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## **Dietary Changes and Food Preferences Experienced by Older Adult Cancer Patients and the Impact on Health Outcomes**

**KISHA COA<sup>1\*</sup> , JOEL B. EPSTEIN<sup>2,3</sup>,  
KATHY MCMANUS<sup>4</sup> and BRUCE MOSKOWITZ<sup>5</sup>**

<sup>1</sup>ICF, Rockville, Maryland, USA.

<sup>2</sup>Cedars-Sinai Samuel Oschin Comprehensive Cancer Institute, Los Angeles, CA, USA.

<sup>3</sup>City of Hope, Los Angeles, CA, USA .

<sup>4</sup>Dana- Farber/ Brigham and Women's Cancer Center, Boston, Massachusetts, USA.

<sup>5</sup>Cancer Nutrition Consortium, Boston, Massachusetts, USA.

### **Abstract**

To describe how cancer treatment influences the dietary behaviors and food preferences of older adult cancer patients and explore associations between these dietary changes and common cancer symptoms. A convenience sample of 800 cancer patients age 55 years and older undergoing cancer treatment completed a self-administered questionnaire which assessed patients' dietary changes, food preferences and aversions since starting treatment, and health outcomes. Descriptive statistics were conducted to examine associations between dietary changes and age groups (categorized as 55-64 years old, 65-74 years old, and 75 years old and older), and multivariable logistic regression was used to assess associations between dietary changes and health outcomes. The majority of participants experienced at least one cancer symptom, with fatigue and poor appetite being most commonly reported. About half of respondents reported no change in appetite or thirst, but those who did report a change were more likely to report a decrease in appetite rather than an increase, and more likely to report an increase in thirst rather than a decrease. Most of the patterns were consistent across age groups but the oldest age group (75+) was less likely to report eating less frequently, and less likely to report certain increased taste and smell sensitivities. Characterizing the nutritional needs of older adult cancer patients is the first step in being able to address these needs. Future research is needed to evaluate potential strategies to address nutritional concerns, and to better understand the unique needs of specific subgroups of older adult cancer patients at high risk of experiencing dietary changes (e.g., those with head and neck cancer).



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**CONTACT** Kisha I. Coa ✉ [Kisha.Coa@icf.com](mailto:Kisha.Coa@icf.com) 📍 ICF, Rockville, Maryland, USA.



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## Introduction

Cancer is a disease of aging, the median age of a cancer diagnosis is 66 years, with more than 75% of cancers being diagnosed in adults age 55 years or older<sup>1</sup>. In 2017, it is estimated that there will be approximately 1.68 million new cases of cancer in the United States<sup>2</sup>. Approximately 30 to 85% of cancer patients (depending on cancer type) experience malnutrition<sup>3</sup>. There are multiple mechanisms by which tumors and cancer treatment can lead to malnutrition including affect upon oral function and swallowing, changing resting energy expenditures, and reducing energy intake by reducing appetite, producing chemosensory alterations (i.e., sensitivities to specific tastes or smells), inducing nausea and vomiting, and causing food aversions<sup>4,5</sup>. For older adults this is particularly problematic because this can exacerbate dietary alterations that are already occurring as part of the normal aging process, including decreased appetite, deteriorating sense of taste and smell, dental status, and early satiation, all which contribute to decreased energy intake<sup>6-8</sup>.

Malnutrition disproportionately affects older adults and is associated with increased mortality<sup>9</sup>. Malnutrition also negatively impacts quality of life for older adults through multiple domains but these associations tends to be understudied, and nutrition services are not routinely provided to older adults during clinical encounters<sup>10</sup>. Given that older adults are more likely to be diagnosed with cancer, and the number of older adults in the US is increasing<sup>11</sup>, the need to address nutritional challenges of older adult cancer patients will continue to increase in importance. Although there are strategies that can be used to address dietary issues, many cancer patients who could potentially benefit from these services are not being offered nutritional support<sup>3</sup>. There is a need to better understand the nutritional concerns of older adult cancer patients to inform efforts and to address nutrition needs of these patients. The purpose of this paper is to: (1) describe how cancer treatment influences the dietary behaviors and food preferences of older adult cancer patients (age 55 years and older), and (2) explore associations between these dietary changes and common cancer symptoms.

