types. The 2017 Head and Neck Cancer Guidelines now include the recommendation, "A registered dietitian should be part of the multidisciplinary team for treating patients with head and neck cancer throughout the continuum of care." The NCCN 2017 Pancreatic Cancer Guidelines now state that a nutrition evaluation should be carried out by a "registered dietitian" for patients with pancreatic cancer. NCCN's inclusion of evidence-based nutrition guidelines are necessary to close the critical gap in evidence and standards for nutritional services. ON DPG recognizes this as an important step toward payer coverage of nutrition services in the future. More importantly, inclusion of nutritional guidelines embrace NCCN's mission of "improving the quality, effectiveness, and efficiency of cancer care so that patients can live better lives."¹²³

The NCI developed a Request for Applications (R01, R21) through their Provocative Questions mechanism.¹²⁴ The goal of NCI's Provocative Questions is to challenge the scientific community to creatively think about and answer important but nonobvious or understudied questions in cancer research and to stimulate NCI's research communities to use laboratory, clinical, and population research in especially effective and imaginative ways. The NASEM Workshop was the impetus for Provocative Question 11, which asks, "Through what mechanisms do diet and nutritional interventions affect the response to cancer treatment?" A better understanding of how nutrition affects cancer outcomes could help guide future research designed to (1) identify beneficial and detrimental interactions between nutritional interventions and specific cancer therapies; (2) identify patients most likely to benefit from specific nutritional interventions; and (3) optimize, and eventually individualize, nutritional interventions for specific patients.

CONCLUSIONS

Access to nutrition care in outpatient cancer centers remains inadequate. It is well established that malnutrition has a profound impact on cancer treatment and survivorship, yet most outpatient cancer centers have limited

or no nutrition services provided by RDNs.⁵⁶ This deficiency is disconcerting given most cancer patients will experience malnutrition at some point during their treatment course, and malnutrition has been shown to result in poorer treatment outcomes that contribute to morbidity and mortality.^{18,23}

As identified in the NASEM Workshop, there is strong evidence that poor nutritional status negatively affects cancer health outcomes. There is less evidence for the role of nutritional interventions on cancer health outcomes. Providing the evidence necessary to integrate nutritional interventions into standard cancer care will take an understanding of the current state of the science (systematic reviews and meta-analyses), an analysis of gap areas, a research agenda that focuses on priority areas, and a workforce of oncology RDNs educated and trained in conducting research. More research to support the role of RDNs in managing treatment-related side effects and preventing malnutrition is urgently needed. Additional research focusing on the impact of cost-effectiveness on nutrition interventions would provide rationale for RDN reimbursement. In addition, promoting the use of validated malnutrition risk screening tools with defined outpatient referral pathways must become standard clinical practice. Taken together, these initiatives will support the establishment of RDN staffing guidelines and drive the integration of national nutrition interventions into outpatient cancer treatment settings. Ultimately, RDNs must be included in the standards of outpatient care established by the accrediting organizations. As cancer treatment has moved to the outpatient setting, nutrition interventions, provided by RDNs, have become imperative to ensure the best outcomes for both patients in treatment and in survivorship.

References

- Ryan AM, Power DG, Daly L, Cushen SJ, Ni Bhuaichalla E, Prado CM. Cancer-associated malnutrition, cachexia and sarcopenia: The skeleton in the hospital closet 40 years later. *Proc Nutr Soc.* 2016;75(2):199-211.
- Arends J, Baracos V, Bertz H, et al. ESPEN expert group recommendations for action against cancer-related malnutrition. *Clin Nutr.* 2017;36(5):1187-1196.
- Kang MC, Kim JH, Ryu SW, et al. Prevalence of malnutrition in hospitalized patients: A multicenter cross-sectional study. *J Korean Med Sci.* 2018; 33(2):e10.
- Kono T, Sakamoto K, Shinden S, Ogawa K. Pre-therapeutic nutritional assessment for predicting severe adverse events in patients with head and neck cancer treated by radiotherapy. *Clin Nutr.* 2017;36(6): 1681-1685.
- National Academies of Sciences, Engineering, and Medicine. *Examining Access to Nutrition Care in Outpatient Cancer Centers: Proceedings of a Workshop.* Washington, DC: The National Academies Press; 2016.
- Halpern MT, Yabroff KR. Prevalence of outpatient cancer treatment in the United States: Estimates from the Medical Panel Expenditures Survey (MEPS). *Cancer Invest.* 2008;26(6):647-651.
