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Gaps in nutritional research among older adults with cancer

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Abstract

Nutritional issues among older adults with cancer are an understudied area of research despite significant prognostic implications for treatment side effects, cancer-specific mortality, and overall survival. In May of 2015, the National Cancer Institute and the National Institute on Aging co-sponsored a conference focused on future directions in geriatric oncology research. Nutritional research among older adults with cancer was highlighted as a major area of concern as most nutritional cancer research has been conducted among younger adults, with limited evidence to guide the care of nutritional issues among older adults with cancer. Cancer diagnoses among older adults are increasing, and the care of the older adult with cancer is complicated due to multimorbidity, heterogeneous functional status, polypharmacy, deficits in cognitive and mental health, and several other non-cancer factors. Due to this complexity, nutritional needs are dynamic, multifaceted, and dependent on the clinical scenario. This manuscript outlines the proceedings of

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this conference including knowledge gaps and recommendations for future nutritional research among older adults with cancer. Three common clinical scenarios encountered by oncologists include (1) weight loss during anti-cancer therapy, (2) malnutrition during advanced disease, and (3) obesity during survivorship. In this manuscript, we provide a brief overview of relevant cancer literature within these three areas, knowledge gaps that exist, and recommendations for future research.

Keywords

Nutrition; Cancer; Older adults; Geriatrics

1. Introduction

The prevalence and outcomes of nutritional issues among older adults with cancer is a research area of great need. The nutritional needs of the older adult with cancer differ substantially from their younger counterparts as several non-cancer factors influence the nutritional status of the older adult with this disease. Extensive geriatric research has illustrated the impact of competing comorbidities, polypharmacy, psychosocial issues, mobility, and oral and cognitive health on the nutritional needs of the older adult.[1,2] Nutritional status is associated with frailty and is independently a predictor of increased mortality.[3,4] In May 2015, the National Cancer Institute and the National Institute on Aging co-sponsored a conference to discuss future research directions in geriatric oncology research. This meeting of the Cancer and Aging Research Group (CARG) was the third meeting of its kind and addressed a variety of topics key to the field of geriatric oncology. This manuscript outlines the proceedings of this conference as they related to the lack of sufficient research to guide the management of nutritional challenges of older adults with cancer.

The nutritional needs of the older oncology patient vary widely across the diverse scope and continuum of cancer care. Diverse factors influence dietary recommendations for patients with cancer, including the patient's current nutritional status, their cancer stage and treatment, other comorbid conditions, and a host of social and environmental considerations. Based on the proceedings of the CARG conference, we identified three common clinical scenarios seen in our oncology clinics to describe potential future directions for nutritional research among older adults. For each clinical scenario, this article will (1) discuss the relevance and/or prevalence among older adults with cancer, (2) evaluation strategies, and (3) interventions and recommended research directions (Table 1).

This is a conceptual review that highlights the three clinical questions for which there was consensus among conference experts as the most pressing research priorities for nutrition among older adults with cancer. The presented clinical scenarios were initially discussed during the conference and then further developed. For each clinical scenario, select studies were chosen by the group with the purpose of highlighting and illustrating research gaps rather than providing a comprehensive review of the literature.

2. Section 1: cancer treatment and impact on nutritional status

2.1. Common clinical scenario 1

Mrs. A is a 72-year-old woman who considered herself very healthy and only took calcium supplements until three months prior to diagnosis. She presented with early satiety, decreased appetite, abdominal discomfort, and >10% weight loss. She remained independent and continued to undertake all of her instrumental activities of daily living; however, her discomfort led to a decrease in the amount of her social activities. She feels fatigued and anxious but is only napping an hour after lunch each day. After a thorough evaluation, she was found to have Stage II (T2, N1, M0) gastric cancer and started on a chemotherapeutic regimen of three cycles of ECF (epirubicin, cisplatin, and fluorouracil) followed by surgery. She was referred to a geriatrician for a comprehensive geriatric assessment, and she was found have a BMI of 20 kg/m^2. Mrs. A wants to know what type of diet would be appropriate for her during treatment and whether eating more and gaining weight would help her tolerate chemotherapy better and prepare her for surgery. She is concerned about adverse events of chemotherapy including vomiting and mouth sores, which may further impact her nutritional status. What advice should her oncologist and her geriatrician provide to answer these questions?