## Materials and Methods

### Sample

A convenience sample of 1,199 cancer patients ages 18 years and older, of which 800 were age 55 years or older, undergoing active treatment were recruited from seven cancer centers: Roswell Park Cancer Institute, New York University Cancer Institute, Dana Farber/Brigham and Women's Cancer Center, Sidney Kimmel Comprehensive Cancer Center at Johns Hopkins, University of Chicago Comprehensive Cancer Center, Mayo Clinic Cancer Center, and Cedars-Sinai/Samuel Oschin Comprehensive Cancer Institute. Between April and December 2012, nurses, therapists, and dietitians at participating centers approached patients in waiting areas and other clinical areas to enroll them in the study. Institutional Review Boards at each center approved the study protocol. This study is a sub-analysis of cancer patients age 55 or older. An analysis of the full sample stratified by cancer type was previously conducted<sup>12</sup>.

### Measures

Participants completed a 15-minute self-administered paper-and-pencil survey that captured data on their demographic characteristics, cancer and cancer treatment, co-morbidities, medicines and nutritional supplements, treatment-related dietary changes, food preferences, and primary household food preparer. Variables included in this analysis are:

Demographic & cancer related variables: age; gender; race; and co-morbidities; time since diagnosis; treatment type; cancer type; cancer symptoms (assessed using a checklist); Dietary change variables: change in appetite (3 category response option: increased, stayed about the same, decreased); change in frequency of eating (3 category response option: more often, about the same less often); change in thirst (3 category response option: increased, stayed about the same, decreased); change in frequency of drinking fluids (3 category response option: more often, about the same less often); increased and decreased taste sensitivities – bitter, metallic, salty, sour, sweet (check all that apply); increased sensitivity to various aromas (check all that apply); and food preferences and aversions.; Nutrition-related health outcomes:

weight loss (defined as whether participants had lost at least 5 lbs since beginning treatment); significant fatigue

### Statistical Analysis

Descriptive statistics and chi-square tests were conducted to compare baseline demographic and cancer-related characteristics by age group (55-64, 65-74, 75+) and examine associations between dietary changes and age groups. Multivariable logistic regression was used to assess associations between dietary changes and health outcomes (i.e., significant fatigue, weight change); logistic regression models controlled for age and receipt of chemotherapy. A p-value of 0.05 or less was considered to be statistically significant, and all tests

were two-sided. All analyses were conducted using SAS 9.4 software (Cary, NC).

### Results

The sample for this analysis consisted of 800 adult cancer patients age 55 or older (Table 1). Overall the sample was 58.3% female, primarily white (82.2%), about half of participants were diagnosed over a year ago, and chemotherapy was the most prevalent treatment type (89.4%). A little fewer than half of respondents had at least one co-morbidity. Notable differences by age group include the oldest age group (75 years old +) being more likely to have heart disease than other age groups, and being less likely to report undergoing chemotherapy or radiation than the other age groups.