- The Joint Commission: Nutritional, Functional, and Pain Assessments and Screens. Vol 2014. Oakbrook Terrace, IL: The Joint Commission; 2008.
- Schulze SO. Defining and developing an oncology nutrition program in a cancer center. In: Leser M, Ledesma N, Bergerson S, Trujillo E, eds. *Oncology Nutrition for Clinical Practice.* Chicago, IL: Oncology Nutrition Dietetic Practice Group of the Academy of Nutrition and Dietetics; 2013:47-51.
- American College of Surgeons Commission on Cancer. *Cancer Program Standards 2012: Ensuring Patient-Centered Care.* Chicago, IL: American College of Surgeons Commission on Cancer.
- The Association of Community Cancer Centers. *Cancer Nutrition Services: A Practical Guide for Cancer Programs.* Rockville, MD: The Association of Community Cancer Centers; 2012.
- August DA, Huhmann MB. A.S.P.E.N. clinical guidelines: nutrition support therapy during adult anticancer treatment and in hematopoietic cell transplantation. *JPEN J Parenter Enteral Nutr.* 2009;33(5):472-500.
- National Institute for Health and Care Excellence. <http://www.nice.org.uk/Guidance/Topic>. Accessed December 18, 2017.
- Victoria State Government. Patient management framework. Head and neck tumour stream: larynx, pharynx and oral cancer. State of Victoria: Metropolitan Health and Aged Care Services Division, Victorian Government Department of Human Services; 2006. www.health.vic.gov.au/cancer. Accessed December 18, 2017.
- Clinical Oncology Society of Australia. *About.* Sydney NSW: COSA; 2016. <https://www.cosa.org.au/groups/nutrition/about/>. Accessed January 4, 2018.
- The Advisory Board Company. *Blueprint for Growth II: Evaluating Staffing Models.* Washington DC: The Advisory Board Company; 2009.
- Grant B. Board certification: specialist in oncology nutrition "CSO." *Oncol Nutt Connect.* 2008;16:5-10.
- Platek ME, Johnson J, Woolf K, Makarem N, Ompad DC. Availability of outpatient clinical nutrition services for patients with cancer undergoing treatment at comprehensive cancer centers. *J Oncol Pract.* 2015;11(1):1-5.
- von Haehling S, Anker SD. Cachexia as a major underestimated and unmet medical need: Facts and numbers. *J Cachexia Sarcopenia Muscle.* 2010;1(1):1-5.
- Muscaritoli M, Lucia S, Farcomeni A, et al. Prevalence of malnutrition in patients at first medical oncology visit: the PreMiO study. *Oncotarget.* 2017; 8(45):79884-79896.
- Caillet P, Liuu E, Raynaud Simon A, et al. Association between cachexia, chemotherapy and outcomes in older cancer patients: A systematic review. *Clin Nutr.* 2017;36(6):1473-1482.
- Dewys WD, Begg C, Lavin PT, et al. Prognostic effect of weight loss prior to chemotherapy in cancer patients. Eastern Cooperative Oncology Group. *Am J Med.* 1980;69(4):491-497.
- Tisdale MJ. Cachexia in cancer patients. *Nat Rev Cancer.* 2002;2(11):862-871.
- Academy of Nutrition and Dietetics. Evidence Analysis Library: Oncology evidence-Based Nutrition Practice Guidelines. <https://www.andea.org/topic.cfm?menu=5291>. Accessed December 18, 2017.
- Huang J, Yuan Y, Wang Y, et al. Preoperative prognostic nutritional index is a significant predictor of survival in patients with localized upper tract urothelial carcinoma after radical nephroureterectomy. *Urol Oncol.* 2017; 35(12):671.e671-671.e679.
- Fan L, Wang X, Chi C, et al. Prognostic nutritional index predicts initial response to treatment and prognosis in metastatic castration-resistant prostate cancer patients treated with abiraterone. *Prostate.* 2017;77(12):1233-1241.
- Zhang W, Ye B, Liang W, Ren Y. Preoperative prognostic nutritional index is a powerful predictor of prognosis in patients with stage III ovarian cancer. *Sci Rep.* 2017;7(1):9548.
- Martin L, Birdsell L, Macdonald N, et al. Cancer cachexia in the age of obesity: skeletal muscle depletion is a powerful prognostic factor, independent of body mass index. *J Clin Oncol.* 2013;31(12): 1539-1547.