2.1.1. Weight loss and malnutrition among older adults with cancer—Mrs. A clearly is suffering from weight loss due to a combination of a new cancer diagnosis and non-cancer contributing factors. She is also at risk of worsening weight loss from the proposed therapy. The first step in helping Mrs. A is to identify the issue of weight loss and malnutrition as an important determinant of her current health. Malnutrition is underdiagnosed among elderly patients in part because there is no uniformly accepted definition of malnutrition.[1] Unsurprisingly, there is a paucity of data regarding the prevalence of malnutrition among older adults with cancer in the U.S. One study from Europe defined malnutrition as weight loss of 10% or greater and estimated the prevalence of malnutrition as 71% of elderly patients hospitalized with advanced cancer.[5] An Italian prospective study of community-dwelling older adults with cancer showed 42.5% of patients had a significant weight loss of 10% or more of their usual body weight.[6] Recent data from France revealed among community-dwelling older adults (age 70 and older) with cancer, 13.3% of patients with non-gastrointestinal and 28.6% of patients with gastrointestinal malignancies met the criteria for malnutrition (defined as a Mini Nutritional Assessment (MNA) score <17).[7] Additionally, 43.5% of patients were classified as “at risk” for malnutrition defined as having an MNA score of 17–23.5. Additional research in the U.S. is required to determine the prevalence of malnutrition in our burgeoning population of older adult oncology patients.

While the prevalence of malnutrition among older adults with cancer in the U.S. is unknown, in general, older adults are at risk for weight loss and malnutrition due to a host of reasons related to aging.[8] In 2008, the Institute of Medicine recognized malnutrition as a geriatric syndrome that significantly impacts mortality and quality of life among aging adults.[9] Malnutrition is pervasive among acute care and post-acute care patients and is a contributor to frailty.[4] Weight loss due to dementia, social isolation, depression, dental issues, functional

dependence, polypharmacy, and poor vision are associated with malnutrition in the elderly.[1] Therefore, when addressing weight loss and/or malnutrition among older patients with cancer, a multitude of issues must be considered to target the correct nutritional intervention.

2.1.2. Nutrition and active cancer treatment—Nutritional status is of paramount importance during active cancer treatment as it is an independent predictor of survival, with poor nutritional status being associated with worse outcomes for older adults with cancer undergoing active treatment such as chemotherapy.[10–12] For example, pre-existing weight loss has been shown to be a risk factor for non-hematologic chemotherapy toxicity.[13] Malnutrition has also been shown to affect the outcomes and tolerance of anti-cancer therapy. In a cohort of 993 French patients aged 70 years and older with newly diagnosed solid or hematologic malignancies, malnutrition was associated with a doubling of mortality in a multivariate analysis (HR = 2.11, 95% CI = 1.67–2.83).[14] The presence of malnutrition has also been shown to increase the probability of chemotherapy toxicity. An MNA score <28 was found to be an independent predictor of non-hematologic toxicity among older adults starting chemotherapy.[13] Other measures of poor nutritional status have been associated with increased toxicity from treatment, including weight loss and hypoalbuminemia,[15] sarcopenia,[16] and low BMI.[17] Compared with well-nourished patients, those with malnutrition are more likely to manifest cognitive impairment, depression, and a higher fall risk.[7]

2.1.3. Identification and evaluation of malnutrition during cancer treatment—Due to the high prevalence and deleterious impact of malnutrition on older adults with cancer, the International Society for Geriatric Oncology (SIOG) has recommended the inclusion of nutritional assessment before the start of active cancer treatment.[18] Despite this recommendation, there remains a lack of validated and consistent assessment tools for nutrition specifically in older adults with cancer. Table 2 presents common nutrition assessment tools for malnutrition from the geriatric literature, some of which have been used among older adults with cancer.

Both cancer and its treatment have a profound effect on patients' nutritional needs and habits; therefore, nutritional assessment should begin soon after diagnosis and continue throughout treatment and beyond.[19] A full evaluation should include an assessment of social and demographic factors, nutritional screening including the review of biochemical parameters, and a careful clinical examination with meticulous symptom assessment by a clinician. In addition to the baseline nutritional status, the risk of specific side effects of chemotherapy should be taken into account and aggressively managed.

During her treatment, Mrs. A may experience pain, anxiety, and social isolation in addition to adverse side effects of chemotherapy. The clinician should also evaluate for dental issues, taste changes, mobility impairments, and fatigue severity to identify other related issues that impair her ability to obtain, prepare, and enjoy adequate nutrition. Additional questions and physical exam should address dry mouth, oral candidiasis, dysgeusia, and dysosmia. Anti-emetics, anti-diarrheal, and oral anesthetics should be prescribed to aggressively combat common anticipated side effects of chemotherapy. Lastly, a thorough review of her medications, mental health, and cognition screen as commonly performed in a geriatric

assessment would identify additional contributing factors to weight loss that are separate and distinct from loss of appetite or taste changes. For example, Mrs. A's fatigue could make trips to the grocery store or food preparation difficult; therefore, arrangements for delivery and/or food preparation might be needed.

