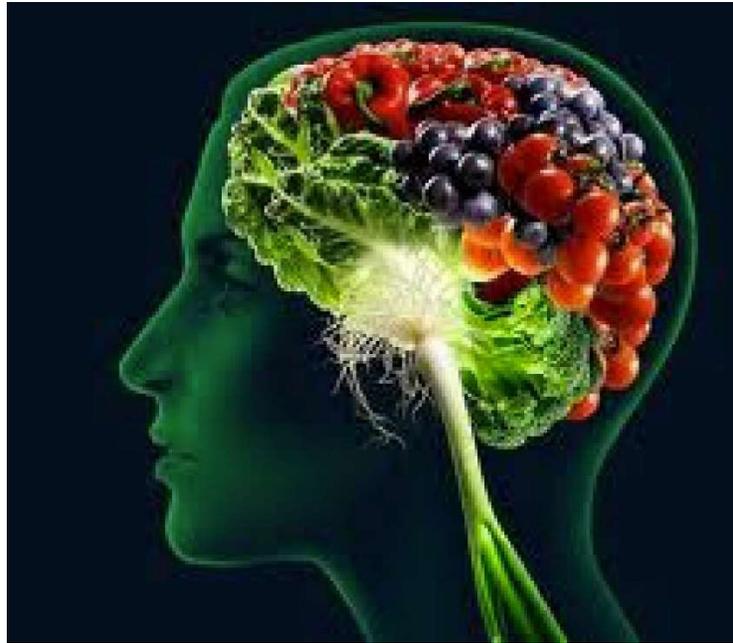


Factors that Affect Implementing the MIND diet in an Acute Care Setting to Prevent Alzheimer's Disease



Major Project/Report submitted to the faculty of the Virginia Polytechnical Institute and State University in partial fulfillment of the requirements for the degree of

**Online Master of Agriculture and Life Sciences in
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Abstract

Alzheimer's disease is a debilitating and life-altering diagnosis that continues to rise each year, as our population continues to live longer. While there is currently no proven cure for the disease, there are proactive measures that can be taken to delay or prevent onset of the disease. The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet is a compilation of foods that work synergistically to promote the prevention of Alzheimer's Disease (AD). The specific amount and types of foods in this diet promote the reduction of inflammation and oxidative stress in the body, thus preventing or delaying onset of AD. While there is evidence to support the use of the MIND diet as a long-term approach to prevent AD, this diet is currently not being administered in healthcare settings in the United States. This study explores the factors affecting implementing the MIND diet in an acute care setting.

Working within the transtheoretical model of behavior change, a foodservice organization is examined in regard to their readiness to change and willingness to adopt this diet into their facilities. Their willingness to adopt the MIND diet was determined by a series of interviews held via email, phone call, and in person. The organization deemed the MIND diet inappropriate for the acute care setting because of the short length of stay of patients, budgetary restraints, and patient preferences. While the MIND diet was deemed inappropriate for effective use in this environment, there are multiple other settings that should be explored in future research. The MIND diet is most beneficial when adhered to for a long duration, therefore, introducing the diet in a setting where the population is exposed for longer be most beneficial. Example of these settings include daycares, schools, long-term care facilities, senior living centers, or assisted living facilities.

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Introduction

Background and Significance

In 1906, Doctor Alzheimer started to notice a pattern in the autopsies of his female patients who were dying of an unusual mental illness. The symptoms these women were experiencing included memory loss, language problems, and unpredictable behavior (What is Alzheimer's Disease, 2017). The brains of these patients contained what is now defined as amyloid plaques, neurofibrillary or tau, and a decrease in neurotransmitters (Alzheimer's Disease, 2018). While these are now all considered some of the hallmark features of Alzheimer's Disease (AD), beta amyloid is one of the prime suspects. While beta amyloid protein usually is essential in growth and repair of cell membranes, when corrupted, fragments accumulate in the brain and disrupt communication between brain cells (Beta-amyloid, 2017). These accumulations are known as beta amyloid plaques. Neurofibrillary or tau proteins make up the "tangles" observed in the brains of AD patients. Tau is required for normal neurological function but clumps together irregularly into tangles in a person with AD, which again disrupts normal brain cell communication (What is Alzheimer's Disease, 2017). Neurotransmitters are chemical messengers in the brain that are noted to be generally low in people with AD (What is Alzheimer's Disease, 2017). The combination of these disturbances in the brain leads to the typical symptoms observed in a person with AD.

Alzheimer's disease continues to affect the world today and its effect is only predicted to grow. Currently, "one in four people over the age of 85" are affected by Alzheimer's disease (Cremonini, 2019). This number is believed to grow to nearly 13.8 million cases by the year 2050 (Nelms, p. 619–622, 2016). While pharmaceutical treatments exist, they fall short in

prevention and treatment of this debilitating disease as the number of cases continue to grow. While there is no cure for the disease at this time, there is a growing need to “develop nonpharmacological strategies to stop this ever-increasing global burden” (Cremonini, 2019). Diet may be a potential strategy for preventing or delaying the development of Alzheimer’s Disease (Cremonini, 2019).