- Feliciano EMC, Kroenke CH, Meyerhardt JA, et al. Association of systemic inflammation and sarcopenia with survival in nonmetastatic colorectal cancer: results from the C SCANS Study. *JAMA Oncol.* 2017;3(12): e172319.
- Prado CM, Cushen SJ, Orsso CE, Ryan AM. Sarcopenia and cachexia in the era of obesity: clinical and nutritional impact. *Proc Nutr Soc.* 2016;75(2):188-198.
- Soubeyran P, Fonck M, Blanc-Bisson C, et al. Predictors of early death risk in older patients treated with first-line

- chemotherapy for cancer. *J Clin Oncol*. 2012;30(15):1829-1834.
31. Ferrat E, Paillaud E, Laurent M, et al. Predictors of 1-year mortality in a prospective cohort of elderly patients with cancer. *J Gerontol A Biol Sci Med Sci*. 2015;70(9):1148-1155.
 32. Harada K, Doki N, Hagino T, et al. Underweight status at diagnosis is associated with poorer outcomes in adult patients with acute myeloid leukemia: A retrospective study of JALSG AML 201. *Ann Hematol*. 2018; 97(1):73-81.
 33. Ravasco P, Monteiro-Grillo I, Camilo M. Individualized nutrition intervention is of major benefit to colorectal cancer patients: Long-term follow-up of a randomized controlled trial of nutritional therapy. *Am J Clin Nutr*. 2012;96(6): 1346-1353.
 34. Halfdanarson TR, Thordardottir E, West CP, Jatoi A. Does dietary counseling improve quality of life in cancer patients? A systematic review and meta-analysis. *J Support Oncol*. 2008; 6(5):234-237.
 35. Bozzetti F. Forcing the vicious circle: sarcopenia increases toxicity, decreases response to chemotherapy and worsens with chemotherapy. *Ann Oncol*. 2017; 28(9):2107-2118.
 36. Laviano A, Rossi Fanelli F. Nutritional status is a predictor of outcome in cancer patients, irrespective of stage. *Intern Emerg Med*. 2017;12(1):135-136.
 37. Lee H, Cho YS, Jung S, Kim H. Effect of nutritional risk at admission on the length of hospital stay and mortality in gastrointestinal cancer patients. *Clin Nutr Res*. 2013;2(1):12-18.
 38. Andreyev HJ, Norman AR, Oates J, Cunningham D. Why do patients with weight loss have a worse outcome when undergoing chemotherapy for gastrointestinal malignancies? *Eur J Cancer*. 1998;34(4):503-509.
 39. Lis CG, Gupta D, Lammersfeld CA, Markman M, Vashi PG. Role of nutritional status in predicting quality of life outcomes in cancer—A systematic review of the epidemiological literature. *Nutr J*. 2012;11:27.
 40. Hoppe S, Rainfray M, Fonck M, et al. Functional decline in older patients with cancer receiving first-line chemotherapy. *J Clin Oncol*. 2013;31(31): 3877-3882.
 41. Mantzourou M, Koutelidakis A, Theocharis S, Giaginis C. Clinical value of nutritional status in cancer: what is its impact and how it affects disease progression and prognosis? *Nutr Cancer*. 2017;69(8):1151-1176.
 42. Park S, Park S, Lee SH, et al. Nutritional status in the era of target therapy: poor nutrition is a prognostic factor in non-small cell lung cancer with activating epidermal growth factor receptor mutations. *Korean J Intern Med*. 2016;31(6): 1140-1149.
 43. Extermann M, Boler I, Reich RR, et al. Predicting the risk of chemotherapy toxicity in older patients: the Chemotherapy Risk Assessment Scale for High-Age Patients (CRASH) score. *Cancer*. 2012;118(13):3377-3386.
 44. Prado CM, Baracos VE, McCargar LJ, et al. Sarcopenia as a determinant of chemotherapy toxicity and time to tumor progression in metastatic breast cancer patients receiving capecitabine treatment. *Clin Cancer Res*. 2009;15(8): 2920-2926.
 45. Bauer J, Capra S, Battistutta D, Davidson W, Ash S. Compliance with nutrition prescription improves outcomes in patients with unresectable pancreatic cancer. *Clin Nutr*. 2005;24(6): 998-1004.
