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# Evaluation of Bmi, Diet Quality, Alcohol Intake, and Physical Activity in Cancer Survivors: Is There an Association With Primary Source of Nutrition Advice?

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EVALUATION OF BMI, DIET QUALITY, ALCOHOL INTAKE, AND PHYSICAL

ACTIVITY IN CANCER SURVIVORS: IS THERE AN ASSOCIATION

WITH PRIMARY SOURCE OF NUTRITION ADVICE?


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64 Pages

Objective: The purpose of this study was to determine if cancer survivors are meeting nutrition and physical activity recommendations presented by the ACS. The association between a survivor's primary source of nutrition advice and these factors was also assessed.

Method: A sample of 132 cancer survivors was recruited through social media. Inclusion criteria included: United States citizenship, at least 18 years of age, and diagnosis of cancer or malignancy by a health care professional. A one-time, self-administered survey was distributed via Qualtrics. The *Dietary Screener Questionnaire* was utilized to determine average daily consumption of fruits and vegetables and the weekly consumption of red and processed meat. Additional questions were used to determine BMI, alcohol intake, and physical activity.

Results: Mean consumption of fruits and vegetables among participants were both lower than guideline recommendations. Mean fruit consumption was .913 cup equivalents (SD = .411), mean vegetable consumption was 1.549 cup (SD = .370). There was no statistically significant association between primary source of nutrition advice and mean fruit, vegetable, red or processed meat consumption. There were also no statistically significant associations between primary source of nutrition advice and BMI, alcohol intake, or physical activity.

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PHYSICAL ACTIVITY IN CANCER SURVIVORS: IS THERE AN ASSOCIATION

WITH PRIMARY SOURCE OF NUTRITION ADVICE?

**Introduction**

Over the course of 2021, the American Cancer Society (ACS) estimated there were

1,898,160 new cases of cancer and 608,570 cancer-related deaths in the United States (Siegel et

al., 2021). Cancer trails only heart disease as the leading causes of death in the United States

(Kochanek et al., 2020). These numbers demand further investigation into the mitigation of

cancer-related mortality. Among the prominent contributing factors for cancer death is excess

body weight, excessive alcohol intake, poor diet, and physical inactivity (Islami et al., 2017). The

ACS has published guidelines that addresses these modifiable risk factors and what

nutrition/physical activity parameters should be followed to improve survivorship (Rock et al.,

2012). These guidelines were created so health care providers could initiate implementation of a

nutrition and physical activity plan for survivors to follow. Currently, the research indicates that

even with this information, diet quality among American adult cancer survivors remains to be

inadequate (Lee et al., 2021).

Interpretation and application of these guidelines may be difficult for a survivor to do on

their own due to perceived barriers (Cho & Park, 2017; Clifford et al., 2017; Keaver et al., 2021).

Among the most prevalent perceived barriers to physical activity and healthy eating is fatigue or

lack of energy (Cho & Park, 2017; Clifford et al., 2017; Keaver et al., 2021). Appropriate

management of dietary intake through education and counseling is the primary intervention

strategy for fatigue management (Berger et al., 2015). A comprehensive approach, including the

screening of nutrient deficiencies and gastrointestinal/renal function along with balancing energy

levels, has been recommended to improve outcomes of fatigue (Berger et al., 2015). Another barrier may be finding accurate advice. A recent survey finding indicated that 82.9% of survivors sampled reported seeking out nutrition advice (Keaver et al., 2021). If a survivor does not have access to a professional source of nutrition advice, then it may lead to them to seek advice through other means.

In the absence of professional nutrition advice, survivors seek information from the internet (Keaver et al., 2021). The use of the internet generates different challenges that makes finding accurate information more difficult (Brug et al., 2005). Regardless, the internet is more accessible to most individuals and provides a quicker method of acquiring information. There is also the issue of some health care providers not even discussing nutrition recommendations. A 2017 survey reported up to 72% of the cancer survivors did not discuss nutrition education with their health care provider (Hoedjes et al., 2017). In a study conducted by the Association of Community Cancer Centers, it was discovered that there were barely any electronic health records indicating in-depth discussions on healthy diets prior to 2018 (Bowen et al., 2020). The term "health care provider" covers a list of multiple disciplines, such as clinics, psychologists, dentists, or chiropractors ("*Covered Entities and Business Associates*", 2017). If the health care provider does not have a specialization in nutrition, then they may lack the skills or knowledge of guidelines required to give specific nutrition advice (Koutoukidis et al., 2018). This may contribute to the lack of nutrition being discussed between survivors and health care providers.

The availability of a registered dietitian nutritionist (RDN) would present survivors with the opportunity to learn and implement strategies that follow the ACS guidelines (American Cancer Society, n.d.). RDN's are required to complete a minimum of a bachelor's degree program from an accredited college or university (Umphfleet, S. S., n.d.). Following completion

of a degree is a supervised practice program at a health-care facility, community agency, or a foodservice corporation (Academy of Nutrition and Dietetics' Accreditation and Education Programs Team, 2018). In addition to that, they must also complete a national exam which focuses on nutrition assessment, intervention, planning, education, research applications, and nutrient composition of foods among other food-related topics (Commission on Dietetic Registration, 2017). All of this would appear to show that RDN's would be a valuable resource for those trying to follow the established health guidelines, but access to their services is not always available. Outpatient cancer centers, which account for approximately 90% of cancer care, are often understaffed and fail to provide appropriate nutrition care services (Halpern & Yabroff, 2008; American Society of Clinical Oncology, 2017, Trujillo et al., 2019).

Therefore, the current study seeks to assess nutrition and physical activity behaviors of cancer survivors, as well as their primary source of nutrition advice. Adherence to these recommendations is likely to increase survivorship (Rock et al., 2012). Examining the relationship between a survivor's primary source of nutrition advice and their adherence to key nutrition and physical activity recommendations may provide a better understanding as to why cancer remains to be a prominent cause of mortality. The specific research questions this study aims to answer are as follows:

1. Are cancer survivors meeting key fruit and vegetable recommendations as outlined by the American Cancer Society?

2. Are cancer survivors meeting physical activity recommendations as outlined by the American Cancer society?

3. Is the primary source of nutrition advice of cancer survivors associated with their diet quality and health characteristics?

It was anticipated that there would be an overall lack of adherence to nutrition and physical activity recommendations. The current data indicates that cancer survivors often lack adequate fruits and vegetables in their diet. One study reported that only 36%-39% of cancer survivors consume more than five servings of fruits and vegetables (DeNysschen et al., 2014). Other studies report similar low fruit and vegetable intake (Potter et al., 2014; Lee et al., 2021). Cancer survivors have also been reported to underperform in achieving adequate moderate-to-vigorous physical activity (Smith et al., 2018; D'Errico & Fessele, 2021; Keaver et al., 2021). Additionally, alcohol consumption remains an issue for many cancer survivors as 56.5% reported still being current drinkers (Sanford et al., 2020). These problematic lifestyle habits have culminated in obesity rates of about 30% in cancer survivors (Shoemaker et al., 2016). The findings of past studies indicate that survivors are struggling to achieve adherence to guideline recommendations.

## Methodology

### *Characteristics of Sample*

Adult cancer survivors were recruited and asked to complete an online survey through Qualtrics. Eligibility to complete the survey required the following criteria: potential participants must have resided in the United States, be 18 years of age or older, and have been diagnosed with cancer or a malignancy at any time in their life. In total 448 submissions were completed. There was a total of 132 usable responses. Approximately 7% of total submissions failed at least one of the three preliminary questions that required a "Yes" to take part in the survey. Submissions that were completed in less than 5-minutes were manually removed to limit responses that may have been sped through, or completed by robots, or those seeking to scam the survey to receive a gift card. Submissions that contained unrealistic or inappropriate answers to

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free-response questions (such as e-mails or incoherent responses) were removed as well. Duplicate submissions were determined by comparing answers to free-response questions. If a submission had an unrealistic height or weight, then the response was also removed. An example of this is a participant who reported being 58 feet tall. Participants were recruited through social media via a post shared on Facebook with personal contacts, possibly impacting the diversity of the sample. The project received approval from the Institutional Review Board.