Due to the lack of effective pharmaceutical treatments for AD, dietary patterns show the strongest evidence for preventing and slowing the development of the disease (Dominguez, 2019). A dietary pattern refers to the quantity, variety, and combination of food or beverage in a diet and the frequency with which they are habitually consumed (Sanchez-Villegas, 2018). A single nutrient or food component is likely not the “right way to prevent the development of AD” (Cremonini, 2019). However, focusing on dietary patterns instead has proven beneficial due to the “synergistic effects of various nutrients” (Cremonini, 2019).

There are believed to be seven pillars of brain health that aid in the preservation of cognitive function (Preventing Alzheimer’s Disease, 2020). Social activity, regular exercise, mental stimulation, quality sleep, and stress management are all critically important to AD prevention. However, the MIND diet focuses on supporting the final two pillars of brain health: a healthy diet and vascular health. The Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) diet is a combination of the dietary approach to hypertension (DASH) diet and the Mediterranean diet. The DASH diet focuses on decreasing intake of total fat, saturated fat, and sodium (Morris, p. 1007-1014, 2015). The Mediterranean diet consists of foods traditionally consumed in that region of the world. The focus is on fish, whole grains, nuts, fruits, vegetables, and olive oil, accompanied by a reduction in sweets, red meat, and

dairy products (D’Innocenzo, 2019). While both diets aim to support vascular health, they do not individually contain all of the foods recommended for neuroprotective benefits (Appendix A).

The MIND diet is rich in omega-3 fatty acids, nuts, fiber, monounsaturated fatty acids, fiber, and folate. The antioxidative, anti-inflammatory, and vascular health benefits of the MIND diet make it a feasible nonpharmacological strategy to combat the rising rate of AD worldwide (Sanchez-Villegas, 2018).

Statement of the Problem

Currently there are a variety of therapeutic diets offered in a hospital or acute care setting. These vary by location, type of healthcare facility, and foodservice company, but some examples include a consistent carbohydrate diet for those with diabetes, a heart healthy diet for those with cardiovascular concerns, a renal diet for those on dialysis, etc. The AD crisis continues to worsen, but health care systems have not made any changes in their menus to support the prevention of this disease.

Purpose of the Project

The overarching purpose of this project is to promote the MIND diet and raise awareness about its beneficial effects on preventing AD. An observational study showed a “53% reduction in the rate of developing AD” in persons in the highest tertile of MIND scores compared to those in the lowest tertile (Morris, 2015, p. 1007-1014). However, the MIND diet is currently not being offered in the acute care setting. The focus of this study is to evaluate the factors that affect implementing the MIND diet as the new standard menu option in an acute

care setting. Those factors include budget, short length of stay for patients, food accessibility from distributor, patient preferences, re-training of dietary aides, and menu approval from administration. This study will assess all of these factors and how they impact willingness to implement the MIND diet in the acute care setting.

Review of Literature

The incidence of Alzheimer's disease continues to rise. Unfortunately, health care systems have not made changes in their menus to support the prevention of this disease. The two pillars three seven pillars of brain health that can be beneficially affected by the MIND diet are vascular health and a healthy diet (Preventing Alzheimer's Disease, 2020). The MIND diet is an emerging area of study in the nutrition field and therefore there are only two major longitudinal studies linking the MIND diet and prevention of AD. These studies utilize food frequency questionnaires (FFQ) to assess dietary intake of individuals and the majority of participants lived in retirement communities and senior housing.

It is widely accepted that fruits and vegetables are an important part of any healthy diet. Fruits and vegetables are high in antioxidants, such as vitamin C and beta-carotene, which are related to lower levels of inflammatory markers and oxidative stress (Graham, 2000). Foods rich in flavonoids and antioxidants "have been associated with lower risk of stroke, coronary heart disease, and markers of inflammation and oxidative stress in adults" (Holt, 2009). Alzheimer's disease is the result of a lifetime of inflammation and oxidative stress in the body and subsequent death of the affected brain cells. Consumption of at least five fruits and vegetables leads to a reduction in inflammatory markers and oxidative stress in people as young as 13

years old (Holt, 2009). The foods highest in folate, antioxidants, and total flavonoids were inversely associated with markers of inflammation and oxidative stress in this population (Holt, 2009). This demonstrates the importance of consuming a healthy diet at an early age, to limit the oxidative and inflammatory damage that can occur over a lifetime. The MIND diet is rich in fruits and vegetables, as the goal of the diet is to reduce inflammation and oxidative stress in the body (Appendix A).

While all fruits and vegetables are beneficial to the promotion of vascular and overall health, scientists were interested in identifying specific neuroprotective foods. Alzheimer's disease impairs, damages, and degenerates the nerve cells in the brain and neuroprotective foods are believed to protect nerve cells from this damage (Vajda, 2002). Some studies have found neuroprotective benefits in participants who have higher consumption of flavonoids, specifically, those flavonoids found in berry crops (Devore, 2012). It was observed that the greater the intake of total flavonoids, particularly those found in strawberries and blueberries, the slower the rate of cognitive decline (Devore, 2012). For this reason, the MIND diet promotes intake of berries at least twice per week (Appendix A).