 46. Odelli C, Burgess D, Bateman L, et al. Nutrition support improves patient outcomes, treatment tolerance and admission characteristics in oesophageal cancer. *Clin Oncol (R Coll Radiol)*. 2005; 17(8):639-645.
 47. Ravasco P, Monteiro-Grillo I, Vidal PM, Camilo ME. Dietary counseling improves patient outcomes: A prospective, randomized, controlled trial in colorectal cancer patients undergoing radiotherapy. *J Clin Oncol*. 2005;23(7): 1431-1438.
 48. Ravasco P, Monteiro Grillo I, Camilo M. Cancer wasting and quality of life react to early individualized nutritional counselling!. *Clin Nutr*. 2007;26(1):7-15.
 49. Isenring EA, Capra S, Bauer JD. Nutrition intervention is beneficial in oncology outpatients receiving radiotherapy to the gastrointestinal or head and neck area. *Br J Cancer*. 2004;91(3):447-452.
 50. Isenring EA, Teleni L. Nutritional counseling and nutritional supplements: a cornerstone of multidisciplinary cancer care for cachectic patients. *Curr Opin Support Palliat Care*. 2013;7(4):390-395.
 51. Rock CL. Dietary counseling is beneficial for the patient with cancer. *J Clin Oncol*. 2005;23(7):1348-1349.
 52. Paccagnella A, Morello M, Da Mosto MC, et al. Early nutritional intervention improves treatment tolerance and outcomes in head and neck cancer patients undergoing concurrent chemoradiotherapy. *Support Care Cancer*. 2010; 18(7):837-845.
 53. Marin Caro MM, Laviano A, Pichard C. Nutritional intervention and quality of life in adult oncology patients. *Clin Nutr*. 2007;26(3):289-301.
 54. Roulin D, Donadini A, Gander S, et al. Cost-effectiveness of the implementation of an enhanced recovery protocol for colorectal surgery. *Br J Surg*. 2013; 100(8):1108-1114.
 55. Langius JA, Zandbergen MC, Eerenstein SE, et al. Effect of nutritional interventions on nutritional status, quality of life and mortality in patients with head and neck cancer receiving (chemo)radiotherapy: A systematic review. *Clin Nutr*. 2013;32(5):671-678.
 56. Hebuterne X, Lemarie E, Michallet M, Beauvillain de Montreuil C, Schneider SM, Goldwasser F. Prevalence of malnutrition and current use of nutrition support in patients with cancer. *JPEN J Parenter Enteral Nutr*. 2014;38:196-204.
 57. Brown TE, Banks MD, Hughes BGM, Lin CY, Kenny LM, Bauer JD. Randomised controlled trial of early prophylactic feeding vs standard care in patients with head and neck cancer. *Br J Cancer*. 2017;117(1):15-24.
 58. Uster A, Ruefenacht U, Ruelin M, et al. Influence of a nutritional intervention on dietary intake and quality of life in cancer patients: A randomized controlled trial. *Nutrition*. 2013;29(11-12):1342-1349.
 59. Bourdel-Marchasson I, Blanc-Bisson C, Doussau A, et al. Nutritional advice in older patients at risk of malnutrition during treatment for chemotherapy: A two-year randomized controlled trial. *PLoS One*. 2014;9(9):e108687.
 60. Roussel LM, Micault E, Peyronnet D, et al. Intensive nutritional care for patients treated with radiotherapy in head and neck cancer: A randomized study and meta-analysis. *Eur Arch Otorhinolaryngol*. 2017;274(2):977-987.
 61. Baldwin C, Weekes CE. Dietary counseling with or without oral nutritional supplements in the management of malnourished patients: A systematic review and meta-analysis of randomised controlled trials. *J Hum Nutr Diet*. 2012; 25(5):411-426.
 62. Arribas L, Hurtos L, Sendros MJ, et al. NUTRISCORE: A new nutritional screening tool for oncological outpatients. *Nutrition*. 2017;33:297-303.
 63. Yang Y, Gao P, Song Y, et al. The prognostic nutritional index is a predictive indicator of prognosis and postoperative complications in gastric cancer: A meta-analysis. *Eur J Surg Oncol*. 2016;42(8):1176-1182.
 64. Hakonsen SJ, Pedersen PU, Bath-Hextall F, Kirkpatrick P. Diagnostic test accuracy of nutritional tools used to identify undernutrition in patients with colorectal cancer: A systematic review. *JBI Database System Rev Implement Rep*. 2015;13(4):141-187.