The average age of respondents was 35.5 years old, and their average BMI was determined to be 23.3 kg/m$^2$ ($SD = 4.811$). Demographic information collected indicated that 65.9% of these participants were males and 34.1% were female. As for ethnicity, this sample was predominately white (72%). The other prominent ethnicities represented were Black or African American (15.9%) and American Indian (4.5%) (Table 1). Non-physical characteristic information was also collected, such as income level and education level. The highest reported responses from those demographics were that participants had an income between $40,000-$59,999 (33.3%) and completed a bachelor's degree (28.0%). Furthermore, it was found that 87 of the 132 survivors (65.9%) being evaluated in this study were actively undergoing treatment during the research period (Table 2).

***Survey Design***

A survey questionnaire was designed using previously established and validated questionnaires. Questions from the *Dietary Screener Questionnaire* and *NPAQ-Short* were adapted for this study. Alcohol questions were included from the National Health Institute's Recommended Alcohol Questions. In total, this survey was a 47-item questionnaire created through Qualtrics. All surveys were self-administered.

### Demographic and Anthropometric Characteristics

Demographic information was collected such as age, gender, race, income, and education level. This information was used to examine external factors that may have played a role in the outcome of the results. Each participant was asked to report their weight in pounds and height in feet and inches to later calculate BMI. This BMI number was then used to categorize weight status of participants. Participants were asked about the site of their first cancer diagnosis and if they were currently receiving treatment for their cancer.

### Dietary Screener Questionnaire

Diet quality was assessed with the National Institutes of Health's *Dietary Screener Questionnaire* (DSQ). This screener tool has been validated to be used in the assessment of diet quality for fruit and vegetable intake (Thompson et al., 2005). The DSQ uses 30 questions to determine the frequency of intake from different food groups over the last month. It was developed by the Risk Factor Assessment Branch in the National Cancer Institute's Epidemiology and Genomics Research Program (National Cancer Institute, 2021a). It assesses the diet by examining the average intake of a variety of foods and drinks. Questions were combined to create categories of food groups. The food groups being identified were fruits, vegetables, and red/processed meats. Each food group's average daily consumption was calculated by adding daily cup equivalence for each food item per food group. Consumption of red/processed meats was converted into weekly consumption. Permission for use in research has been granted by the National Institute of Health.

### Body Mass Index

BMI has been declared a useful tool in studies including large numbers of people for determination of disease risk (American Institute for Cancer Research, 2020). BMI was

calculated by using the self-reported measurements for height and weight. Weight was converted into kilograms (kg) from pounds. Height was calculated into meters (m) from feet and inches. BMI of each participant was determined using the formula $kg/m^2$. The specific BMI was then recoded into one of the four classifications. BMI less than 18.5 $kg/m^2$ is considered underweight, BMI between 18.5 $kg/m^2$ and less than 25 $kg/m^2$ is within the normal range, BMI 25.0 $kg/m^2$ to less than 30 $kg/m^2$ is overweight, and BMI 30.0 $kg/m^2$ or higher is classified as obese (Centers for Disease Control, 2021a).

*Alcohol Intake*

Alcohol frequency intake was determined using the National Institute of Alcohol Abuse and Alcoholism recommended alcohol questions (National Institute on Alcohol Abuse and Alcoholism, 2003). Number of drinks on a typical day in the past 12 months was reported. Reported number of drinks were compared to the gender of the participant. This allowed for categorization of moderate or excessive alcohol intake. The parameters used by the ACS in their nutrition guidelines were used to define the two categories (Rock et al., 2020). This equates to a maximum intake of one drink per day for women and two drinks per day for men.

*Physical Activity*

Physical activity levels were assessed using the NPAQ-short. The NPAQ-short has been found to be a reliable and valid measurement of physical activity levels in the population and included two questions (Danquah et al., 2018). The questions were used to assess weekly moderate-to-vigorous physical activity (MVPA) and vigorous physical activity (VPA). Both questions provided five options. The MVPA responses included "Less than ½ an hour (less than 30 minutes)" to "More than 5 hours (more than 300 minutes). The VPA responses ranged from "Less than ½ an hour (less than 30 minutes)" to "More than 2 ½ hours (more than 150 minutes)".

These responses were then be compared to the ACS recommendations for physical activity of 150-300 minutes of moderate intensity or 75-150 minutes of vigorous intensity activity each week (American Cancer Society, 2020). Adherence was determined if the participant met either of the recommended amounts for MVPA or VPA.

*Source of Nutrition Advice*

The source of nutrition advice was identified using a drop-down list including nine options: primary care physician (family doctor), registered dietitian, family or friends, books, newspaper, or magazine, television or radio, internet search on Google, social media such as Facebook, Twitter, Instagram, YouTube, Tik Tok etc., or I do not ask for nutrition advice. The options listed were adapted from the National Cancer Institute's Health Information National Trends Survey which assessed cancer advice seeking behaviors of cancer survivors (National Cancer Institute, 2020).

## Data Analysis

Data was analyzed using the Statistical Package for the Social Sciences (SPSS v.26). Descriptive statistics of mean and standard deviation were conducted for participant demographics. One-way ANOVA analysis was utilized to analyze the relationship between main source of nutrition advice and diet quality. A Chi-Square test of independence was used to analyze the relationship between main source of nutrition advice and BMI and physical activity. A level of $p < 0.05$ was used to determine significance. The independent variable used was the main source of nutrition advice and the dependent variables were diet quality, BMI, and physical activity. Analysis of nutrition consisted of two steps. First, the frequency data was converted to daily or weekly frequency. Then the date was inputted into an algorithm used for scoring.

**Results**

*Primary Source of Nutrition Advice*

Primary source of nutrition advice was recoded into three categories. The first category was 'Primary Care Physician' (Family Doctor). The second category was 'Registered Dietitian.' The third category combined all non-medical sources of information. Included in this category were 'Family or Friends,' 'Media' (Television, Newspaper, Radio), 'Internet' (Google Search, Blogs, Social Media, etc.). All participants surveyed stated they sought nutrition advice. There were 59 participants that sought advice from their Primary Care Physician (PCP) (44.70%), 34 sought advice from a dietitian (25.76%), and 39 sought their advice from a non-medical source (29.55%). Reported reasons for choosing a non-medical source for primary nutrition advice included cost and convenience. Some who chose their PCP as a primary source of nutrition advice did so because of the trust they had in them. Another reason one of the participants listed was that they believed their PCP knew their overall health picture the best. One reason for choosing dietitians as a primary source was that they were the expert in nutrition.

*Mean Consumption of Food Groups and Relationship to Primary Source of Nutrition Advice*

The average daily consumption of fruits and vegetables was found by recoding DSQ responses into daily cup equivalents. Afterwards, an algorithm including the daily cup equivalents, median portion size equivalents by sex and age, and gender-specific estimated regression coefficients was used to estimate individual dietary intakes (Table 3). Mean fruit consumption was .913 cup equivalents (*SD* = .411), mean vegetable consumption was 1.549 cup (*SD* = .370). Mean consumption for fruit and vegetables for participants were both lower than guideline recommendations. Adherence to ACS fruit and vegetable recommendations was compared between the different primary source of nutrition advice groups (Table 4). Red and

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processed meat were converted from daily frequency to weekly consumption. Weekly mean consumption of red meat was 2.03 servings ($SD = 1.82$). Weekly mean consumption of processed meat was 1.60 servings ($SD = 1.89$). A one-way between subjects ANOVA was conducted to compare the effect of primary source of nutrition advice on fruit, vegetable, red meat, and processed meat. There was not a statistically significant effect of primary source of nutrition advice on fruit [$F(2, 129) = 1.465$, $p = .235$], vegetable [$F(2, 129) = .648$, $p = .525$], red meat [$F(2, 129) = 0.63$, $p = .939$], and processed meat consumption [$F(2, 129) = .352$, $p = .704$], at the $p \leq .05$ level (Table 5).