Another study explored the correlation between the consumption of green leafy vegetables and cognitive decline. Green leafy vegetables are high in folate. Folate is required for the conversion of homocysteine to methionine (Nelms, 2016 p. 315-323). This is important because high levels of homocysteine are correlated with increased risk of a cardiac event (Nelms, 2016, p. 315-323). Dietary intake of folate lowers serum levels of homocysteine and therefore promotes vascular health. Participants in this study who had a higher intake of green leafy vegetables and berries, and therefore a higher MIND diet score, substantially slower

cognitive decline with age (Morris, 2015, p.1015-1022). This suggests a benefit of green leafy vegetables and berries on preventing cognitive decline. For this reason, the MIND diet promotes the consumption of one salad per day with an additional serving of green leafy vegetables at another mealtime (Appendix A).

As previously mentioned, the MIND diet is a hybrid of the Mediterranean and the DASH diets. These diets all promote the consumption of monounsaturated fats, whole grains, omega-3 fatty acids, nuts, and fiber, with decreased consumption of red meat, sweets, and saturated fats. Substituting monounsaturated fats for saturated fats “appears to lower low density lipoprotein” (Nelms, 2016, p. 315-323). Low density lipoprotein (LDL) deposits cholesterol into the lining of the arteries and is known as the “bad” cholesterol because of its negative effect on vascular health (Nelms, 2016, p. 315-323). Examples of monounsaturated fats include nuts, avocado, and olive oil. The MIND diet promotes olive oil as the primary fat source and promotes the consumption of nuts at least five days per week (Appendix A). Acetylcholine is a neurotransmitter in the brain that is particularly low in patients with AD (Alzheimer’s Disease, 2018). Choline is an essential nutrient, meaning your body does not make it and it must be obtained through dietary intake. Choline is the building block of acetylcholine and its synthesis is dependent on adequate amounts of choline (Preventing Alzheimer’s Disease, 2020). Choline is found in eggs, meat, fish, and whole grains. Foods rich in choline are abundant in the MIND diet (Appendix A) to prevent the quantity of acetylcholine from decreasing, as is commonly identified in patients with AD (Nelms, 2016, p. 619-622). Additionally, an observation study conducted in 2015 found that high adherence to all three diets (MIND, Mediterranean, DASH) may reduce AD risk. This study suggests persons in the highest tertile of MIND diet scores

showed a 53% reduction in the rate of developing AD compared to those in the lowest tertile (Morris, 2015, p. 1007-1014). Additionally, persons in the middle tertile of MIND diet scores (those showing moderate adherence) had a statistically significant 35% reduction in AD rate, when compared with those in the first tertile (Morris, 2015, p. 1007-1014). This suggests the potentially powerful benefits of following the MIND diet.

According to current literature, a dietary pattern that includes fish, fruits (specifically berries), vegetables (specifically green leafy vegetables), nuts, and monounsaturated fats promotes vascular health and the prevention of cognitive decline. Diet patterns with higher MIND scores were associated with a delay in cognitive decline and reduction in the rate of Alzheimer's Disease development. These benefits were also seen with participants whose dietary patterns only moderately adhered to the MIND diet, which is critical for realistic application in humans.

Project Methodology and Design

Design

The AD crisis continues to worsen, but health care systems have not made changes in their menus to support the prevention of this disease. Hospital systems have to consider a multitude of factors prior to implementing a new diet. Some of these factors include budget, short length of stay for patients, food accessibility from distributor, patient preferences, re-training of dietary aides, and menu approval from administration. Typically, behavior change occurs as humans move through a series of stages, like those in the transtheoretical model (Prochaska, 1994). The transtheoretical model (TTM) is a framework used to understand how

individuals and populations adopt and sustain health behavior changes (McKenzie, 2017). The TTM theory was used to determine the feasibility of implementing the MIND diet in the acute care setting.

The TTM suggests people move through a series of five stages of change. These stages have been well defined as precontemplation, contemplation, preparation, action, and maintenance (Figure 1). Precontemplation is a stage in which change is not in the foreseeable future and no action is planned. Contemplation is when there is intention to change, awareness of the pros and cons of changing have increased, but no action has been taken yet. The preparation stage is when a plan has been made and action is planned to begin in the next month. The action stage is when the change has been implemented and this is usually the measure of change to the lay person as it is the stage at which change can be physically seen and easily measured. The maintenance phase is when the change has been implemented and sustained and relapse to the prior behavior is prevented (Prochaska, 1994).

This theory is applicable to individual behavior modification as well as organizational change (Prochaska, 2001). The proposed MIND menu would need to be accepted by key HHS leaders because individual behavior is core to organizational change (Prochaska, 2001). Later, the TTM could be utilized by HHS leaders during implementation to decrease resistance of dietary staff and increase progress toward the proposed change.

The TTM theory was used to assess what stage of change key HHS administrative members were in, in regard to implementing the MIND diet as the new standard menu in the acute care setting.