2.1.4. Interventions to address weight loss during active cancer treatment—

During active cancer treatment, the goals of nutritional care for all patients, regardless of age, should be to aggressively treat side effects to prevent nutritional deficiencies, to maintain a healthy weight, and to maximize quality of life [8]. For older adults with cancer, remembering to first assess non-cancer contributors commonly seen among older patients is the key to success.[1] Key areas to address are summarized in Table 3.

Currently, data are lacking regarding the benefits of instituting dietary intervention such as counseling and addressing contributing non-cancer health determinants to prevent weight loss and malnutrition during active cancer treatment among older adults. Although there are studies of the utility of nutritional counseling in younger adults undergoing active treatment, such studies have not been conducted in older populations.[20] Studies designed to address both nutritional care and management of non-cancer geriatric nutritional health determinants in older adults with cancer are needed in order to make tailor-made recommendations. Such studies should take into account the complexity of the older adult and non-cancer contributing factors and use inclusion criteria that allow enrollment of vulnerable and frail adults.

The management of gastrointestinal side effects of treatment represents an example of another relevant gap in knowledge among older adults with cancer. While published studies of antiemetic medications have included adults aged 65 years and older, this population is largely underrepresented in clinical trials. In large randomized clinical trials studying palonosetron[21] and aprepitant,[22] the median age was 56.1 (±11.7) and 57.1 (±11.8), respectively. Although subset analysis of adults aged 65 years and older have shown similar efficacy and acceptable side effect profiles when compared with their younger counterparts,[23,24] clinical trials designed to test the efficacy and safety of antiemetic medications or antiemetic guidelines in older adults are lacking. The same holds true for other gastrointestinal side effects such as mucositis or chemotherapy-associated diarrhea.

Current recommendations emphasize the importance of nutritional assessment with concomitant intervention as an integral part of both the geriatric oncology consultation and routine oncology care for older adults.[25,26] Future nutritional research among older adults with cancer should focus on (1) routine evaluation for geriatric syndromes contributing to weight loss and malnutrition, (2) improving uniformity for nutritional assessment tools, and (3) implementing nutritional and geriatric-specific interventions aimed at improving functional and symptom-specific outcomes. The overarching goal of such trials should be to first identify nutritional issues using validated geriatric nutrition assessment tools and second implement validated, geriatric-specific interventions that can be incorporated into the standard treatment of older adults with cancer.

3. Section 2: cachexia among older adults with chronic and advanced cancer

3.1. Common clinical scenario

Mr. N is an 80-year-old gentleman with advanced squamous cell carcinoma of the face who presented with metastatic disease after multiple surgeries and radiation. Since starting palliative chemotherapy, he has begun to gradually lose weight over the past 6 months (≥5% weight loss). He has started drinking protein shakes in addition to a soft diet as he cannot use dentures due to skin deformity from the multiple surgeries. He is keeping up with his hydration but is experiencing significant facial and oral pain. He dislikes taking narcotics due to side effects of dry mouth and constipation. He is asking for addition medications to help him maintain and gain weight now that he has lost 50 lb since his diagnosis. What do you recommend?

Weight loss among older adults with cancer commonly manifests as anorexia and cancer cachexia, a metabolic malnutrition syndrome.[27] Anorexia, or a decrease in appetite, exists in older adults with and without cancer. Anorexia is an important cause of weight loss in both cancer and non-cancer patients alike.[28,29,30] Multiple physiologic factors associated with aging, such as sensory and gut motility changes impact both the desire to eat and early satiety, are drivers of anorexia. A cancer diagnosis can directly cause anorexia due to the location of the tumor, toxicities related to treatment, and mood changes. Cancer is the second leading medical cause of weight loss in older adults to which anorexia is a major contributing factor.[30] Among patients with cancer, prolonged anorexia will often contribute to cancer-related cachexia, which is a major cause of death in patients with advanced disease and thus was a key focus of discussion at the conference.

More than 50% of patients with advanced cancer of all ages suffer from cachexia.[31] Cancer cachexia is a multifactorial syndrome characterized by ongoing skeletal muscle loss with or without fat loss that cannot be reversed by conventional nutritional interventions and ultimately leads to progressive functional impairment.[32] Cachexia affects many patients with cancer and results in poor treatment tolerance and decreased quality of life and survival.[33–35] This has been shown specifically among older patients with diffuse large B cell lymphoma, a curable condition, who underwent assessment of adipose and muscle tissue loss by CT scan.[36] Patients with fat or muscle tissue loss demonstrated decreased progression-free and overall survival, compared to patients whose body composition remained stable. Similar findings are also seen in other advanced cancers.[37,38].

Despite the adverse impact of cancer cachexia among older adults with advanced disease, it remains an understudied and under-resourced area of cancer care. As a result, clinicians lack the tools needed to assess and manage cancer-related cachexia among older adults. Future studies should focus on the course of cachexia among older patients undergoing treatments for both chronic and advanced cancer diagnoses.