### *BMI and Relationship to Primary Source of Nutrition Advice*

Out of the 132 participants evaluated, 22 were found to be underweight (16.7%), 71 were normal weight (53.8%), 27 were overweight (20.5%), and 12 were obese (9.1%). A chi-square test of independence was performed to examine the relation between BMI and primary source of nutrition advice. The relationship between these variables was not statistically significant, $\chi^2$ (6, $N = 132$) $= 4.902$, $p = .552$. Most participants in this sample were within the normal weight range (Table 6). Interestingly, 35.9% of the non-medical group and 30.5% of the PCP group were considered overweight or obese compared to 20.6% of the dietitian group.

### *Alcohol Intake and Relationship to Primary Source of Nutrition Advice*

Out of the 87 male participants evaluated, 60 reported moderate alcohol consumption (69.0%) and 27 reported excessive alcohol intake (31.0%). Out of the 45 females, 29 reported moderate alcohol consumption (64.4%) and 16 reported excessive alcohol consumption (35.6%). Those who reported no alcohol intake were included in the moderate alcohol consumption category for simplicity of data evaluation. A chi-square test of independence was performed to examine the relation between alcohol consumption and primary source of nutrition advice. The

relation between these variables was not significant for males, $\chi^2$ (2, $n = 87$) = 4.099, $p = .129$ or

for females $\chi^2$ (2, $n = 45$) = .751, $p = .687$ (Table 7).

***Physical Activity and Relationship to Primary Source of Nutrition Advice***

Out of the 132 participants evaluated, 44 did not meet either MVPA or VPA

recommendations (33.3%) and 88 did meet either MVPA or VPA recommendations (66.7%).

The primary source of nutrition advice group with the highest adherence to meeting physical

activity guidelines was the 'Dietitian' group with 73.53% (Table 8). A chi-square test of

independence was performed to examine the relation between physical activity and primary

source of nutrition advice. The relation between these variables was not significant, $\chi^2$ (2, $N =$

132) = 1.693, $p = .431$.

## Discussion

Primary source of nutrition advice was not found to be significantly correlated with any

of diet or health characteristics, including fruit, vegetable, red or processed meat intake, BMI,

alcohol, or physical activity as measured in the current study. In addition, most participants did

not reach recommended intakes for fruits and vegetables. BMI results indicate that only about

half of the participants were at a healthy weight and one-fourth of the sample was considered

overweight or obese. Approximately one-third of the sample reported excessive alcoholic

drinking patterns. About the same fraction of the sample also reported not meeting physical

activity recommendations. Only one-fourth of participants reported using a dietitian as a primary

source of nutrition advice, but the possibility also exists that they have received nutrition advice

from a dietitian at some point.

These results show that, while there was no significant relationship between primary

source of nutrition advice with modifiable risk factors of cancer mortality, the adherence to

recommendations is still undesirable in this population. The demographics should also be considered as factors for the results revealed in this study. According to the data, 65.9% of participants were actively undergoing treatment at the time of their survey submission. Active cancer and cancer-related side-effects may make eating a diet of fruits and vegetables more difficult due to decreased appetite or altered taste. There may also be an emphasis on more calorie-dense foods. As for financial status, 65.2% reported making less than $60,000 in their household. There may be a correlation between financial status and ability to meet recommendations that was not evaluated in this research.

### *Cancer Survivors Primary Source of Nutrition Advice*

The data found in this current study differs from research conducted by Keaver and colleagues (2021). In their study, they found that most respondents received their nutrition advice from sources other than health care providers. The difference in results could be due to fact that 64.8% of their respondents reported having already completed treatment. Another factor affecting this differentiation is that they included multiple sources of nutrition advice in their research, not just the primary source. Considering that most participants in this study were actively undergoing treatment, they are more likely to have frequent interactions with health care professionals. Accessibility to a dietitian was not assessed in this survey and could have influenced those who reported having a PCP or non-medical source as their primary source of nutrition advice. Results were, however, similar to Sullivan and colleagues (2021) survey of 1,073 respondents which found only 39% of respondents had received access to a dietitian. Overall, research is limited regarding the primary source of nutrition advice used by cancer survivors.

*Impact of Dietitians as the Primary Source of Nutrition Advice*

Studies evaluating dietetic interventions have yielded mostly positive outcomes (Mitchell et al., 2017). Those receiving care from dietitians have been shown to have a statistically significant improvement on dietary and anthropometric measures. In the meta-analysis by Mitchell and colleagues (2017), 18 of 26 studies showed improvements in these areas. BMI was improved for 8 of 12 studies that used it as an outcome. These findings are not mimicked in this research. A possible difference in outcomes examined here could be that the population of this study was exclusively narrowed to cancer. The meta-analysis by Mitchell and colleague reviewed data from consultations in the primary health care setting. This included multiple chronic disease populations. Although, the research they had on the cancer population did show more favorable outcomes on management of nutrition-related symptoms of cancer patients (Ravasco et al., 2012). Specific evaluation of diet quality by dietetic intervention on the cancer population is sparse, but dietetic intervention in general appears to be promising in creating change in dietary habits. A study involving a dietitian-led intervention in chronic kidney disease patients did show that the participants increased their vegetable intake (Chan et al., 2021).

*Diet Quality of Cancer Survivors*

The results of diet quality in this study are similar to Lee and colleagues (2021). Their study found poor adherence to dietary recommendations using The Healthy Eating Index (HEI). The HEI is a tool that has been used by approximately 300 publications to analyze the eating habits of Americans (Schap et al., 2017). It uses a score of 100 points to indicate healthy dietary compliance (Krebs-Smith et al., 2018). It evaluates components of the diet by separating them into two categories. The "Adequacy" category contains total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and fatty

acids. The "Moderation" category contains refined grains, sodium, added sugars, and saturated fats (Krebs-Smith et al., 2018). Lee et al. (2021) used the 2015 version of the HEI to evaluate diet quality of adult cancer survivors between 2005-2016 and concluded that the overall diet quality of this population had an overall poor adherence to the CDC's 2015-2020 Dietary Guidelines for Americans.

### Alcohol Intake of Cancer Survivors

In a study of US cancer survivors, the pattern of problem drinking is alarming as 56.5% reported being current drinkers, 34.9% exceed moderate drinking recommendations, and 21% binge drink (Sanford et al., 2020). Those results were similar to the data shown here. Studies focusing of female cancer survivors in the US reported numbers of 15-23% of excess alcohol intake (Fazzino et al., 2016). The sample in this research revealed an even higher percentage (35.5%) who reported drinking more than moderate amounts. However, the sample size of this study was much smaller and only had 45 female subjects. Review of 164,692 adults (both male and female) also shows that cancer survivors were less likely to report current moderate/heavy drinking habits than non-cancer survivors (Arem et al., 2020). It is possible that in this study, alcohol consumption was underreported as well.