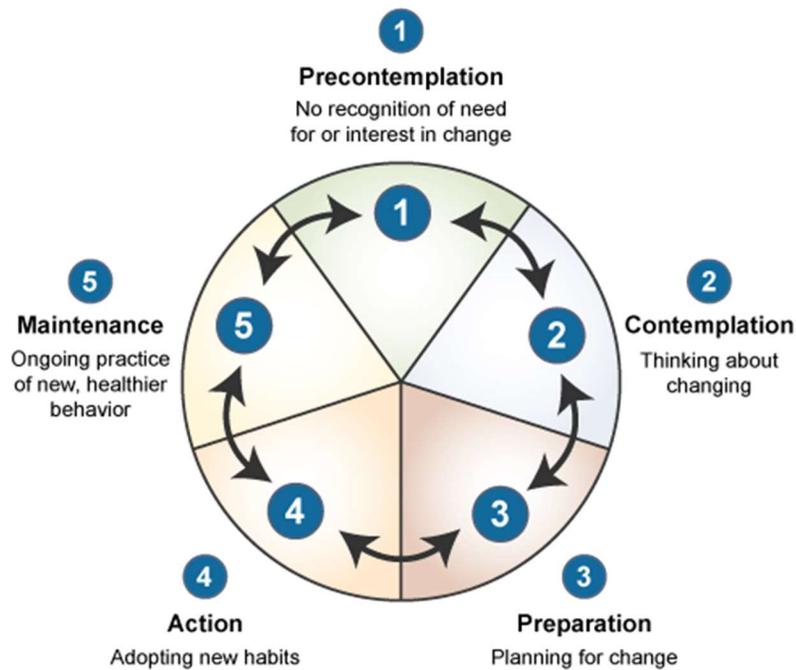


Figure 1. (Prochaska, 1982).

Methodology

The purpose of this study was to assess the feasibility of implementing the MIND diet in the acute care setting. In order to assess the feasibility of implementation, anticipated barriers were identified, a proposed MIND diet was developed to be used in the healthcare system as the standard menu, interviews were conducted with lead dietary staff and administration, the diet was modified based on those interviews, and the key factors that affect implementation were identified. Based on these factors, the TTM was used to establish the stage of change key HHS administrative members were in, and how that impacted implementation of the MIND diet as the new standard menu.

Target population

Sovah Health Danville is the proposed implementation site for the MIND diet. This is a 250-bed acute care facility located in Danville, Virginia. This facility cares primarily for adult and geriatric patients. Hospital Housekeeping Services (HHS) is a consulting company that supports all foodservice functions at Sovah Health Danville. HHS has acute care, long term care, and senior living facilities across the United States. Sovah Health Danville is located in a rural area, serving a low-income population. Currently this facility utilizes a “regular” diet (Appendix B), as well as various therapeutic diets aimed at treating chronic diseases, such as diabetes, chronic kidney disease, and cardiovascular disease.

Anticipated Barriers

The key attributes of the MIND diet were identified using PubMed and Google Scholar. The current evidence regarding the MIND diet and AD was reviewed. The research suggested that the MIND diet is beneficial in delaying the onset of cognitive decline and reducing the risk of AD development. However, there is no evidence to support the dietary patterns’ use as a treatment for the disease. The key components of the MIND diet are folate, fiber, choline, monounsaturated fat, omega-3 fatty acids, and antioxidants. While these are key components of the diet, it is the compilation of all these nutrients that work together synergistically to promote the prevention of AD.

With consideration for the location and patient population, some anticipated key factors affecting implementation of the MIND diet were identified. Patient’s in this area are resolute and steadfast in their dietary preferences. This diet focuses on foods that are not customary in the southern United States and therefore may be difficult for patients to adopt. Additionally,

any business needs to consider budgetary restraints when making changes to their operation. Due to the rural location of Sovah Health, there may be limitations on the variety of foods the distributor can provide to the facility. This would make creating the proposed menu difficult. If menu items are able to be obtained, there may also be issues with storing these new foods in the facility. The menus served at Sovah Health are created by HHS and therefore a new menu would need HHS approval. Furthermore, the dietary aides who take the patient's orders and deliver their meal trays, would require training. The dietary aides would need to know the possible substitutions that could be made, upon patient request. They would also require education about the new menu to be able to prepare the meal trays for patients on the MIND diet. Lastly, patients in an acute care facility typically have a short length of stay. At Sovah, the average length of stay is five to seven days. This would pose a problem as the benefits of the MIND diet would likely not be seen in that short of a time. However, none of the therapeutic diets currently provided in the acute care setting are effective if only followed for five to seven days. The goal of offering the MIND diet in the acute care setting would be to expose the patient to the diet and provide an initial orientation to both the components of the diet and the suggested benefits.

Diet Development

Based on the analysis of current research, a proposed MIND diet menu was created that could reasonably be implemented at Sovah Health Danville (Appendix C). It is important to note the diet is not proven effective as a therapeutic diet, only as a preventative measure. Therefore, if the diet were to be incorporated into the acute care setting, it would need to be used in place of the current "Regular diet" (Appendix B). The specific guidelines for food types

and quantities required for the MIND diet are outlined in Appendix A. These guidelines were followed to create the proposed MIND diet. Sovah Health currently utilizes a 7-day menu cycle. This means that the menu changes every day but repeats after 7 days. The proposed MIND menu follows this same pattern for ease of implementation (Appendix C). The proposed menu was revised several times after interviews with the hospital's chef, HHS vice president of culinary, various HHS dietitians from other facilities, and HHS corporate dietitian to produce the final proposed MIND diet (Appendix D). A nutrient analysis was done for the seven-day menu and the alternative menu options (Appendix F). This specifies the portion size, calories, grams of carbohydrates, grams of protein, and grams of fat for each food item.

Interviews

After the menu was developed, several interviews were held with key personnel within HHS and Sovah Health to determine the feasibility of implementing the proposed diet. Individuals were selected based on their hierarchical position in the company, expertise in menu planning, and experience in implementing a non-traditional diet in an acute care setting.