**Table 1: Demographic/treatment characteristics by age group**

	55-64 years old (n=329) %(n)	65-74 years old (n=320)%(n)	75 years or older (n=151)%(n)	Total (n=800) %(n)	p-value
<b>Gender</b>					
Female	57.4 (186)	60.3 (187)	55.6 (79)	58.3 (452)	0.59
Male	42.6 (138)	39.7 (123)	44.4 (63)	41.8 (324)	
<b>Race/ethnicity</b>					
White	83.2 (267)	79.6 (254)	85.3 (128)	82.2 (649)	0.06
Black	10.3 (33)	9.7 (31)	4.0 (6)	8.9 (70)	
Hispanic	1.3 (4)	3.5 (11)	4.7 (7)	2.8 (22)	
Asian	1.6 (5)	4.1 (13)	2.0 (3)	2.7 (21)	
Other	3.7 (12)	3.1 (10)	4.0 (6)	3.5 (28)	
<b>Cancer type</b>					
Breast cancer	15.5 (51)	10.9 (35)	10.6 (16)	12.8 (102)	
GI cancers	17.6 (58)	14.1 (45)	16.6 (25)	16.0 (128)	
Lung	14.9 (49)	21.3 (68)	16.6 (25)	17.8 8 (142)	
Other solid1	30.1 (99)	30.3 (97)	25.2 (38)	29.3 (234)	
Hematologic	17.9 (59)	27.2 (87)	25.8 (39)	23.1 (185)	
<b>Comorbidities</b>					
Diabetes	14.6 (48)	15.0 (48)	21.2 (32)	16.0 (128)	0.15
Heart disease	10.0 (33)	11.9 (38)	19.2 (29)	12.5 (100)	0.02
Lung disease	4.6 (15)	8.8 (28)	7.3 (11)	6.8 (54)	0.10
Liver	2.7 (9)	2.2 (7)	3.3 (5)	2.6 (21)	0.77
Kidney	1.8 (6)	2.2 (7)	3.3 (5)	2.3 (18)	0.59
HIV	0.6 (2)	0	0	0.3 (2)	---
Other	18.8 (62)	19.4 (62)	12.6 (19)	17.9 (143)	0.17
None	54.7 (180)	51.6 (165)	47.7 (72)	52.1 (417)	0.35
<b>Time since diagnosis</b>					
With the past 2 months	12.6 (41)	8.9 (28)	8.1 (12)	10.3 (81)	0.053

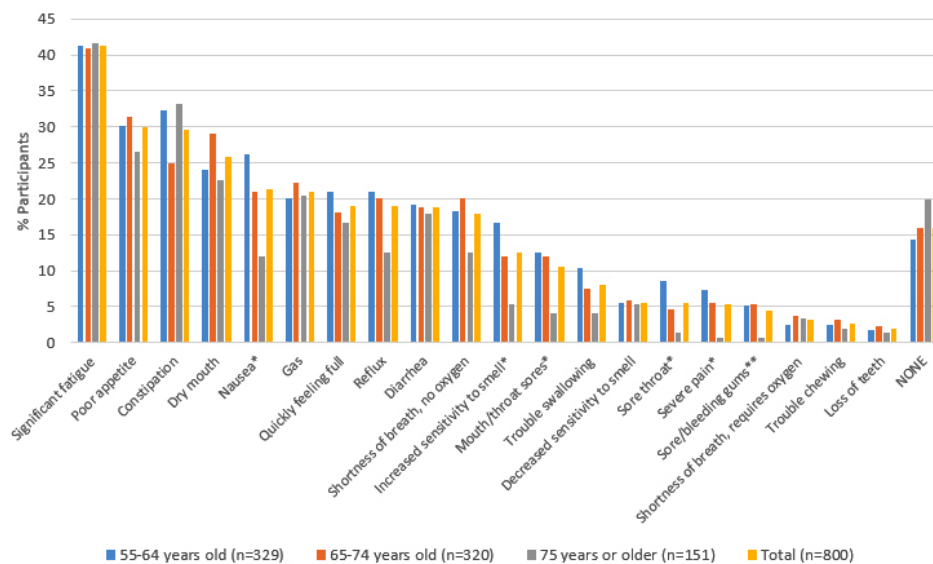
Within the past 4 months	18.1 (59)	13.0 (41)	12.2 (18)	14.9 (118)	
Within the past 6 months	12.9 (42)	10.4 (33)	10.8 (16)	11.5 (91)	
Within the past 9 months	6.4 (21)	6.7 (21)	3.4 (5)	6.0 (47)	
Within the past year	6.8 (22)	7.9 (25)	4.7 (7)	6.8 (54)	
More than one year ago	43.3 (141)	53.2 (168)	60.8 (90)	50.5 (399)	
<b>Treatment type (all the apply)</b>					
Chemotherapy	90.6 (298)	90.9 (291)	83.4 (126)	89.4 (715)	0.03
Radiation	17.9 (59)	14.1 (45)	6.0 (9)	14.1 (113)	<0.01
Surgery	7.6 (25)	8.1 (26)	8.0 (12)	7.9 (63)	0.97
Hormone therapy	4.3 (14)	3.4 (11)	7.3 (11)	4.5 (36)	0.16
Transplant	1.8 (6)	0.9 (3)	0	1.1 (9)	---
None	4.0 (13)	4.0 (13)	8.0 (12)	4.8 (38)	0.12