### BMI and Cancer Survivors

The current study has a drastically lower obesity percentage than reported by the CDC. Compared to the estimated 30% of survivors with obesity reported in the US population, only 9.1% were classified as obese in this sample (Centers for Disease Control and Prevention, 2021b). The lower percentage of survivors with obesity could be explained by the high rate of survivors actively undergoing treatment. Effects from active cancer and cancer-treatment increase likelihood of unintended weight loss (Cooper et al., 2015). Cancer cachexia is the

process in which a negative protein and energy balance occurs, resulting in wasting of both adipose tissue and lean body mass (Fearon et al., 2011). Side-effects of treatment can also cause anorexia, nausea, vomiting, altered taste, sensitivity to food smells make adequate nutrition difficult to achieve (Milliron et al., 2022). The nutritional and physiological impact of actively undergoing treatment needs to be considered when reviewing the data of the current study.

*Physical Activity and Cancer Survivors*

An almost identical percentage of cancer survivors were found to engage in insufficient physical activity in this study compared to Troeschel et al. (2018). In both the current and the referenced study, approximately 34% of survivors failed to achieve adequate physical activity. However, the methods of approach for evaluating physical activity recommendations differed significantly. The current study used the CDC's physical activity guidelines of 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity to determine adequate activity (Centers for Disease Control and Prevention, 2022). The comparative study used the *2011 Compendium of Physical Activities* to assign metabolic equivalent of task values to specific activities reported by participants (Troeschel et al., 2018). The limited scope of expertise of the current study's researcher made resulted in a less detailed evaluation of physical activity.

*Limitations and Future Research*

The anonymous self-administered questionnaire method created limitations in the current research study. There is no way to validate anonymous responses. In future research, it may be more impactful to perform a longitudinal study. This type of study could provide an educational intervention with a dietitian. Evaluation of the factors reviewed in this research at baseline compared to post-intervention would help identify what type of impact exists. Due to the data collection method and lack of diversity in this sample, it is unclear to whom findings might

generalize. The timing of this survey should also be noted. Responses were submitted during the COVID-19 pandemic. This may have impacted cancer survivors' ability to receive nutrition education due to restrictions on in-person meetings to reduce the spread of the virus.

Another limitation was the lack of differentiation of the cancer survivor population. As explained in this paper, "cancer survivor" is a broad term that encompasses all individuals from the moment they are diagnosed until they pass away. A sample with 65.9% of participants actively undergoing treatment complicates the research. Different treatments, cancer types, and cancer staging could affect whether the main goal of care is to focus on an overall healthy diet or to prioritize any source of nutrition. Active treatment also means that there is an increased likelihood of having a primary source of nutrition advice be a medical professional, as reflected by the over 70% of respondents that reported having access to and using a health care professional as a main source of nutrition advice. Future research could explore interventions at different stages of treatment. Opportunities for receiving nutrition advice could also be studied throughout treatment.

## Conclusion and Implications

This study found that cancer survivors are not meeting recommendations of 1 ½ to 2 cups per day of fruits, or 2 to 3 cups per day of vegetables based on mean averages of reported intake. Engagement in physical activity is also not being adequately met by most cancer survivors being evaluated. The frequency of alcohol intake is concerning considering that one-third of the sample reported excessive drinking habits. These factors were not significantly impacted by the primary source of nutrition advice. Overall, the results of this study reveal a lack of adherence to key factors in tumorigenesis and cancer mortality.

Based on these results, it is evident there is a need for additional investigation into improving the measures included in this study. Excessive weight, diet quality, alcohol intake, and physical activity play critical roles in prevention and survival of cancer. BMI as an indicator of excessive weight may not always reveal a clear clinical picture but can be used as an inexpensive tool to help identify and measure risk. Avoidance of unnecessary and excessive weight gain should be encouraged for long-term survivors. The carcinogenic effects of alcohol make excessive or even moderate consumption a risky behavior for cancer survivors. Survivors should limit intake. Pairing these recommendations with an active lifestyle can help to prevent inflammation, which may foster an environment for tumor growth.

Education, awareness, and counseling should be provided by health care professionals to assists survivors and the public in achieving the physical activity and nutrition guidelines presented by the ACS. Survivors are recommended to engage in 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity physical activity per week. This activity should be accompanied with healthy eating patterns including fruits, vegetables, whole grains and limited red or processed meats, sugar-sweetened drinks, refined grains, and alcohol intake. These lifestyle habits can help create an energy balance, preventing excessive weight gain. Dietitians especially can play a prominent role in assist survivors in achieving these guidelines due to their required education and focus on effective counseling strategies in creating behavioral change. Access to dietitians is currently limited due to understaffing. The study of dietetics includes understanding energy balance and the impact of nutrients on disease. Use of a dietitian in an outpatient setting can allow for critical investigation, intervention, and monitoring on the outcomes highlighted in this study for long-term behavioral change sustainability. The research

gathered here shows the ways in which dietitians can impact the main modifiable risk factors

associated with cancer mortality.

**Tables**

Table 1: *Demographic Characteristics of Cancer Survivors |*
*N=132*

| Measure | M | SD |
|---|---|---|
| Age (years) | 35.5 | 11.641 |
| BMI (kg/m$^2$) | 23.2 | 4.811 |
|  | Frequency | Percent |
| Sex |  |  |
| Male | 87 | 65.9% |
| Female | 45 | 34.1% |
| Ethnicity |  |  |
| White | 95 | 72% |
| Black or African American | 21 | 15.9% |
| American Indian or Alaska Native | 6 | 4.5% |
| Asian | 4 | 3% |
| Native Hawaiian or Pacific Islander | 5 | 3.8% |
| Other | 1 | 0.8% |
| Income Level |  |  |
| <$20,000 | 15 | 11.4% |
| $20,000-$39,999 | 27 | 20.5% |
| $40,000-$59,999 | 44 | 33.3% |
| $60,000-$79,999 | 32 | 24.2% |
| $80,000 or higher | 13 | 9.8% |
| Do not wish to answer | 1 | 0.8% |
| Education Level |  |  |
| No Formal Schooling | 2 | 1.5% |
| Elementary School (Grades 1-8) | 2 | 1.5% |
| Some High School (Grades 9-11) | 15 | 11.4% |
| Completed High School (GED) | 28 | 21.2% |
| Some College, No Degree | 35 | 26.5% |
| Completed Bachelor's Degree | 37 | 28.0% |
| Post-Baccalaureate Degree | 13 | 9.8% |

*Note: The mean BMI of this participant group would be classified as a normal BMI.*

Table 2: *Cancer Type and Treatment*

| Measure | M | SD |
|---|---|---|
| Cancer | | |
|    Bladder | 3 | 2.3% |
|    Breast | 9 | 6.8% |
|    Colorectal | 12 | 9.1% |
|    Esophageal | 9 | 6.8% |
|    Kidney | 5 | 3.8% |
|    Leukemia | 13 | 9.8% |
|    Lung | 9 | 6.8% |
|    Liver | 11 | 8.3% |
|    Melanoma | 4 | 3.0% |
|    Non-Hodgkin Lymphoma | 2 | 1.5% |
|    Pancreatic | 1 | 0.8% |
|    Prostate | 11 | 8.3% |
|    Stomach | 19 | 14.4% |
|    Thyroid | 8 | 6.1% |
|    Uterine/Ovarian | 9 | 6.8% |
|    Other | 7 | 5.3% |
| Currently Receiving Treatment | | |
|    Yes | 87 | 65.9% |
|    Have Not Started | 2 | 1.5% |
|    Completed | 43 | 32.6% |

*Note: Treatment was classified as surgery, radiation therapy, chemotherapy, or chemotherapy pills.*

Table 3: *Average Intake of Food Groups of Cancer Survivors in Equivalents*

| Measure | M | SD | Range |
|---|---|---|---|
| Average Fruit Intake | 0.913 | 0.411 | 0.421-2.820 |
| Average Vegetable Intake | 1.584 | 0.369 | 0.951-3.219 |
| Average Red Meat Intake | 2.032 | 1.824 | 0-7.00 |
| Average Processed Meat Intake | 1.6 | 1.89 | 0-14.00 |