3.1.1. Diagnosis of cachexia in older adults—Many diagnostic criteria exist for cachexia.[39,40] An international consensus has recommended the following criteria: weight

loss of >5%, >2% in patients with BMI <20, or evidence of sarcopenia.[40–42] Other groups, including the Cachexia Consensus Conference, have advocated for inclusion of factors associated with inflammation such as serum C-reactive protein (CRP) levels (Table 4).[43] To date, a clear definition has not been validated among older adults with cancer. Furthermore, older adults can have varying degrees of weight loss, as a result of comorbidities, and other geriatric syndromes, which can compound the diagnosis of cancer-related cachexia. Cachexia is not only difficult to define, it also changes throughout the course of cancer care and ranges from pre-cachexia (limited weight loss, anorexia and metabolic changes), to cachexia, and finally to refractory cachexia at which point there is low functional status, poor response to therapy, and an estimated time to death of less than 3 months. Further research is warranted in (1) understanding the cachexia continuum specifically among older adults and (2) novel intervention strategies.

An early diagnosis of pre-cachexia or mild cachexia could enable clinicians to deliver interventions prior to presentation of moderate or severe cachexia, specifically for adults with at the initial phase of anti-cancer therapy. Studies in lung, head and neck, and colon cancer have reported findings that support the theory that early intervention can result in maintained nutritional status and improved tolerance to therapy and clinical outcomes.[44–46] The challenge remains in the early identification of pre-cachexia in the patient population most likely to benefit from either a nutritional or geriatric-syndrome-specific intervention. Studies are ongoing to evaluate markers such as serum CRP, urinary myosin heavy chain protein, and assessment of body fat and muscle mass by CT scans.[47–51] Novel biomarkers such as leptin and ghrelin are also being studied as early markers for cachexia.[52] The utility of these biomarkers in older patients is unknown and requires additional investigation. In the future, such studies will have to take into account the fact that some of these markers of inflammation are already elevated in older patients and predict for frailty.[53] One specific research area would be to prospectively study the coexistence of pre-cachexia or cachexia and other geriatric syndromes and the interactions between these conditions. Future longitudinal studies documenting the high prevalence and diagnosis of cachexia in older patients with cancer will improve the awareness of the oncology community about this important syndrome, and promote development of novel management tools.

3.1.2. Interventions aimed at reversal and management of cancer cachexia—

Various interventions have been studied with the goal to manage and improve cancer cachexia, including oral nutritional supplements, exercise, and pharmacologic interventions. To date, clinical trials evaluating these interventions have failed to prove efficacy.[54] In addition to the absence of efficacy, challenges persist in relation to patient adherence and the heterogeneity of effects of various types of cancers and cancer therapies on the specific interventions. A large meta-analysis of 13 randomized controlled trials in patients with cachexia or at risk for cachexia demonstrated improvement in quality of life following oral nutrition interventions yet observed no improvement in survival or significant weight gain.[54] No improvement in 1-year mortality was reported in a large randomized controlled trial of 336 older patients undergoing chemotherapy who were randomized to dietary counseling versus standard care. This study demonstrated improvement in nutritional intake among patients who received nutritional guidance, but that did not translate into improvement in

survival.[55] Multiple studies have evaluated the use of n-3-fatty acids or fish oil in patients with advanced cancer cachexia with negative results.[56–59] The limited benefit seen with nutritional interventions may be related to the ability of these treatments to reduce loss of fat, while having limited success in reversal of muscle wasting and the catabolic effect of cachexia.

Several pharmacologic interventions have also been evaluated with limited success in cachexia management; however, previous trials have not been specific to older adults with cancer. Although supplementation with amino acids and amine dietary supplements shows promise in treatment of cancer cachexia, specific studies among older adults with cancer are required.[39] This is a specific area of interest, as essential amino acid supplementation has been shown to improve muscle outcomes among older patients with sarcopenia.[60] NSAIDs are one of the main pharmacologic interventions studied with regards to cachexia; however, systematic evaluation of 13 studies evaluating the role of NSAIDS in the management of cachexia was inconclusive, and NSAIDs are largely contraindicated in older adults.[61] A Cochrane review was recently published on the utility of megestrol acetate for treatment of anorexia/cachexia syndrome; the review of 35 studies with over 3963 patients showed a benefit of megestrol acetate over placebo in weight gain (RR = 1.51, 95% CI = 1.08 to 2.11) and appetite stimulation (RR = 2.19, 95% CI = 1.41 to 3.4) without significant improvement in quality of life (SMD = 0.32, 95% CI = −0.02 to 0.65). Perhaps even more concerning were data showing that megestrol acetate was associated with a significantly increased risk of death (RR = 1.43, 95% CI = 1.05 to 1.96).[62] Phase II studies using the ghrelin receptor agonist, anamorelin (100 mg), versus placebo demonstrated increased weight and improved hand grip strength in NSCLC patients; phase III trials are underway and subset analyses among older patients demonstrating efficacy are required.[63,64] Similarly, the selective androgen receptor modulator, enobosaram, increased lean body mass among younger patients (mean age: 66 years old).[65] The Multimodal Exercise/Nutrition/Anti-inflammatory treatment of Cachexia (MENAC) study attempts to combine all these interventions with the exception of megestrol acetate [ClinicalTrials.gov Identifier: NCT02330926]. This study randomizes patients 18 years and older receiving chemotherapy to standard of care with or without oral nutritional supplements, exercise, and NSAIDS. The primary objective of the study is to determine whether the interventions achieve a difference in skeletal muscle mass at 6 weeks.