 65. Faramarzi E, Mahdavi R, Mohammad-Zadeh M, Nasirimotlagh B. Validation of nutritional risk index method against patient-generated subjective global assessment in screening malnutrition in colorectal cancer patients. *Chin J Cancer Res*. 2013;25(5):544-548.
 66. Tonorezos ES, Jones LW. Energy balance and metabolism after cancer treatment. *Semin Oncol*. 2013;40(6):745-756.
 67. Chandra RA, Chen MH, Zhang D, Loffredo M, D'Amico AV. Evidence suggesting that obesity prevention measures may improve prostate cancer outcomes using data from a prospective randomized trial. *Prostate Cancer*. 2014;2014:478983.
 68. Lynce F, Pehlivanova M, Catlett J, Malkovska V. Obesity in adult lymphoma survivors. *Leuk Lymphoma*. 2012; 53(4):569-574.
 69. Love E, Schneiderman JE, Stephens D, et al. A cross-sectional study of overweight in pediatric survivors of acute lymphoblastic leukemia (ALL). *Pediatr Blood Cancer*. 2011;57(7):1204-1209.
 70. Vance V, Mourtzakis M, McCargar L, Hanning R. Weight gain in breast cancer survivors: Prevalence, pattern and

- health consequences. *Obes Rev*. 2011; 12(4):282-294.
71. Bradshaw PT, Ibrahim JG, Stevens J, et al. Postdiagnosis change in bodyweight and survival after breast cancer diagnosis. *Epidemiology*. 2012;23(2):320-327.
 72. Whitley BM, Moreira DM, Thomas JA, et al. Preoperative weight change and risk of adverse outcome following radical prostatectomy: Results from the Shared Equal Access Regional Cancer Hospital database. *Prostate Cancer Prostatic Dis*. 2011;14(4):361-366.
 73. Playdon MC, Bracken MB, Sanft TB, Ligibel JA, Harrigan M, Irwin ML. Weight gain after breast cancer diagnosis and all-cause mortality: Systematic review and meta-analysis. *J Natl Cancer Inst*. 2015;107(12):djv275.
 74. Liu YL, Saraf A, Catanese B, et al. Obesity and survival in the neoadjuvant breast cancer setting: role of tumor subtype in an ethnically diverse population. *Breast Cancer Res Treat*. 2018;167(1):277-288.
 75. Jayasekara H, English DR, Haydon A, et al. Associations of alcohol intake, smoking, physical activity and obesity with survival following colorectal cancer diagnosis by stage, anatomic site and tumor molecular subtype. *Int J Cancer*. 2018;142(2):238-250.
 76. Maliniak ML, Patel AV, McCullough ML, et al. Obesity, physical activity, and breast cancer survival among older breast cancer survivors in the Cancer Prevention Study-II Nutrition Cohort. *Breast Cancer Res Treat*. 2018;167(1):133-145.
 77. Fedirko V, Romieu I, Aleksandrova K, et al. Pre-diagnostic anthropometry and survival after colorectal cancer diagnosis in Western European populations. *Int J Cancer*. 2014;135(8):1949-1960.
 78. Tan BH, Birdsall LA, Martin L, Baracos VE, Fearon KC. Sarcopenia in an overweight or obese patient is an adverse prognostic factor in pancreatic cancer. *Clin Cancer Res*. 2009;15(22):6973-6979.
 79. Prado CM, Lieffers JR, McCargar LJ, et al. Prevalence and clinical implications of sarcopenic obesity in patients with solid tumours of the respiratory and gastrointestinal tracts: a population-based study. *Lancet Oncol*. 2008;9(7):629-635.
 80. Lennon H, Sperrin M, Badrick E, Renehan AG. The obesity paradox in cancer: A review. *Curr Oncol Rep*. 2016;18(9):56.
 81. Berrino F. Life style prevention of cancer recurrence: The yin and the yang. *Cancer Treat Res*. 2014;159:341-351.
 82. Demark-Wahnefried W, Campbell KL, Hayes SC. Weight management and its role in breast cancer rehabilitation. *Cancer*. 2012;118(8 suppl):2277-2287.
 83. Jen KL, Djuric Z, DiLaura NM, et al. Improvement of metabolism among obese breast cancer survivors in differing weight loss regimens. *Obes Res*. 2004; 12(2):306-312.