<sup>1</sup>Other solid tumors: brain or spinal, gynecological, head and neck, prostate, kidney, bladder, osteosarcoma, or soft tissue sarcoma

### Cancer symptoms

Eight-four percent of cancer patients age 55 or older reported experiencing at least one cancer symptom, with fatigue being the most common (41.3%) followed by poor appetite, constipation, dry mouth, nausea and gas, all experienced by at least 20% of participants (Figure 1). The frequency

of experiencing symptoms was similar across age groups; however, those 75+ were significantly less likely to be experiencing nausea, increased sensitivity to smell, mouth/tongue sores, sore throat, severe pain and sore/bleeding gums than the other age groups.



\*p<0.01; \*\*p<0.05

Fig. 1: Percentage of participants reporting symptoms by age group

**Dietary Changes since Beginning Cancer Treatment**

Approximately 50% of participants experienced changes in appetite and thirst since beginning cancer treatment (Table 2). Decreased appetite (39.1%) was more common than increased appetite

(14.1%). The oldest age group was less likely to experience a change in frequency of eating than the other age groups. Increased thirst (28.3%) was more common than decreased thirst (13.3%). There were no significant age related differences in change in thirst.

**Table 2: Dietary changes since beginning treatment by age group**

	55-64 years old (n=329)% (n)	65-74 years old (n=320)% (n)	75 years or older (n=151)% (n)	Total (n=800) % (n)	
<b>Appetite</b>					
Increased appetite	15.2 (49)	13.5 (42)	12.9 (19)	14.1 (110)	0.49
Same	47.4 (153)	44.1 (137)	51.7 (76)	46.9 (366)	
Decreased appetite	37.5(121)	42.4 (132)	35.4 (52)	39.1 (305)	
<b>Frequency of eating</b>					
More often	24.4 (78)	19.5 (60)	15.7 (23)	20.8 (161)	0.02
About the same	46.6 (149)	49.7 (153)	62.6 (92)	50.8 (394)	
Less often	29.1 (93)	30.8 (95)	21.8 (32)	28.4 (220)	
<b>Thirst</b>					
Increased thirst	28.4 (91)	30.9 (95)	22.8 (33)	28.3 (219)	0.17
Stayed the same	56.1 (180)	57.0 (175)	66.2 (96)	58.3 (451)	
Decreased thirst	15.6 (50)	12.1 (37)	11.0 (16)	13.3 (103)	
<b>Frequency of drinking</b>					
More often	47.2 (151)	45.8 (142)	43.8 (64)	46.0 (357)	0.12
About the same	40.9 (131)	45.8 (142)	50.7 (74)	44.7 (347)	
Less often	11.9 (38)	8.4 (26)	5.5 (8)	9.3 (72)	

**Chemosensory alterations**

Increased taste sensitivities were more commonly reported than decreased taste sensitivities (Table 3). Cleaning solutions and perfume were the smells most bothersome to participants. When there were age related differences in chemosensory

alterations, the oldest age group was less likely to experience alterations – this was the case for increased sensitivity to metallic, sweet, and sour flavors. The oldest -age group was also less likely to report sensitivity to the smells of cleaning solutions, perfume, food cooking, and hand sanitizer.