Lastly, the role of exercise in improvement of cachexia among patients with cancer has been poorly studied, although it is thought to enhance muscle protein synthesis and attenuate the catabolic effects of cachexia.[66] A systematic Cochrane review on the role of exercise in the management of cancer cachexia determined that there is insufficient evidence to determine the safety and efficacy of exercise in this setting.[39,67] Given the multifactorial nature of cachexia, it is clear that a multi-disciplinary approach will be required. A significant gap exists in the evaluation of these interventions among older adults with cancer. Studies of cancer cachexia targeting older adults are much needed and should optimally focus on combination of both pharmacologic and nonpharmacologic interventions.

4. Section 3: obesity and nutrition among older cancer survivors

4.1. Common clinical scenario

Mr. W is a 75-year-old gentleman recently diagnosed with indolent advanced prostate cancer who also has a history of coronary artery disease and diabetes. His current BMI is 30, and he is starting androgen deprivation therapy. He is concerned because when he takes his chemotherapy pre-medications, he feels like “eating everything in sight.” He also experiences unpleasant taste changes and dry mouth. He would like to lose weight but realizes if he “doesn't eat, he doesn't get nutrition.” He is looking for concrete, evidence-based recommendations concerning what and how often he should be eating and if he should be actively trying to lose weight. He knows “good nutrition is important for cancer patients,” and is looking for advice on food selection and portion control. What can a clinician recommend based on the current evidence for nutrition and weight gain among older adults undergoing chronic cancer treatment?

4.1.1. Weight gain and obesity among older cancer survivors—The National Comprehensive Cancer Network defines a cancer survivor as an individual from the time of diagnosis through the balance of her or her life.[68] For the remainder of this section, patients with cancer as a chronic condition, in remission, and in surveillance phases of their disease will be referred to as “cancer survivors.”

Overall, 5-year survival rates for most patients with cancer are improving, increasing the number of cancer survivors and patients managing their cancer as a chronic disease.[69] Older adults comprise the clear majority of cancer survivors, with over 60% of survivors aged 65 years and older and 45% aged 70 years and older.[68,69] Both the World Health Organization and the Center for Disease Control in the U.S. have identified weight gain and obesity as a major public health issue.[70–75] Due to the rising prevalence of obesity and its impact on quality of life and risk of subsequent illness,[75,76] it will become an increasingly common issue among cancer survivors.

Among all cancer survivors in the U.S. from 1992 to 2012, roughly one-third (30.6%) were obese with a BMI >30.[77] While anorexia and weight loss are important issues among patients undergoing active curative treatment and for advanced disease, weight gain and obesity will become increasingly common among older cancer survivors as the overall prevalence of overweight and obese adults continues to increase.[74,76] Although weight gain and obesity are relatively new “nutritional issues” among older adults with cancer, with the increase in cancer survivors who are at risk for obesity clinicians must consider how to counsel patients facing these issues. The American Society of Clinical Oncology (ASCO) has identified obesity as a major concern among patients with cancer, and has urged oncologists to intervene.[78]

Due to the paucity of obesity research among older adults with cancer, we do not know the prevalence of obesity among older cancer survivors and therefore lack a clear understanding of nutritional status and weight management throughout the survivorship period.[79] Future nutritional research among older adults with cancer should focus on determining both the prevalence and impact of malnutrition with respect to obesity.