*Note: Average fruit and vegetable intake values are measured as cups per day. These results can be compared to the ACS nutrition recommendations of 1½-2 cups/day for fruit and 2-3 cups/day for vegetables. In the sample population, only 7.58% met fruit intake recommendations and 8.33% met vegetable intake recommendations. Red meat and processed meat values represent weekly frequency. The ACS encourages limited red meat intake and avoidance of processed meat. However, no specific recommended intake amount for red or processed meat has been established.*

Table 4: *Adherence to ACS Guidelines of Daily Fruit and Vegetable Consumption*

|  | Primary Source of Nutrition Advice | | | |
|  | PCP | Dietitian | Non-Medical | Total |
|---|---|---|---|---|
| Fruit |  |  |  |  |
| Met recommendations | 4 | 4 | 2 | 10 |
| Did not meet recommendations | 55 | 30 | 37 | 122 |
| Vegetables |  |  |  |  |
| Met recommendations | 6 | 2 | 3 | 11 |
| Did not meet recommendations | 53 | 32 | 36 | 121 |
| Total | 59 | 34 | 39 |  |

*Note: Participants who reported 'Dietitian' as their primary source of nutrition advice had the highest percentage of adherence to fruit recommendations (11.76%). As for vegetable consumption, participants who reported 'PCP' as their primary source of nutrition advice had the highest percentage of adherence (10.17%).*

Table 5: *Association Between Primary Source of Nutrition Advice and Average Food Group Consumption*

| Measure |  | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Average Fruit Intake | Between Groups | 0.491 | 2 | 0.246 | 1.465 | 0.235 |
|  | Within Groups | 21.615 | 129 | 0.168 |  |  |
|  | Total | 22.106 | 131 |  |  |  |
| Average Veggie Intake | Between Groups | 0.203 | 2 | 0.101 | 0.737 | 0.480 |
|  | Within Groups | 17.733 | 129 | 0.137 |  |  |
|  | Total | 17.936 | 131 |  |  |  |
| Average Red Meat Intake | Between Groups | 0.429 | 2 | 0.214 | .063 | 0.939 |
|  | Within Groups | 435.618 | 129 | 3.337 |  |  |
|  | Total | 436.046 | 131 |  |  |  |
| Average Processed Meat Intake | Between Groups | 2.546 | 2 | 1.273 | 0.352 | 0.704 |
|  | Within Groups | 466.026 | 129 | 3.613 |  |  |
|  | Total | 468.573 | 131 |  |  |  |

*Note: No significant associations were found between any of the food groups and primary source of nutrition advice. Significance was evaluated at the $p \leq 0.05$ level.*

Table 6: *Association Between Primary Source of Nutrition Advice and BMI*

|  |  | *Primary Source of Nutrition Advice* |  |  |
|---|---|---|---|---|---|
|  |  | PCP | Dietitian | Non-Medical | Total |
| BMI Categories | Underweight | 7 | 7 | 8 | 22 |
|  | Normal | 34 | 20 | 17 | 71 |
|  | Overweight | 12 | 6 | 9 | 27 |
|  | Obese | 6 | 1 | 5 | 12 |
| Total |  | 59 | 34 | 39 | 132 |

*Note: PCP – Primary Care Physician; Underweight = BMI 18.5 kg/m² or lower, Normal = BMI 18.5 kg/m² - $\leq$ 25 kg/m², Overweight = BMI 25.0 kg/m² - $\leq$ 30 kg/m², Obese = BMI 30.0 kg/m² $\leq$*

Table 7: *Association Between Primary Source of Nutrition Advice and Alcohol Consumption*

|  |  | *Primary Source of Nutrition Advice* |  |  |
|---|---|---|---|---|---|
|  |  | PCP | Dietitian | Non-Medical | Total |
| Male Alcohol Consumption | Moderate | 33 | 15 | 12 | 60 |
|  | Excessive | 9 | 8 | 10 | 27 |
| Female Alcohol Consumption | Moderate | 11 | 6 | 12 | 29 |
|  | Excessive | 6 | 5 | 5 | 16 |
| Total |  | 59 | 34 | 39 | 132 |

*Note: Moderate alcohol consumption for males was considered as $\leq 2$ drinks/day. Moderate alcohol consumption for females was $\leq 1$ drink/day. Participants who responded as not drinking any alcohol were classified under the 'Moderate' category. One alcoholic drink was defined as a half an ounce of alcohol.*

Table 8: *Association Between Primary Source of Nutrition Advice and Physical Activity*

|  |  | *Primary Source of Nutrition Advice* |  |  |
|---|---|---|---|---|---|
|  |  | PCP | Dietitian | Non-Medical | Total |
| Physical Activity | Met recommendations | 36 | 25 | 27 | 88 |
|  | Did not meet recommendations | 23 | 9 | 12 | 44 |
| Total |  | 59 | 34 | 39 | 132 |

*Note: The CDC's physical activity guidelines of 150-300 minutes of moderate intensity or 75-150 minutes of vigorous intensity activity each week were used.*

CHAPTER II: EXTENDED REVIEW OF THE LITERATURE

## Modifiable Risk Factors for Cancer Survivors

Healthy lifestyle choices play a major role in preventing cancer occurrence and long-term survival of those who have already been (Rock et al., 2020). Studies have determined that one-third to half of cancers can be prevented by with healthy lifestyle choices. Maintaining a healthy BMI, moderating use of alcohol, and engaging in regular physical activity are descriptors used to define a healthy lifestyle. The CDC reports that obesity, poor nutrition, and physical inactivity account for almost 40% of cancer cases in the US. Guidelines presented by the ACS focus on these key factors. 1). Avoiding excessive weight gain and maintaining an appropriate weight; 2). Maintaining 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity physical activity; 3). Maintaining healthy eating patterns including fruits, vegetables, whole grains and limited red or processed meats, sugar-sweetened drinks, or refined grains; 4). Limiting alcohol intake to no more than 1 drink per day for women or 2 drinks per day for women (Rock et al., 2020). Community awareness, advocacy, and policy change for increasing adherence to these recommendations are vital for reducing cancer onset and increasing cancer survivability (Rock et al., 2020).

## Relationship Between Healthy Weight and Cancer

After a review of over 1,000 world-wide epidemiological studies, the IARC declared overweight/obese individuals to have an increased risk of developing cancer in the esophagus, colon, breast, endometrium, kidney, gastric cardia, liver, gallbladder, pancreas, ovary, and thyroid (Arem & Loftfield, 2017; Doleman et al., 2016; Lauby-Secretan et al., 2016). Higher BMI was also found to increase risk of multiple melanoma and meningioma (Lauby-Secretan et al., 2016). The risk of these cancers increased in positive association with BMI (Lauby-Secretan

et al., 2016). Survivor prognosis is less favorable for overweight/obese individuals (Aune et al., 2016). A large meta-analysis of 230 cohort studies containing data on more than 30 million people associated higher than normal BMI with increased mortality risk (Aune et al., 2016). In 2003, a study evaluated the associations between BMI and cancer mortality for over 1 million people in the U.S. who had no cancer during enrollment (Calle et al., 2003). After a 16-year follow-up, researchers calculated the percentage of deaths attributed to overweight/obese individuals. They reported that compared to men with normal BMI, obese class 1 (BMI of 30.0 $kg/m^2$ to 34.9 $kg/m^2$) men had a 9% increased risk in cancer mortality. Obese class 2 (BMI 35.0 to 39.9 $kg/m^2$) men had a 20% increased risk. Men that were obese class 3 (>40.0 $kg/m^2$) had a 52% increased risk. Compared to women with normal BMI, overweight women had an 8% increased risk, obese class 1 women had a 23% increased risk, obese class 2 women had a 32% increased risk, and obese class 3 women had a 62% increased risk (Calle et al., 2003). This data is concerning considering that 42.4% of US citizens and approximately 30% of survivors are considered obese according to the CDC (Centers for Disease Control and Prevention, 2021b; Centers for Disease Control and Prevention, 2021c).