**Table 3: Chemosensory alterations by age group**

	55-64 years old (n=329)% (n)	65-74 years old (n=320)% (n)	75 years or older (n=151)% (n)	Total (n=800)% (n)	
<b>% (n) reporting increased taste sensitivity</b>					
Metallic	19.2 (63)	15.0 (48)	8.0 (12)	15.4 (123)	0.01
Salty	15.2 (50)	14.4 (46)	9.9 (15)	13.9 (111)	0.28
Sweet	15.8 (52)	12.2 (39)	8.0 (12)	12.9 (103)	0.05
Bitter	8.2 (27)	8.1 (26)	6.0 (9)	7.8 (62)	0.66
Sour	9.7 (32)	6.6 (21)	3.3 (5)	7.3 (58)	0.03

**%(n) reporting decreased taste sensitivity**

Sweet	8.2 (27)	8.1 (26)	4.0 (6)	7.4 (59)	0.21
Salty	7.3 (24)	5.9 (19)	8.0 (12)	6.9 (55)	0.67
Sour	2.4 (8)	5.3 (17)	4.0 (6)	3.9 (31)	0.15
Bitter	4.6 (15)	3.8 (12)	2.7 (4)	3.9 (31)	0.60

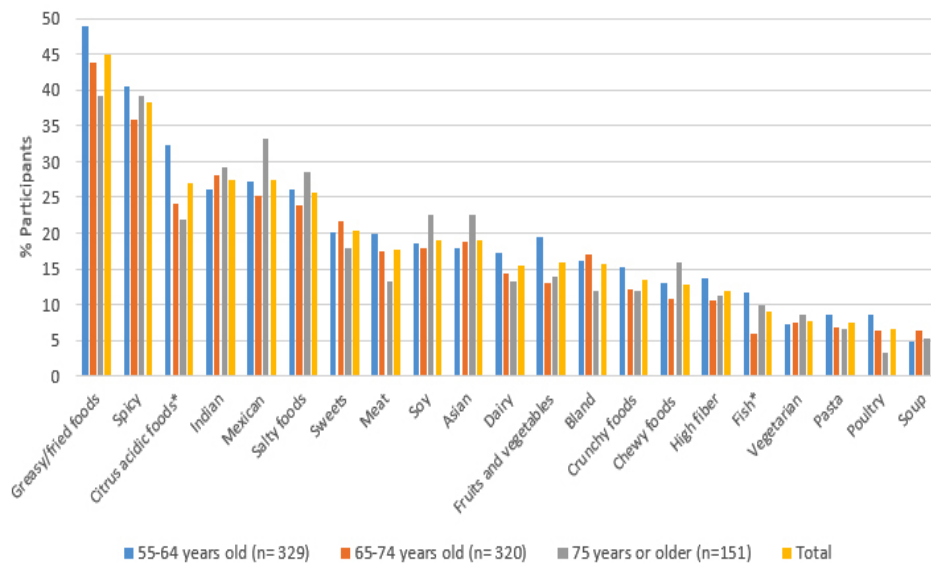
**%(n) reporting sensitivity to aroma**

Cleaning solutions	26.1 (86)	17.8 (57)	12.6 (19)	20.3 (162)	<0.01
Perfume	23.7 (78)	18.8 (60)	9.3 (14)	19.0 (152)	<0.01
Food cooking	10.9 (36)	11.6 (37)	4.6 (7)	10.0 (80)	0.05
Fish	9.1 (30)	7.2 (23)	6.6 (10)	7.9 (63)	0.54
Hand sanitizer	8.5 (28)	5.0 (16)	0.7 (1)	5.6 (45)	<0.01
Plastic	4.3 (14)	4.7 (15)	2.7 (4)	4.1 (33)	0.58
Meat	4.9 (16)	4.4 (14)	1.3 (2)	4.0 (32)	0.17
Poultry	4.3 (14)	2.5 (8)	0.7 (1)	2.9 (23)	0.08
Dairy	1.8 (6)	2.5 (8)	1.3 (2)	2.0 (16)	0.67