First an interview was conducted with the HHS foodservice director. This was done in person for 45 minutes. During this interview, the budget constraints were established and explained. The budget is \$6.00 per patient per day, that includes all three meals. This is a non-negotiable budget with little room for error, and the current regular diet follows this budget closely. The director also explained the steps involved in menu creation and approval. The consulting company, HHS, creates the menus and conducts the nutrient analysis. This is provided to the client, Sovah Health Danville, and the hospital's administration accepts the menu as they see fit. HHS prefers their menus are consistent across all of their acute care

facilities across the country. While each facility can make minor adjustments to best suit their population, the goal is to provide standardized menus. For that reason, it was established that if the MIND diet were to be adapted as the new regular menu, it would have to be done at all HHS acute care facilities. The nutrient analysis portion is necessary when the hospital is audited by the Joint Commission and allows the hospital to pass their survey, administered every 36 months. It is also utilized by dietitians to analyze a particular patient's intake and to ensure they are adequately nourished. Therefore, the menu and the nutrient analysis would need to be approved by HHS administration before it would be shown to hospital administration, if at all.

The chef at Sovah Health Danville was also interviewed. This interview was conducted in-person for 60 minutes. The chef was able to provide specific recommendations and revisions to the proposed MIND menu. His major recommendation was to make an alternative menu that has "always available" food options. This would be particularly important when considering the preferences of the target population. To address some of these concerns, the menu was revised and then an additional alternative menu with "always available" food choices for patients to select from, was also created (Appendix E). This alternative menu offered other healthy options that generally fell within the MIND diet restrictions, with the hope of increasing patient satisfaction. He made small revisions to the menu, such as offering fresh pico de gallo instead of a jarred option and offering the roasted turkey with an au jus if no gravy would be provided. He discussed issues with obtaining certain foods from distributors and budget concerns. Some of the fish options, such as salmon and tuna, are more expensive. However, he explained if all HHS facilities were utilizing this menu, distributors would carry these options

regularly due to the increase in demand. Additionally, the fish could be bought in larger sizes and be “broken down” at the facility, into appropriate portions.

An interview was conducted with the HHS’ vice president of culinary via email. He was able to provide specific feedback about the proposed menu, recommended changes and recommended discussing implementation with other HHS dietitians. He was concerned about patient satisfaction, especially in rural areas such as Danville, because of the focus on whole grains and lean proteins. He recommended adding a dessert to every meal, even if it was fruit, to improve patient satisfaction. He also expressed concern about the budget and suggested implementing the diet in an assisted living facility where the budget is larger.

An interview was conducted with the HHS corporate registered dietitian via email and a subsequent 35-minute phone call. This dietitian was interested in the MIND diet and even stated she wanted to start consuming this menu herself. She liked the variety of foods offered and felt the snack options were much healthier than what is currently provided at many HHS facilities. She expressed some concern about patients that have difficulty chewing or swallowing. These patients currently are evaluated by a speech language pathologist. Then the patient may be put on a modified texture diet, such as ground, chopped or pureed. For these patients, she recommended they not receive, for example, a pureed salad. Instead, she advised offering the protein that would have been on the salad that day in a pureed form, with another green leafy vegetable that would be pureed as well. She ended by saying this diet, while valuable, was likely not fit for an acute care setting due to the short length of stay and limited budget. However, she was interested in pursuing implementation in senior living facilities as they have increased funding and the population lives at the facility long-term.

An interview was conducted with a registered dietitian at an HHS acute care facility in Columbia, South Carolina. This was conducted via email. She expressed concern that education material on the MIND diet is currently not available in the Nutrition Care Manual (NCM). The NCM is a website created and managed by the Academy of Nutrition and Dietetics, which is the governing body for dietitians. The NCM provides current evidence-based nutrition research and a client education library (Academy of Nutrition and Dietetics). This is typically where HHS prefers all patient education material originate from because it is standardized across all facilities. While the MIND diet would not be used as a therapeutic diet, for it to be effective in the acute care setting education materials would need to be provided to patients for use after discharge from the facility.

An interview was conducted with a registered dietitian at an HHS acute care facility in Baton Rouge, Louisiana. This was conducted via email. This dietitian works at an acute care facility where the administration requested a “paleo” menu be offered as an alternative option. This diet is typically ordered by a physician and not by the request of the patient. She reported her experience with implementation of a “very clean and healthy menu” in an acute care setting is that patient satisfaction suffers. She reported this may be due to the patient’s lack of choice in the matter.

Key Factors & Feasibility Determined

While all administrators were enthusiastic about the prospect of being on the cutting edge of new and exciting nutrition research, they were hesitant to implement the MIND diet at this time. Administration felt that this diet was not best utilized in the acute care setting given

the short length of stay, budgetary restraints, and resolute preferences of patients at Sovah Health Danville.