There also exists a phenomenon in which obesity has a protective factor on the body (Arem & Loftfield, 2017; Shachar & Williams, 2017). Referred to as the "Obesity Paradox," data reveals that some individuals with normal BMI have worse outcomes than those who are overweight or obese (Wang et al., 2018; Shachar & Williams, 2017; Lennon et al., 2016). One theory for this phenomenon relates to how BMI is measured (Petrelli et al., 2021). A flaw in the establishment of a person's BMI is that it does not differentiate between lean body mass and fatty tissues, therefore providing an incomplete evaluation of a person's weight status (Wells, 2005). In oncology, sarcopenia is a primary concern for survivors who have active cancer

(Anjanappa et al., 2020; Chindapasirt, 2016). Sarcopenia is defined as the loss of skeletal muscle mass and function (Santilli, 2014). Age, malnutrition, physical inactivity, cancer therapy, tumor-derived factors, supportive care medication, and comorbidities all exacerbate this skeletal muscle loss (Chindapasirt, 2016). The loss of skeletal muscle mass can be shrouded by the presence of fat mass. Someone presenting with a normal BMI can still be experiencing significant muscle wasting. The presence of sarcopenia, regardless of BMI, has been associated with higher mortality in cancer survivors (Caan et al., 2018; Caan et al., 2017). In certain cases, a person may be diagnosed with both obesity and sarcopenia. This condition, known as sarcopenic obesity, emphasizes the importance of attending to the other modifiable risk factors such as proper nutrition and physical activity to maintain lean body mass.

## The Role of Physical Activity in Cancer Prevention and Survivability

Physical activity has been established as a main modifiable lifestyle factor relating to cancer prevention and cancer survivorship (Rock et al., 2020). As mentioned previously, physical activity facilitates weight loss, helps to prevent excessive weight gain, and maintains lean body mass (Jakicic et al., 2019; Cox, 2017). In prevention, physical activity has been associated with reduced risk of onset for several types of cancers. The WCRF/AICR and the Physical Activity Guidelines Advisory Committee to Physical Activity report that there is strong evidence linking physical activity with lower risk for colon cancer (Miles, 2018). A meta-analysis of 126 studies revealed that higher physical activity resulted in a 19% lower risk of developing colon cancer (Liu et al., 2015). Additional strong evidence exists for bladder, breast, endometrial, esophageal, kidney, and stomach cancer (National Cancer Institute, 2020). Less consistent evidence exists for lung cancer prevention, but the relative reduction in risk associated with increased physical activity was found to be between 21-25% (McTiernan et al., 2019).

Evidence was limited for other various cancers; including hematologic, pancreatic, prostate, thyroid, liver, and rectal cancer (National Cancer Institute, 2020; Rock et al., 2020). The data shown here underlines the need for survivors to meet physical activity recommendations of 150-300 minutes of moderate-intensity or 75-150 minutes of vigorous-intensity physical activity, but studies show only 17-47% adhere to these guidelines (Troeschel et al., 2018).

The physiological effects of exercise on the body have been examined to explain why this relationship exists. A systematic review of 353 publications sought to analyze the effect of exercise on biomarkers implicated in colon and breast cancer genesis (Winzer et al., 2011). Specifically, blood concentration of insulin, leptin, estrogens, and apoptosis regulation were better managed by individuals engaging in aerobic exercise (Winzer et al., 2011). Consistent exercise has also been shown to produce an anti-inflammatory action (Ertek & Cicero, 2012). Chronic inflammation plays a role in cancer development and anti-inflammatory agents are often used in treatment to decrease incidence of recurrence (Rayburn, 2009; Karin, 2006). Habitual physical activity not only results in anti-inflammatory action directly, but indirectly prevents inflammation associated with unnecessary weight gain (Ellulu et al., 2017). The most effective method of averting obesity is to use physical activity in conjunction with a healthy diet to maintain a proper energy balance (Hill et al., 2012).

### Characteristics and Impact of Healthy Dietary Patterns on Cancer

Nutrition plays a critical role in achieving energy balance (Westerterp, 2004). A positive energy balance occurs when more calories are consumed then burned (Hall et al., 2012). Studies examining weight gain show strong association between diets high in potato chips, potatoes, sugar-sweetened beverages, processed and unprocessed red meats and increased weight (Mozaffarian et al., 2011). Inversely, diets with higher amounts of fruits, vegetables, whole

grains, nuts, and yogurt have been shown to have decreased weight gain (Mozaffarian et al., 2011). Aside from achieving energy balance, nutrition also has direct impacts on tumorigenesis (Patel et al., 2018; Meadows et al., 2015). Therefore, diet quality is an important part of prevention of cancer and cancer-related mortality. Both the non-cancer population and long-term survivors are recommended to follow healthy dietary patterns (Rock et al., 2020). Specific data exists to support that plant-rich diets lower risks of mouth, pharynx, larynx, esophagus, stomach, and lung cancer (Fruit and Vegetable Consumption, 2021). Limited evidence also suggests a reduction of risk of onset of colon, pancreas, and prostate cancer (National Cancer Institute, 2021b).

       A review of the research pertaining to nutrition's role in cancer pathogenesis by Patel et al. (2018) provides insight on preferential dietary practices. The studies examined showed a reduction in the risk of oral cancer by about 50% for each serving of fruit and vegetables added per day due to their micronutrient profiles (Zheng et al., 1993; La Vecchia et al., 1991). Following a fruit and vegetable-rich diet lowers the likelihood of experiencing cancer mortality for head and neck, as well as ovarian cancer survivors (Hurtado-Barroso et al., 2020). Fruits and vegetables also elevate plasma vitamin C levels (Lykkesfeldt et al., 2014). This increased circulation of vitamin C was associated with reduced risk for cancers in the stomach (Lam et al., 2013). In addition to increasing intake of plant foods, limitation of consumption of red and processed meat has been encouraged due to their carcinogenic classification (Rock et al., 2022, Bouvard, 2015) A meta-analysis found intake of processed meat had a significant association with the risk of oral cavity and oropharyngeal cancers (Xu et al., 2014). Diets with high intake of processed meat have also been linked to colorectal cancer recurrence and mortality in observational studies (Hurtado-Barroso et al., 2020; Jochems et al., 2017; Schwedhelm et al.,

2016). It has been stated that, based on review of 11 meta-analyses, red and processed meat increases the risk of colorectal cancer by up to 20-30% (Aykan, 2015). Alternative protein sources are encouraged due to red meat's association with increased rates of cancer-related mortality (Sun, 2012).

Cancer survivor and cancer prevention recommendations are to consume adequate amounts of fruits, vegetables, whole grains, beans, and legumes (Rock et al., 2020). It is equally important to limit red, processed meats, sugar sweetened beverages, highly processed foods, and refined grains. Following an overall healthy diet, as previously defined, is more important than focusing on a singular food or nutrient. Investigations of dietary patterns with preferential outcomes consistently follow these guidelines (Rock et al., 2020). These general guidelines also help mitigate risk of acquiring other chronic health diseases like diabetes or cardiovascular disease (Krauss et al., 2000). Unfortunately, the current western diet contains high amounts of foods recommended to be limited, and inadequate amounts of plant-based foods (Statovci et al., 2017). Recommendations provided by the CDC and ACS are for all adults is to aim for a minimum of 1 ½ to 2 cups per day of fruits, 2 to 3 cups per day of vegetables, and to limit red or processed meat to engage in a healthy eating pattern (Rock, et al., 2022; Phillips, 2021).