 84. Mitchell LJ, Ball LE, Ross LJ, Barnes KA, Williams LT. Effectiveness of dietetic consultations in primary health care: A systematic review of randomized controlled trials. *J Acad Nutr Diet*. 2017; 117(12):1941-1962.
 85. Playdon M, Thomas G, Sanft T, Harrigan M, Ligibel J, Irwin M. Weight loss intervention for breast cancer survivors: A systematic review. *Curr Breast Cancer Rep*. 2013;5(3):222-246.
 86. The National Academies Press. *The Role of Obesity in Cancer Survival and Recurrence—Workshop Summary*. Washington, DC: The National Academies Press; 2012.
 87. US Food and Drug Administration; ; US Department of Health and Human Services. Questions and Answers on Dietary Supplements. https://www.fda.gov/food/dietarysupplements/usingdietarysupplements/ucm480069.htm#what_is. Accessed February 1, 2018.
 88. Frenkel M, Sierpina V. The use of dietary supplements in oncology. *Curr Oncol Rep*. 2014;16(11):411.
 89. Velicer CM, Ulrich CM. Vitamin and mineral supplement use among US adults after cancer diagnosis: A systematic review. *J Clin Oncol*. 2008;26(4):665-673.
 90. Li C, Hansen RA, Chou C, Calderon AI, Qian J. Trends in botanical dietary supplement use among US adults by cancer status: The National Health and Nutrition Examination Survey, 1999 to 2014 [published online ahead of print December 6, 2017]. *Cancer*. <https://doi.org/10.1002/cncr.31183>.
 91. Moyer VA. Vitamin, mineral, and multivitamin supplements for the primary prevention of cardiovascular disease and cancer: U.S. Preventive services Task Force recommendation statement. *Ann Intern Med*. 2014;160(8):558-564.
 92. Kruiuzenga H, van Keeken S, Weijts P, et al. Undernutrition screening survey in 564, 063 patients: patients with a positive undernutrition screening score stay in hospital 1.4 d longer. *Am J Clin Nutr*. 2016;103(4):1026-1032.
 93. Leandro-Merhi VA, Aquino JLB. Relationship between nutritional status and the clinical outcomes of patients with and without neoplasms according to multiple correspondence analysis. *Arg Gastroenterol*. 2017;54(2):148-155.
 94. van der Kroft G, Janssen-Heijnen MLG, van Berlo CLH, Konsten JLM. Evaluation of nutritional status as an independent predictor of post-operative complications and morbidity after gastrointestinal surgery. *Clin Nutr ESPEN*. 2015;10(4):e129-e133.
 95. Leandro-Merhi VA, Braga de Aquino JL. Comparison of nutritional diagnosis methods and prediction of clinical outcomes in patients with neoplasms and digestive tract diseases. *Clin Nutr*. 2015;34(4):647-651.
 96. Cong MH, Li SL, Cheng GW, et al. An interdisciplinary nutrition support team improves clinical and hospitalized outcomes of esophageal cancer patients with concurrent chemoradiotherapy. *Chin Med J (Engl)*. 2015;128(22):3003-3007.
 97. Edington J, Winter PD, Coles SJ, Gale CR, Martyn CN. Outcomes of undernutrition in patients in the community with cancer or cardiovascular disease. *Proc Nutr Soc*. 1999;58(3):655-661.
 98. Cawley J, Meyerhoefer C. The medical care costs of obesity: An instrumental variables approach. *J Health Econ*. 2012;31(1):219-230.
 99. Su W. The impact of Medicare coverage for anti-obesity interventions. <http://blog.ihs.com/the-impact-of-medicare-coverage-for-anti-obesity-interventions>. IHS Markit. Accessed January 4, 2018.
 100. Apovian CM. The clinical and economic consequences of obesity. *Am J Manag Care*. 2013;19(10 suppl):s219-s228.
 101. Charuhas Macris P, Schilling K, Palko R. Academy of Nutrition and Dietetics: Revised 2017 standards of practice and standards of professional performance for registered dietitian nutritionists (competent, proficient, and expert) in oncology nutrition. *J Acad Nutr Diet*. 2018;118(4):736-748e.42.