The transtheoretical model of behavior change (TTM) consists of 5 stages that categorize a person or organization's readiness to adapt to a specified change. In this case, HHS administrators would be in the "contemplation" phase. Their awareness of the pros and cons of implementing the MIND diet in the acute care setting were increased, but no action has been taken or planned yet. HHS administrators determined that while the MIND diet is a worthwhile advancement in the prevention of AD, they do not believe it has a role in the acute care setting. Being in the contemplation phase means that the company does not intend to act on the proposed change in the foreseeable future. While HHS administration identified many pros to implementing the MIND diet, they do not believe those benefits would be seen in the acute care setting due to the short length of stay. They also believe the cons outweigh the pros currently. Of note, this research was done during the coronavirus pandemic. This was another factor that HHS pointed to in why they were currently not prepared to implement the MIND diet in the acute care setting. Administration was not able to travel on their normal schedules to visit facilities and thus they would not be available to assist with the roll-out of this new menu. There are also currently limited face-to-face meetings permitted in the hospital, to minimize exposure to potential carriers of the illness. This face-to-face contact would be critical when educating staff members (dietary aides, cooks, nurses) about the menu changes and alternative menu options. For these reasons, HHS is currently in the contemplation phase. There needs to be more research on the efficacy and feasibility of the MIND diet before HHS administrators would consider implementing it in the acute care setting. Standardized

education material would also need to be created to allow patients to continue following the dietary pattern after discharge.

Summary of outcomes, discussions, and recommendations

Outcomes/Results

An observational study showed a “53% reduction in the rate of developing AD” in persons in the highest tertile of MIND scores compared to those in the lowest tertile (Morris, 2015, p. 1007-1014). While the benefits are substantial, the MIND diet is not currently being utilized in healthcare as a preventative measure to reduce incidence of AD. While HHS administrative team members were interested in the MIND diet and found the benefits of preventing Alzheimer’s Disease profound and beneficial, it was ultimately deemed not appropriate for the acute care setting. The short length of stay of patients, budgetary restraints, and patient preferences in the acute care setting were the key factors that impacted the decision to not implement the MIND diet at this time.

Implications, Impacts, Recommendations

The MIND diet is beneficial for individuals to follow in order to prevent the onset of AD and cognitive decline that occurs with aging. Typically, acute care patients vary in almost every way: age, gender, race, religion, etc. This means that their preferences will vary just as much, which makes creating one diet that pleases all people difficult. In order to satisfy patients, dietary aides may be spending a larger portion of their time adjusting individual patient diets to meet their preferences, as the MIND diet is quite different from the current foods consumed by most patients in Danville, Virginia. In acute care, patients are assigned their diet by physicians

or dietitians. If a patient is provided the MIND diet, not of their choosing, while in acute care, this may result in decreased patient satisfaction. Furthermore, patients in an acute care setting may only receive this diet for five to seven days, as this is the average length of stay. This is not long enough to see any long-term benefit in AD prevention. For these reasons, the acute care setting was deemed not the most appropriate setting for implementation.

The diet may be better utilized in a setting where people reside for longer and/or consume a majority of their meals, such as daycares, schools, senior living, or long-term care facilities. HHS administration was interested in pursuing the possibility of serving the MIND diet as an option at their current senior living facilities. The company currently advertises that their senior living centers utilize a “farm-to-table” approach to their menu creation. The corporate dietitian expressed interest in incorporating the MIND diet and its benefits into this advertisement. Unlike in acute care, in senior living centers, residents have more freedom of choice and can make menu selections. The MIND diet would be promoted and advertised with emphasis on its neuroprotective benefits and residents would be able to choose if they wish to be served their meals from that menu. Providing the MIND diet at a facility like this would also allow longer exposure to the diet and thus, maximum the benefits of the nutrients. Additionally, these facilities have different, often more flexible, budgets than acute care facilities.

Future Research Recommendations

The organization deemed the MIND diet inappropriate for the acute care setting because of the short length of stay of patients, budgetary restraints, and patient preferences. While the MIND diet was deemed inappropriate for effective use in this environment, there are

multiple other settings that should be explored in future research. These settings include daycares, schools, long-term care facilities, senior living centers, or assisted living facilities. The MIND diet is most beneficial when adhered to for a long duration, therefore, introducing the diet in one of these settings may be most beneficial. HHS is interested in pursuing implementation in these settings when more research becomes available on the feasibility and efficacy of the MIND diet.

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Appendices

Appendix A- MIND Diet Guidelines

Foods to Eat	Foods to Limit
<ul style="list-style-type: none"> – Green leafy vegetables (6 servings/week) <ul style="list-style-type: none"> – Encourages 1 salad and one other vegetable/day – Nuts (5 servings/week) – Berries (2 servings/week) – Beans (3 servings/week) – Whole grains (3 servings/day) – Fish (1 servings/week) – Poultry (2 servings/week) – Olive oil as primary oil used – Wine (no more than 1 glass/day) 	<ul style="list-style-type: none"> – Red meat (4 servings per week max) – Butter/margarine (1tbsp daily max) – Cheese (1 serving per week max) – Sweets (5 servings per week max) – Fried/fast food (1 serving/week max) – Excess sugar and processed foods (overall should be limited)