**Alcohol and Cancer Survivorship**

These same CDC guidelines recommend limiting consumption of alcohol (Phillips, 2021). Alcoholic beverages were classified as carcinogenic to humans by the IARC Monographs Programme in 1988, 2007, and 2010 (World Health Organization & International Agency for Research on Cancer, 2022; Baan et al., 2007). Research on the topic found an association with drinking alcoholic beverages and oral, pharyngeal, laryngeal, esophageal, liver, colorectal, and female breast tumor growth (Baan et al., 2007). A recent study published in Cancer

Epidemiology concluded that alcohol consumption is responsible for a "considerable proportion" of both cancer incidence and mortality (Goding Sauer et al., 2021). The study reviewed data from the US Cancer Statistics database between 2013-2016. Based on this reporting, alcohol accounted for 75,199 cases of cancer and 18,947 cancer deaths annually (Goding Sauer et al., 2021). In 2020, the global impact was estimated to be around 741,300 of new cancer cases (Rumgay et al., 2021). Specifically, heavy drinking (<6 drinks per day) represented 46.7% of these cases, risky drinking (2-6 drinks/day) represented 39.4%, and moderate drinking (<2 drinks/day) represented 13.9% (Rumgay et al., 2021).

These figures indicate the importance of reducing alcohol consumption for the cancer population. The WCRF (World Cancer Research Fund)/AICR (American Institute for Cancer Research) guidelines suggest adults should have no more than moderate intake of alcohol, if any (Miles, 2018). This equates to one alcoholic drink per day for women and two drinks per day for men (Rock et al., 2020). The ACS subscribes to these same guidelines but emphasizes that alcohol avoidance is preferred to minimize risk of cancer onset (American Cancer Society, 2020). The mechanism of carcinogenesis by alcohol is explained in a review by Seitz and Stickel (2007). Alcohol's carcinogenic effect occurs because ethanol (the chemical compound of alcoholic beverages) contains the metabolite acetaldehyde (Cederbaum, 2012). Acetaldehyde's impairs DNA's ability to synthesize and repair itself (Cederbaum, 2012; Singh, 1995). Additionally, it can form stable DNA adducts. These adducts have been indicated as an important process of cancer initiation because the can lead to mutation of DNA (Melendez-Colon et al., 1997). Prevention and treatment of excessive alcohol intake is imperative in the action to reduce cancer onset and mortality (Rock et al., 2022). Chronic alcohol abusers also experience nutrition-related side effects. Alcohol contains low amounts of micronutrients, but

high amounts of calories (Barve et al., 2017). This combination makes obesity and nutrient deficiency common for excessive alcohol users which leads to further health complications for cancer survivors (Barve et al., 2017, Traversy & Chaput, 2015). Chronic or even acute excessive alcohol consumption can create concerns malnutrition due to these micronutrient deficiencies (Barve et al., 2017; Lieber, 2000). It can also decrease activity of mTORC1, a major regulator of protein balance in both skeletal and cardiac muscle, leading to protein calorie malnutrition and reducing lean body mass (Kimball & Lang, 2018). Promoting physical activity and nutrition education in combination with substance abuse education predicted favorable treatment outcomes in alcohol abuse treatment settings (Manthou et al., 2016; Grant et al., 2004). Physical activity and nutrition counseling or programs additionally aids in obesity management (Johns et al., 2014). An integrative approach with clinical interventions is necessary to offset the negatives brought upon by excessive alcohol use, particularly in the cancer survivor population (Demark-Wahnefried et al., 2015).

## Research on Improving Physical Activity and Nutrition Intake

Implementing long-term changes in diet and exercise behaviors require ongoing support (Demark-Wahnefried et al., 2015). Research focusing on physical performance and goal setting have seen positive results. Individuals who were given specific pedometer-related goals saw an increase in physical activity (Wilson et al., 2017). In another experiment, participants saw a significant increase in their weekly number of steps when they were given a specific step goal (Zarate et al., 2019). These examples show that walking goals are a simple, but effective way to increase physical activity so that the activity guidelines can be met. High weight-loss has also been shown to be achieved with high weight-loss goals when accompanied by a detailed plan (Dombrowski et al., 2016). The frequency of goals set has also been found as a prevalent factor

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in weight loss (Avery et al., 2016). Adults with longer duration goals are also more likely to engage with longer activity sessions (Jennings et al., 2018). In contrast, obese people are less likely to engage in frequent goal setting (Avery et al., 2016).

Goal setting in nutrition needs to be given the appropriate amount of attention as well. Reaching adequate consumption of vegetables can be increased with goal setting (O'Donnell, 2014). The importance of vegetable intake is commonly taught throughout child and adulthood, yet the results of merely talking about it have been underwhelming. If dietary changes are to be made for weight loss, specific weight loss goals need to be set (Whitehead et al., 2020). Dietary goal setting shows the most promise in promoting dietary change (Whitehead et al., 2020). An example of this would be making a commitment to try a new vegetable by the end of the week and building from that. Making the goals attainable is a major component of SMART goal setting. Attainable goal setting is a vital part of finding success with achieving said goal and promoting dietary change from that (Cullen et al., 2004). Health coaching provides an effective way to teach people how to set SMART goals in a way that will yield the best results. Adherence to diet recommendations is more likely if the participant is given appropriate feedback on their goal setting strategies (Turner et al., 2018).

## Social Cognitive Theoretical Approach in Behavioral Change

Understanding these guidelines is just a portion of what is required to successfully manage behavioral change. Increased self-efficacy in both eating habits and physical activity have been found to be predictive of weight loss (Nezami et al., 2016). Self-efficacy is dependent upon an individual's belief in themselves make the changes required to achieve their personal goals (Bandura, 2004). Increasing self-efficacy has become a priority in weight management. Social Cognitive Theory (SCT) is an effective means of doing this (Annesi, 2012). SCT has been

used as a way approach and understand factors required to change a person's behavior (Bandura, 1999). Self-efficacy is a vital component of SCT along with reciprocal determinism, observational learning, reinforcements, and expectations (Bandura, 1999).

Health coaching can be a successful approach to treating obesity (Sherman et al, 2017). Weight loss interventions must be provided in an effective manner to yield desired results. Goal setting is an initial and recurring step involved in health coaching. SMART goal setting has been considered an effective method for implementing behavioral change (Epton et al., 2017). Participants of programs are more responsive when they are fully aware of what their goal is (Freigoun et al., 2017). Goals need to be clear and concise to be fully transparent. Goal setting also need to be specific and meaningful to the person who is trying to achieve the goal (Dekker et al., 2019). The individual needs to be invested in the goal to find success with it. Going back to the point of self-efficacy, teaching an individual how to appropriately set a goal can provide them with an opportunity to achieve higher-quality goals. It is important to note that this process of creating specific goals needs to be thoroughly explained or the success of goal setting will be hindered (Yearta et al., 1995). Specific goals and regular feedback (components of SCT) are important in achieving success in health change behavior (Pearson, 2012).

Alcohol abuse and dependency has also been examined through the lens of SCT. It is proposed that the engagement of alcoholic drinking is related to the perceived outcomes associated with it (Young et al., 2005). The perceived outcomes being enhancements in relaxation or comfortability in social settings (Young et al., 2005). Finding alternatives to managing stress or anxiety would then be goals for those who depend on alcohol to get them through social interactions. Research shows that cognitive-behavioral counseling techniques, like those found in SCT, are effective in treatment for adults with substance use disorders (Moos,

2007). These approaches are motivational interviewing, specific goal directives, feedback, and a social support structure (Moos, 2007).