An increase in body fat and obesity occurs with aging despite a decrease in food intake.[8] Yet despite the increasing prevalence of obesity among adults, there is still a risk of developing malnutrition, particularly among older adults. Among older adults, weight gain and obesity can occur in the presence of age-related decline in muscle mass, sarcopenia, and an overall nutritional deficient state.[8] In addition, long-term effects of cancer treatments, such as steroids and hormonal therapy, contribute to CVD and diabetes, for which older adults are already at an increased risk and which are exacerbated by excess body weight.[80,81] This paradox requires targeted research to understand the presence of common geriatric syndromes such as anorexia, malnutrition, and sarcopenia with respect to obesity, specifically among older cancer survivors. Furthermore, nutritional research is needed among older obese adults in order to understand the association between obesity and cancer prognosis.[81,82]

4.1.2. Dietary practices and interventions for older cancer survivors—In the absence of evidence-based guidelines for nutritional care for older cancer survivors, uncertainty persists regarding the appropriate nutritional assessment tools, use of supplements, and appropriate diet composition. Minimal data exist on dietary supplements (i.e., fish oil) in older adult cancer survivors. The few trials that have been published reported no improvement in prognosis or overall survival, with suggestion of chemo-resistance and early death as a result of these treatments.[19,83] It should be noted that both the World Cancer Research Fund and the American Cancer Society do not currently endorse the use of dietary supplements for the purposes of cancer control among cancer survivors in general.[19,84].

As people age their energy needs decrease, but their need for most nutrients does not, making dietary intake of extreme importance. Thus, there is an imperative for wiser food choices as there is little room for empty calories and foods with high amounts of sugar and fat. Instead, foods of high nutrient density are warranted, i.e., vegetables, fruits, whole grains, and low fat dairy products. While most people in the Western world consume ample amounts of protein, as energy requirements decrease and age-related problems in dentition increase, inadequate intakes of protein may become more prevalent. The American Cancer Society Guidelines for cancer survivors include an endorsement of the US Dietary Guidelines of 10–35% of energy coming from protein, with an intake of at least 0.8 g/kg body weight recommended. However, it is currently unknown how this recommendation is affected by age.[19,85,86] Older patients may need guidance on protein sources that are easier to chew and comparatively low in fat, e.g., eggs, low fat dairy products, and legumes.

Several geriatric factors impact dietary intake including but not limited to dental issues, taste changes, and xerostomia. The consumption of vegetables, fruits, and whole grains may decrease because they can be difficult to chew. Therefore, clinicians may help their patients by guiding them to more acceptable options, such as cooked vegetables and canned fruits (no added sugar), as compared to those that are fresh. Such advice also may address other barriers, such as cost, that often are a concern for older individuals living on fixed incomes. Due to changes in taste that can result from cancer and its treatment, as well as those that are reported with age (i.e., a loss of sour and bitter taste receptors, which results in a proclivity towards sweets),[87] older cancer survivors face specific challenges with regard to food

consumption as compared to their younger counterparts. In addition, xerostomia can influence intake and results not only from age, and cancer treatment, but also several medications that are used to treat common comorbidities among older patients, such as anti-hypertensives, pain medications, anti-histamines, and antidepressants. These are just a few examples of geriatric-specific dietary issues in need of further research.

Lifestyle interventions that promote a healthy diet and nutrition show potential to improve diet quality, functional status, and long-term outcomes of cancer survivors.[85] Published studies indicate cancer survivors have high interest in adopting healthy behaviors,[88] including diet-related and exercise-related interventions,[80] presenting oncologists with important opportunities to target older patients for education, prevention, and lifestyle modifications.

Despite prior research, there have been a limited number of nutritional interventions targeting older adults with cancer. The project, Leading the Way in Exercise and Diet (LEAD), of 182 older breast and prostate cancer survivors assigned patients to a 6-month home-based diet and exercise intervention.[89,90] The telephone-based, tailor-made material intervention introduced dietary changes in several domains (diet diversity, decreased total fat and saturated fat, adequate iron, and calcium). While this developmental study did not meet its accrual goal, in the intervention group, there was a trend toward improvement in physical functioning measures and a significant improvement in the short-term dietary quality. The study results confirm the difficulty in maintaining long-term adherence to healthy practices, with diminished differences seen in the control and intervention arms at the 12 month follow-up. This developmental study was followed by a fully powered randomized controlled trial among 641 older (age 65+ years) overweight or obese, long-term survivors of breast, prostate, and colorectal cancer in which the intervention (which was extended from 6 months to 12 months in duration) promoted both aerobic and resistance training, as well as a calorically restricted diet of high quality (increased fruits, vegetables, and whole grains and low amounts of sugar and fat).[90] This study, entitled Reach-Out to Enhance Wellness in Older Cancer Survivors (RENEW), resulted in significant improvements in physical function as well as weight loss, improved diet quality, and increased physical activity. This home-based intervention through telephone counseling and tailor-made materials was found replicable and durable at 2-year follow-up.[91] Future nutritional intervention research is needed specifically among older adults to target the intersection of geriatric syndromes, nutrition, and cancer-specific outcomes.