**Food Preferences and Aversions**

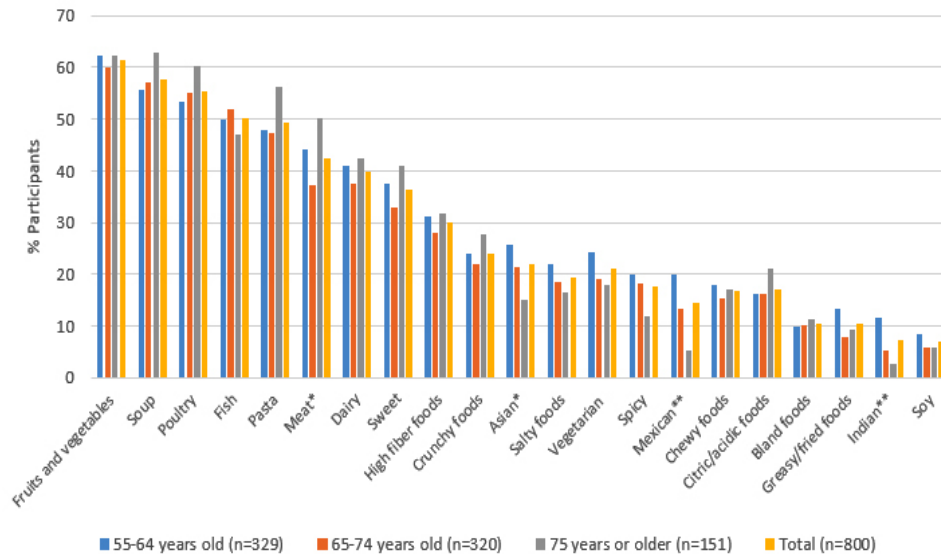
The foods that participants were most likely to avoid were greasy/fried foods, spicy, and citrus/acid foods. However, those 75 years old older were less likely to report an aversion to citrus/acidic foods than other

age groups (Figure 2). Also, participants age 75 years and older were also less likely to prefer salty foods and ethnic foods (i.e., Mexican, Indian, Asian; Figure 3), but were more likely to prefer meat.



\*p<0.05

**Fig. 2: Percentage of participants reporting food aversions by age group**



\* $p < 0.05$ ; \*\* $p < 0.01$

**Fig. 3: Percentage of participants reporting food preferences by age group**

### Differences in Health Outcomes

In adjusted analyses examining correlates of fatigue, participants who experienced a decreased appetite were 2.04 times more likely (95% CI: 1.35, 3.09) to experience significant fatigue than those whose appetite stayed about the same. Participants who reported a change in frequency of eating – either more often or less often – were also more likely to experience fatigue than those who ate about the same frequency as before treatment (OR: 2.23, 95% CI: 1.38, 3.60 and OR: 1.67, 95% CI: 1.07, 2.63, respectively).

In adjusted analyses examining correlates of weight loss, those who had a decreased appetite were 4.56 times more likely (95% CI: 2.93, 7.08) than those whose appetite stayed the same to report losing 5 or more pounds since beginning treatment. Similarly, those who reported eating less frequently had a 1.98 higher odds of weight loss (95% CI: 1.21, 3.24) than those who ate with about the same frequency as before treatment.