**Role of the Dietitian**

Dietitians are trained under the framework of the Nutrition Care Process (NCP) (Carpenter et al., 2019). This process is defined by collection of data through assessment, diagnosis of specific issues, determination of appropriate interventions, and evaluation of intervention methods (Ichimasa, 2015). Behavioral change is implemented using the NCP and the Academy of Nutrition and Dietetics encourages dietitians to use a theoretical basis in their approach to care (Carpenter et al., 2019). A systematic review of dietitians using theoretical approaches, such as the SCT, indicated a notable improvement of primary outcomes for those being treated (Rigby et al., 2020). Physicians and specialists in physical activity may be better equipped to manage specific issues mentioned in this literature review, but dietitians play a crucial role in promoting long-term behavioral changes of cancer survivors (Rigby et al., 2020). This is due to a few reasons. Medical schooling has been reported by both practicing physicians and medical students to provide inadequate education on nutrition management (Mogre et al., 2018).

Other reported barriers like lack of time, financial benefits, and different priorities in care make nutrition counseling by physicians insufficient in promoting long-term change (Harkin et al., 2018; Kolasa & Rickett, 2010).

Registered dietitians are required to complete a minimum of a bachelor's degree from an accredited program, with plans of requiring a graduate degree beginning on January 1, 2024 (Academy of Nutrition and Dietetics, n.d.). They must also complete 1,000 hours of supervised practice (Academy of Nutrition and Dietetics, 2020). After this supervised practice, they must

also pass the Commission on Dietetic Registration's dietetic registration exam, gain licensure, and maintain continuing education if the field of dietetics (Umphfleet, S. S. n.d.). The issue arises that in the outpatient world of oncology, where the vast majority of cancer care is delivered, the dietetic profession is often underrepresented (Trujillo et al., 2019). This underrepresentation has led to cancer survivors seeking advice on their nutrition through internet searches, media, and social media (Keaver et al., 2021). The concern arises about the amount of potentially harmful misinformation that survivors are exposed to when they use non-medical source for nutrition advice (Wang et al., 2019; Baccarella et al., 2018; Ramachandran et al., 2018). This highlights the need for additional representation and coverage for dietetic services to provide survivors with safe and effective counseling to sustain healthy behavioral changes.

### Impact of Dietetic Intervention on Nutrition Factors and Physical Activity

Effective counseling methods for implementing change in nutrition and physical activity has been established in this review. The rationale behind use of a dietitian to administer this counseling was also presented. So, what kind of impact can a dietitian have on nutrition and physical activity-related outcomes for those dealing with chronic disease? A recent meta-analysis from Hicks-Roof et al. (2021) evaluated changes in weight, BMI, physical activity, and nutritional factors like fruit, vegetable, and whole-grain consumption. This study found that dietitians were able to increase the physical activity and vegetable intake of subjects. Weight and BMI were not significantly altered, with the caveat that the focus of the dietetic interventions may not have been weight loss. This research also included valuable insight on the ability of a dietitian to improve the access of vulnerable populations to fresh fruits, vegetables, whole-grains, and other food (Hicks-Roof et al., 2021). Food insecurity, defined as lack of consistent access to foods leading to disrupted eating patterns, has been associated with obesity and lack of health

dietary patterns (U.S. Department of Agriculture, 2021; Morales & Berkowitz, 2016). The

Academy of Nutrition and Dietetics published a position paper laying out the key roles that

dietitians play in addressing food insecurity (Holben & Marshall, 2017). These include dietitians

educating individuals on healthy food options to prioritize, helping them to find access to local or

federal assistance programs, and advocating for public policy reform (Holben & Marshall, 2017).

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APPENDIX A: CONSENT FORM & SURVEY

You are being asked to participate in a research study conducted by Dr. Amy Bardwell, Professor, Department of Family and Consumer Sciences, Dr. Luke Russell, Professor, Department of Family and Consumer Sciences, Dr. Julie Schumacher, Professor, Department of Food and Consumer Sciences department and Zachary Heindl, Graduate Student, Department of Family and Consumer Sciences. The purpose of this study is to evaluate **BMI, diet quality, alcohol intake, and physical activity among adult cancer survivors and its relationship to a survivor's primary source of nutrition advice.**

**Why are you being asked?**
You have been asked to participate because you meet the criteria for the study which includes having been diagnosed with cancer at one point in your life. Your participation in this study is voluntary. You will not be penalized if you choose to skip parts of the study, not participate, or withdraw from the study at any time.

**What would you do?**
If you choose to participate in this study, you will be asked to complete a survey. In total, your involvement in this study will last approximately 15 minutes.

**Are any risks expected?**
We do not anticipate any risks beyond those that would occur in everyday life.

**Will your information be protected?**
Your responses will be anonymous; nothing that will identify you will be linked to your responses. The findings from this study may be presented in a manuscript and/or presented at a state or national conference.

**Will you receive anything for participating?**
By completing this survey, you will be entered into a raffle to win a $25 Amazon gift card.

The IRS may consider these payments to be taxable compensation. Recipients of a research participant incentive payment may want to consult with their personal tax advisor for advice regarding the participant's situation. Any participant also has the opportunity to participate in the study without accepting the research incentive payment.

In order to receive the compensation, at the end of the survey you will be taken to a separate page to enter your contact information. This information will be kept entirely separate from the survey and your responses and will be securely stored by the researcher for audit purposes only.

**<u>Who will benefit from this study?</u>**

This study will be beneficial improving health outcomes for cancer survivors. Whom do you contact if you have any questions? If you have any questions about the research or wish to withdraw from the study, contact Zachary Heindl at Zheindl@Ilstu.edu or Dr. Amy Bardwell at Ambardw@ilstu.edu.

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If you have any questions about your rights as a participant, or if you feel you have been placed at risk, contact the Illinois State University Research Ethics & Compliance Office at (309) 438-5527 or IRB@ilstu.edu.

**<u>Documentation of Consent</u>**

By continuing with this survey, you are consenting to participating with this research.

You can print this form for your records.

APPENDIX B: IRB APPROVAL FORM



Jul 12, 2021 2:03:54 PM CDT
Amy Bardwell
Family & Consumer Sciences

Re: Exempt - Initial - IRB-2021-226 Evaluation of BMI, diet quality, alcohol intake, and physical activity among adult cancer survivors and its relationship to a survivor's primary source of nutrition advice

Dear Dr. Amy Bardwell:

Illinois State University Institutional Review Board has rendered the decision that your study meets the criteria for an exempt determination and you can begin the study covered under this protocol.

Your study qualified for: Category 2.(i). Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording).
The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects.

The Exempt Status does not relieve the investigator of any responsibilities relating to the research participants or university policy. Research should be conducted in accordance with the ethical principles, (1) Respect for Persons, (ii) Beneficence, and (iii) Justice, as outlined in the Belmont Report. Any change to the protocol or study materials that might affect the Exempt Status must be submitted in Cayuse Human Ethics. Depending on the changes, you may be required to apply for either Expedited or Full Review.

Please contact the Human Subjects Research Specialist to determine if your modifications meet these criteria at 309-438-5527 or tjdeeri@ilstu.edu.

**Additional Notes:**
Please ensure that any COVID related guidelines provided by the university are followed. For

the most up-to-date information and guidance regarding research and how it has been impacted by COVID-19, please review the following links:

- Redbirds Keep Researching: https://research.illinoisstate.edu/coronavirus/.
- IRB Guidance: https://research.illinoisstate.edu/ethics/human/coronavirus/.


For the duration of Illinois' Stay at Home Order, Human Subjects Research may continue remotely and/or use technology to avoid face-to-face interactions. Only face to face research deemed essential can take place on campus, with the permission of your unit Chair/Director, and while observing all State guidelines for social distancing and PPE that is a requirement due to the hazards of your research. Please either reach out or review the following link for additional information: (Coronavirus (COVID-19): IRB Guidance)

Sincerely,

Illinois State University Institutional Review Board