5. Conclusion

ASCO calls for expansion of cancer research among older adults.[92] Although evidence-based practice in geriatric oncology is increasing, significant knowledge gaps remain, particularly in nutritional research among older adults with cancer. Older adults with cancer represent a very heterogeneous group in terms of functional status with varying nutritional needs. The American Cancer Society and the National Comprehensive Cancer Network guidelines detail the need for nutritional support and interventions for older adults with cancer.[19,93] Yet key knowledge gaps exist in how exactly to provide appropriate nutritional support for a growing and vulnerable older adult cancer population. Future studies should

focus on energy balance among older adults, body composition over the course of cancer treatment, biomarkers for cachexia, and personalized, multi-disciplinary interventions for older adults throughout the continuum of cancer care.

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Table 1

Common clinical scenarios, strategies, and summaries.

Section 1: Side effects of active treatment and impact on nutritional status

Common clinical scenario:

Mrs. A is a 72-year-old woman with a recent diagnosis of Stage II (T2, N1, M0) gastric cancer. Until three months ago, she considered herself very healthy and only took calcium supplements. Then she started experiencing early satiety, decreased appetite, and abdominal discomfort and lost 10 kg. She has otherwise remained independent and continues to undertake all of her instrumental activities of daily living. Her discomfort, however, has led to a decrease in the amount of social activities she can perform. Her current BMI is 20 kg/m^2. After a thorough evaluation, her oncologist suggested starting chemotherapy with three cycles of ECF (epirubicin, cisplatin, and fluorouracil) followed by surgery. She was referred to a geriatrician for a comprehensive geriatric assessment, and she was found to be malnourished. Mrs. A wants to know what type of diet would be appropriate for her during treatment, and whether eating more and gaining weight would help her in getting through chemotherapy and preparing for surgery. She has also read on the internet that the proposed chemotherapy could cause severe vomiting and mouth sores, and would like to know if these side effects will further impact her nutritional status. What should her oncologist and her geriatrician tell her to answer these questions?

Strategies and summaries:

• Mrs. A would likely benefit from standard pharmacologic supportive care in addition to referral to a dietician. Small, frequent high-energy meals could be helpful.

• The prevalence of nutritional issues among older patients with cancer undergoing active therapy warrants targeted age-specific research using consistent nutritional assessment methods to determine the importance of weight gain versus weight stabilization during active treatment.

• Side effects related to malnutrition should be considered important adverse events similar to hematologic toxicity, infection, and drug reactions in future clinical trials.

• Sequelae of malnutrition during active treatment such as cognitive impairment, depression, and falls should be additional endpoints in nutritional intervention research.

Section 2: Metabolic dysregulation: cachexia in smoldering disease and advanced disease

Common clinical scenario:

Mr. N is an 80 year-old gentleman with advanced squamous cell carcinoma of the face and after multiple surgeries and radiation now has metastatic disease. Since starting palliative chemotherapy has started to gradually lose weight over the past 6 months. He has started drinking protein shakes in addition to a soft diet. He is keeping up with his hydration but is experiencing significant pain. He dislikes taking narcotics due to side effects of dry mouth and constipation. He is asking for addition medications to help him maintain and gain weight now that he has lost 50 lb since his diagnosis. What do you recommend?

Strategies and summaries:

• For Mr. N, small, frequent high-energy meals could hinder further weight loss until more effective nutritional interventions are known. Referral to a dietician would be helpful.

• Cachexia and sarcopenia are very prevalent issues among patients with cancer; however, further studies are needed to determine 1) the prevalence among older adults with cancer and 2) nutrition interventions and treatment advancements for cachexia in older patients with cancer.

• Dietary counseling, nutritional supplementation, or pharmacologic interventions have not shown significant improvement in the treatment or prevention of cancer related cachexia.

• Future studies should focus on multi-disciplinary approaches to cachexia prevention and treatment in older adults with cancer.

Section 3: obesity during chronic treatment and survivorship

Common clinical scenario:

Mr. W is a 75-year-old gentleman recently diagnosed with indolent advanced prostate cancer who also has a history of coronary artery disease and diabetes. His current BMI is 30, and he is starting androgen deprivation therapy and docetaxel. He is concerned because when he takes his chemotherapy pre-medications, he feels like “eating everything in sight.” He also experiences unpleasant taste changes, and dry mouth. He would like to lose weight, but realizes if he “doesn't eat, he doesn't get nutrition.” He is looking for concrete, evidence-based recommendations concerning what and how often he should be eating and if he should be actively trying to lose weight. He knows “good nutrition is important for cancer patients,” and is looking for advice on food selection and portion control. What can a clinician recommend based on the current evidence for nutrition among older adults undergoing cancer treatment and beyond?

Strategies and summaries:

• Recommendations for Mr. W could include encouragement of high-energy density, low calorie foods i.?e. vegetables and fruits to improve satiety and nutritional content as well as increased aerobic exercise.