Appendix B- HHS Current Regular Diet

Week 1		HHS Patient Menu					Week at a Glance						
01 Regular													
Sunday	1	Monday	2	Tuesday	3	Wednesday	4	Thursday	5	Friday	6	Saturday	7
BREAKFAST													
GRAPE JUICE FRESH BANANA CEREAL OF CHOICE YOGURT PARFAIT WITH GRANOLA COFFEE OR TEA SKIM MILK	APPLE JUICE FRESH CANTALOUPE YOGURT PARFAIT WITH GRANOLA EGG OF CHOICE COFFEE OR TEA SKIM MILK	ORANGE JUICE FRESH PEACH CEREAL OF CHOICE EGG OF CHOICE TOAST MARGARINE JELLY COFFEE OR TEA SKIM MILK	GRAPE JUICE FRESH HONEYDEW MELON CEREAL OF CHOICE YOGURT PARFAIT WITH GRANOLA EGG OF CHOICE COFFEE OR TEA SKIM MILK	APPLE JUICE FRESH CANTALOUPE YOGURT PARFAIT EGG OF CHOICE COFFEE OR TEA SKIM MILK	APPLE JUICE FRESH ORANGE SLICES YOGURT PARFAIT WITH GRANOLA EGG OF CHOICE COFFEE OR TEA SKIM MILK	GRAPE JUICE FRESH CANTALOUPE YOGURT PARFAIT EGG OF CHOICE COFFEE OR TEA SKIM MILK							
LUNCH													
ROAST TURKEY GRAVY MASHED POTATOES ENGLISH PEAS WHOLE WHEAT ROLL MARGARINE SWEET POTATO PIE COFFEE OR TEA SKIM MILK GARNISH CRANBERRY SAUCE	CHICKEN AND DUMPLINGS BABY CARROTS DINNER ROLL MARGARINE CHOCOLATE PIE COFFEE OR TEA SKIM MILK	MEATLOAF MASHED POTATOES GREEN BEANS PEACH COBBLER COFFEE OR TEA SKIM MILK	PORK CHOP MUSHROOM SAUCE SWEET POTATOES CABBAGE DINNER ROLL MARGARINE PINEAPPLE UPSIDE DOWN CAKE COFFEE OR TEA SKIM MILK GARNISH ONION RINGLET	FRIED CHICKEN MASHED POTATOES GRAVY ZUCCHINI BANANA PUDDING W/TOPPING COFFEE OR TEA SKIM MILK	SALISBURY STEAK AU GRATIN POTATOES TURNIP GREENS WHOLE WHEAT ROLL MARGARINE PEACH SLICES COFFEE OR TEA SKIM MILK GARNISH GREEN PEPPER RING	ROTISSERIE GLAZED CHICKEN CORN BROCCOLI ICE CREAM COFFEE OR TEA SKIM MILK GARNISH PARSLEY SPRIG							
DINNER													
CHOPPED STEAK GRAVY SF MASHED POTATOES GREEN BEANS BREAD MARGARINE FRUITED GELATIN COFFEE OR TEA SKIM MILK GARNISH ONION RINGLET	HERB BAKED FLOUNDER COUNTRY RICE BROCCOLI WHOLE WHEAT ROLL MARGARINE FRUIT CUP COFFEE OR TEA SKIM MILK LEMON BAR GARNISH LEMON WEDGE	BBQ CHICKEN COLLARD GREENS COLE SLAW (OPTIONAL) MAC N CHEESE (WHITE CHEESE) FRUIT CUP COFFEE OR TEA SKIM MILK	SPAGHETTI W/MEAT SAUCE ITALIAN VEGETABLES TOMATO WEDGES GARLIC BREAD MARGARINE SHERBET COFFEE OR TEA SKIM MILK	SLOPPY JOE TATER TOTS GREEN BEANS DINNER ROLL MARGARINE FRUIT CUP COFFEE OR TEA SKIM MILK GARNISH PINEAPPLE RING	FRIED FISH (COD) TARTAR SAUCE FRENCH FRIES COLE SLAW KETCHUP SEEDLESS GRAPES COFFEE OR TEA SKIM MILK GARNISH LEMON WEDGE	BEEF TIPS RICE GREEN BEANS AND CARROTS APPLE COBBLER COFFEE OR TEA SKIM MILK							
EVENING SNACK													
JUICE OF CHOICE VANILLA PUDDING	JUICE OF CHOICE YOGURT	JUICE OF CHOICE CARROT STICKS W/DRESSING	JUICE OF CHOICE VANILLA PUDDING	JUICE OF CHOICE YOGURT	JUICE OF CHOICE CARROT STICKS W/DRESSING	JUICE OF CHOICE VANILLA PUDDING							

Appendix C- MIND Diet Draft

Sunday (1)	Monday (2)	Tuesday (3)	Wednesday (4)	Thursday (5)	Friday (6)	Saturday (7)
Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
Oatmeal Whole grain toast Strawberries	Egg of your choice Whole grain toast Fruit	Oatmeal Whole grain toast Blueberries	Egg of your choice Whole grain toast Fruit	Oatmeal Whole grain toast Blackberries	Egg of your choice Whole grain toast Fruit	Oatmeal Whole grain toast Raspberries
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
Turkey Baked potato Green beans Whole grain roll 1 tbsp butter	Grilled chicken salad w/ tomato, red onion, cucumber Served with a vinaigrette	BBQ chicken Pinto beans Collard greens Whole grain roll 1 tbsp butter	Tuna steak salad w/ Carrots, bell peppers, Avocado, tomato, and cucumber Served with a vinaigrette	Grilled chicken Black beans Whole grain rice Peppers and onions Salsa	Shrimp Caesar Salad with Tomato, whole Grain croutons, Parmesan cheese Served with a Vinaigrette	Chili w/ Kidney beans and ground beef Whole grain crackers
Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner
Steak salad w/ tomato, banana peppers, red onion, cucumber Served with a vinaigrette	Herb baked flounder Whole grain rice Broccoli Lemon bar	Quinoa salad w/ tomato, onion, cucumber, red pepper and kale Banana pudding with topping	Whole grain pasta Sauce w/ ground beef Zucchini and squash Sautee Whole grain roll 1 tbsp butter	Salmon salad w/ Tomato, onion, Cucumber, Carrots Served with a vinaigrette Apple cobbler	Grilled pork chop Sweet potato Sautéed cabbage Whole grain roll 1 tbsp butter	Whole grain pasta Salad with grilled Chicken, spinach, Tomato, onion, Bell pepper Served with a vinaigrette Ice cream
Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack
Yogurt Almonds	Cashews Blackberries	Carrot sticks Pistachios	Celery and peanut butter Raspberries	Dried fruit and Cashews	Yogurt Strawberries	Pistachios Blueberries