### Discussion

Despite advancements in cancer treatment, large numbers of cancer patients are still suffering from nutrition related issues that can impact their quality of

life and health outcomes. Our findings are consistent with other studies that demonstrate that cancer and cancer treatment (especially chemotherapy) are associated with dietary changes that can lead to malnutrition<sup>4,13</sup>. The majority of participants experienced at least one cancer symptom, with fatigue and poor appetite being the most commonly reported. Overall the patterns were consistent across older age groups (55-64, 65-74, 75+). About half of respondents reported no change in appetite or thirst, but among those who did report a change they were more likely to report a decrease in appetite rather than an increase, and more likely to report an increase in thirst rather than a decrease. Increased taste sensitivities were more common than decreased, with increased metallic and sour sensitivities being more frequently reported. About a fifth of participants had sensitivities to the aromas of cleaning solutions and perfume. Across all age groups, participants who had decreased appetite or changes in frequency of eating were more likely to suffer from fatigue and weight loss.

This study expands upon a previous analysis of these data<sup>12</sup> to examine potential differences in the ways in which cancer treatment alter the diets among age segments (55-64, 65-74, 75+) of older



adult cancer patients. When there were differences by age group, they were consistent with what would be expected given naturally occurring age related changes in nutrition<sup>7</sup>. For example, the oldest age group (75+) was less likely to report eating less frequently, and less likely to report increased taste and smell sensitivities. Appetite decreases with age which may diminish the perceived impact of cancer treatment on amount eaten relative to younger age groups. Similarly, older adults have a dulled sense of taste and smell,<sup>14</sup> so chemosensory alterations might be less apparent. This may also be due to patients over 75 years old being less likely to receive chemotherapy.

There are some limitations of this study that warrant consideration. First, these data are based on a convenience sample, and therefore may not be representative of all adult cancer patients age 55 years or older undergoing treatment. Second, the sample of participants in the 75 and older group is smaller (almost half the size) of the other age groups, which may have limited our ability to detect significant differences for this group. Third, we did not capture pre-treatment weight and height, only the number of pounds lost, so we could not assess percent weight loss; typically problematic weight loss is calculated as a specific percentage of weight loss over a period of time<sup>15</sup>. Finally, all of these data are based on self-report and therefore subject to reporting biases, and the data are cross sectional so we cannot infer causality.

Nevertheless, this study includes a relatively large, diverse sample of older adult cancer patients recruited from multiple cancer centers, and provides detailed data on nutritional challenges, and food preferences/aversions that can be used to inform the development of nutrition support services. Although nutritional screening guidelines exist,<sup>16,17</sup> many patients with nutritional concerns do not receive support for these needs<sup>3</sup>. Future studies should assess the specific nutritional needs of older cancer patients by cancer type (e.g., head and neck cancer), especially with cancer patients in the

oldest age group. The number of cancer survivors age 75 years and older is continuing to grow<sup>11</sup>, and this age group likely has unique needs. Cancer patients in this age group tend to be underrepresented in research studies. This is problematic because there is evidence that the experiences and expectations of these patients may differ from their younger counterparts. For example, they may underreport specific concerns because they view them as a normal part of undergoing cancer treatment and are less familiar with the availability of supportive services<sup>18</sup>.

Nutritional status is a key component of quality of life in older adults,<sup>10</sup> and this makes nutritional assessment in older adults that much more important<sup>6</sup>. Geriatric assessment interventions (which include nutritional concerns) have been found to be effective in identifying and addressing unmet needs of older adult cancer patients<sup>19-21</sup>. However, geriatric assessments have not been standardized and are not routinely conducted for older adult cancer patients<sup>20</sup>. There is a growing body of research on strategies that can be used to address nutritional needs of older adults<sup>8,22</sup>. For example, Schiffman and colleagues have found flavor enhancement to be an effective strategy for addressing taste and smell losses and improving nutritional status in older adult cancer patients<sup>22</sup>. This study provides insights into the food preferences and aversions of older adults that can be incorporated into nutritional strategies. As nutritional counseling and supportive services are refined and more consistently used, research is needed to evaluate the effect of these support interventions on the health and quality of life outcomes of older adult cancer patients.

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#### **Conflict of Interest**

The authors declare they do not have any conflict of interest.

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