 102. Cancer Guidelines Wiki. Evidence-Based Practice Guidelines for the Nutritional Management of Adult Patients with Head and Neck Cancer. https://wiki.cancer.org.au/australia/COSA:Head_and_neck_cancer_nutrition_guidelines. Sydney: Cancer Council Australia: Head and Neck Guideline Steering Committee. Accessed February 1, 2018.
 103. Platek ME. The role of dietary counseling and nutrition support in head and neck cancer patients. *Curr Opin Support Palliat Care*. 2012;6(4):438-445.
 104. Alshadwi A, Nadershah M, Carlson ER, Young LS, Burke PA, Daley BJ. Nutritional considerations for head and neck cancer patients: A review of the literature. *J Oral Maxillofac Surg*. 2013; 71(11):1853-1860.
 105. Talwar B, Donnelly R, Skelly R, Donaldson M. Nutritional management in head and neck cancer: United Kingdom National Multidisciplinary Guidelines. *J Laryngol Otol*. 2016;130(S2):S32-s40.
 106. Academy of Nutrition and Dietetics: Revised 2017 Scope of Practice for the Registered Dietitian Nutritionist. *J Acad Nutr Diet*. 2018;118(1):141-165.
 107. Kushi LH, Doyle C, McCullough M, et al. American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: Reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin*. 2012;62(1):30-67.
 108. World Cancer Research Fund/American Institute for Cancer Research. *Food, Nutrition, Physical Activity and the Prevention of Cancer: a Global Perspective*. Washington, DC: AICR; 2007.
 109. Ottery FD. Definition of standardized nutritional assessment and interventional pathways in oncology. *Nutrition*. 1996;12(1 suppl):S15-S19.
 110. Bauer J, Capra S, Ferguson M. Use of the scored Patient-Generated Subjective Global Assessment (PG-SGA) as a nutrition assessment tool in patients with cancer. *Eur J Clin Nutr*. 2002;56(8): 779-785.
 111. Ferguson ML, Bauer J, Gallagher B, Capra S, Christie DR, Mason BR. Validation of a malnutrition screening tool for patients receiving radiotherapy. *Australas Radiol*. 1999;43(3):325-327.
 112. Ferguson M, Capra S, Bauer J, Banks M. Development of a valid and reliable

- malnutrition screening tool for adult acute hospital patients. *Nutrition*. 1999; 15(6):458-464.
113. Omenn GS, Goodman GE, Thornquist MD, et al. Effects of a combination of beta carotene and vitamin A on lung cancer and cardiovascular disease. *N Engl J Med*. 1996;334(18): 1150-1155.
 114. Lippman SM, Klein EA, Goodman PJ, et al. Effect of selenium and vitamin E on risk of prostate cancer and other cancers: The Selenium and Vitamin E Cancer Prevention Trial (SELECT). *JAMA*. 2009; 301(1):39-51.
 115. Braicu C, Mehterov N, Vladimirov B, et al. Nutrigenomics in cancer: Revisiting the effects of natural compounds. *Semin Cancer Biol*. 2017;46:84-106.
 116. Academy of Nutrition and Dietetics. Telehealth. <http://www.eatrightpro.org/resources/practice/practice-resources/telehealth>. Accessed February 1, 2018.
 117. Stein K. Propelling the profession with outcomes and evidence: Building a robust research agenda at the Academy. *J Acad Nutr Diet*. 2017;117(10s):S62-s78.
 118. Manore MM, Myers EF. Research and the dietetics profession: Making a bigger impact. *J Am Diet Assoc*. 2003;103(1): 108-112.
 119. Yoo I, Alafaireet P, Marinov M, et al. Data mining in healthcare and biomedicine: A survey of the literature. *J Med Syst*. 2012;36(4):2431-2448.
 120. Koh HC, Tan G. Data mining applications in healthcare. *J Healthc Inf Manag*. 2005;19(2):64-72.
 121. Gibbons K. Toward international best outcomes: The shared path of the nutrition care process, informatics, and research translation. *J Acad Nutr Diet*. 2017;117(11):1727-1730.
 122. About the NCCN Clinical Practice Guidelines in Oncology. National Comprehensive Cancer Network. <https://www.nccn.org/professionals/>. Accessed February 8, 2018.
 123. National Comprehensive Cancer Network. <https://www.nccn.org/>. Accessed December 19, 2017.
 124. National Cancer Institute. National Institutes of Health. Provocative questions: identifying perplexing problems to drive progress against cancer. <https://provocativequestions.nci.nih.gov/>. Accessed December 18, 2017.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

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