• Obesity among older patients living with cancer as a chronic disease or as survivors is increasing and should be rigorously evaluated to determine if weight loss or caloric restriction is beneficial among older adults.

• Nutritional interventions should include impact on comorbidities and functional status in addition to traditional cancer outcomes such as recurrence and survival and take into account factors that are specific to the geriatric population.

Table 2

Common nutrition screening tools for malnutrition.

Mini Nutritional Assessment (MNA) Short Form [*]	A. Has food intake declined over the past 3 months due to appetite, digestive problems, chewing, or swallowing difficulties? Severe, moderate, no decrease
	B. Weight loss during the last 3 months? >3 kg, 1–3 kg, none
	C. Mobility: bed/chair, out of bed, goes out
	D. Has suffered psychological stress or acute disease in the past 3 months? Yes/no
	E. Neuropsychological problems? Severe, mild, none
	F. Body mass index (BMI) or calf circumference (CC): BMI <19, 19–21, 21–23, >23. CC <31 cm or >31 cm
Patient-Generated Subjective Global Assessment (PG-SGA) [£]	1. Height and unintended weight loss over 1 and 3 months: yes/no
	2. Food intake: unchanged, more or less than usual
	3. Symptoms present in last 2 weeks: check boxes
	4. Functional capacity over last month: normal, up or in bed
	5. Primary disease diagnosis:
	6. Physical loss of fat, muscle wasting, or edema
Malnutrition Screening Tool (MST) [#]	Have you been eating poorly because of decreased appetite? Yes/No
	Have you lost weight recently without trying? Yes/No
Simplified nutritional appetite questionnaire (SNAQ) [¥]	Patient answers 4 items:
	1. My appetite is:
	2. When I eat I feel full after:
	3. Food tastes:
	4. Normally I eat ____ meals per day
SCREEN II [S]	17-item tool with an 8 question abbreviated version
Malnutrition Universal Screening Tool (MUST) [a]	BMI
	Weight loss over 3–6 months
	Anorexia for periods of 5 days or longer due to disease
Nutritional Risk Screening (NRS) [ß]	BMI
	% weight loss over 1–3 months
	Change in food intake in preceding week
	Disease severity rating

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[S] Tools can be purchased from Professor Heather Keller, RD, PhD. Contact hkeller@uoguelph.ca

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Table 3

Factors to consider when assessing weight loss and malnutrition in elderly patients with cancer.

• Fatigue
• Functional dependence
• Anemia
• Anorexia
• Dry mouth
• Dysosmia
• Dysgeusia
• Impaired mobility
• Nausea
• Early satiety
• Poor vision
• Dental issues
• Oral candidiasis
• Hand, foot, and mouth syndrome
• Poor dentition, ill-fitting dentures
• Cognitive function
• Mental health
• Polypharmacy
• Social support
• Vomiting
• Diarrhea
• Specific cancer diagnosis which limit oral intake: head and neck, esophageal, gastric

Table 4

Nutritional status definitions.

Cachexia £	• Weight loss of ≥5% in 12 months or less; or BMI <20 kg/m^2 in the presence of underlying illness AND 3 of the 5 criteria:
	• Decreased muscle strength (grip strength)
	• Fatigue
	• Anorexia
	• Low fat-free muscle index
	• Abnormal biochemistry: CRP, hemoglobin <12 g/dL or albumin <3.2 g/dL
	Alternate *
	• Weight loss >5% over past 6 months (in absence of simple starvation); or
	• BMI <20 kg/m^2 and any degree of weight loss >2%; or
	• Appendicular skeletal muscle index consistent with sarcopenia and any degree of weight loss >2%
Sarcopenia *	Loss of muscle mass, strength (grip), and performance (gait speed)
	Muscle mass below the 5th percentile
	• Mid upper-arm muscle area by anthropometry (men <32 cm^2, women <18 cm^2)[31]
	• Appendicular skeletal muscle index determined by dual energy x-ray absorptiometry (men <7·26 kg/m^2; women <5·45 kg/m^2)[32]
	• Lumbar skeletal muscle index determined by CT imaging (men <55 cm^2/m^2; women <39 cm^2/m^2)
	• Whole body fat-free mass index without bone determined by bioelectrical impedance (men <14·6 kg/m^2; women <11·4 kg/m^2)
Body mass index	= (weight in kg) / (height in m^2)
Weight loss	= (current weight) / (starting body weight) × 100
	≥2% in 1 month
	≥5% in 3 months
	≥10% in 6 months
Hypoalbuminemia	=<3.2 g/dL

£ As defined by Evans et al. 2013. Cachexia Consensus Conference. Washington, DC.

* As defined by: Fearson et al. 2011. The Lancet Oncology and EWGSOP.