Appendix D- MIND Diet Final

Sunday (1)	Monday (2)	Tuesday (3)	Wednesday (4)	Thursday (5)	Friday (6)	Saturday (7)
Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
Oatmeal Whole grain toast Strawberries	Egg of your choice Whole grain toast Turkey Sausage Fruit Cup	Oatmeal Whole grain toast Blueberries	Egg of your choice Whole grain toast Turkey Sausage Fruit Cup	Oatmeal Whole grain toast Blackberries	Egg of your choice Whole grain toast Turkey Sausage Fruit Cup	Oatmeal Whole grain toast Raspberries
Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
Turkey with natural juices Baked potato Green beans Whole grain roll 1 tbsp butter	Grilled chicken salad w/ tomato, red onion, cucumber Served with a vinaigrette	BBQ chicken Pinto beans Collard greens Whole grain roll 1 tbsp butter	Tuna steak salad w/ Carrots, bell peppers, Avocado, tomato, and cucumber Served with a vinaigrette	Grilled chicken Black beans Whole grain rice Peppers and onions Fresh Pico de Gallo	Shrimp Caesar Salad with Tomato, whole Grain croutons, Parmesan cheese Served with a Vinaigrette	Chili w/ Kidney beans and ground beef Whole grain crackers Cold Cucumber Salad
Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner
Steak salad w/ tomato, banana peppers, red onion, cucumber Served with a Vinaigrette Peach Slices	Herb baked flounder Whole grain rice Broccoli Lemon bar	Quinoa salad w/ tomato, onion, cucumber, red pepper and kale Banana pudding with topping	Whole grain pasta Sauce w/ ground beef Zucchini and squash Sautee Whole grain roll 1 tbsp butter Seedless Grapes	Salmon salad w/ Tomato, onion, Cucumber, Carrots Served with a vinaigrette Apple cobbler	Grilled pork chop Sweet potato Sautéed cabbage Whole grain roll 1 tbsp butter Pineapple rings	Cold Whole grain pasta Salad with grilled Chicken, spinach, Tomato, onion, Bell pepper with vinaigrette Ice cream
Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack	Evening Snack
Greek Yogurt Almonds	Cashews Blackberries	Carrot sticks Pistachios	Celery and peanut butter Raspberries	Dried fruit and Cashews	Greek Yogurt Strawberries	Pistachios Blueberries

Appendix E- MIND Diet Alternative Menu

Protein	Grains	Snacks
<p>Baked Chicken</p> <p>Deli meats- turkey, chicken, ham</p> <p>Hamburger</p> <p>Low-fat Yogurt- variety of flavors</p>	<p>Brown rice</p> <p>Grits</p> <p>Cereal (Cheerios, Raisin Bran)</p> <p>Whole grain sandwich bread</p> <p>Whole grain bun</p> <p>Whole grain wrap</p>	<p>Hummus</p> <p>Peanut butter Crackers</p> <p>Graham Crackers</p> <p>2% milk</p> <p>Nutragrain Bars</p> <p>Popcorn</p>

Appendix F- MIND Diet Nutrient Analysis by Day

MIND Diet- Cycle Day 1					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Oatmeal	1/2 cup	150	27	5	3
Whole Grain Toast	1 slice	70	12	4	1.5
Strawberries	1 cup	49	11.7	1	0.5
Lunch					
Turkey with natural juices	4 ounces	140	0	24	5
Baked potato	1 medium potato	161	37	4.3	0.2
Green Beans	1 cup	31	7	1.8	0.2
Whole Grain Roll	1.5 oz roll	100	18	5	1
Butter	1 Tbsp.	100	0	0	11
Dinner					
Steak	3 ounces	218	0	15.8	16.5
Romaine Lettuce	2 cups	16	3.2	0	0.2
Tomato	3 wedges	15	3.6	0.9	0.3
Banana Peppers	1 ounce	8	0.9	0.6	0.3
Red Onion	2 ounces	2	0.5	0	0
Cucumber	2 ounces	35	8	0	0
Vinagrette	2 Tbsp.	160	2	0.2	18
Peach Slices	1/2 cup	70	17	1	0
Snack					
Greek Yogurt	1 cup	120	9	22	0.5
Almonds	1/2 cup	80	3	3	7

MIND Diet- Cycle Day 2					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Eggs	2 large	143	0.7	12.6	9.5
Whole Grain Toast	1 slice	70	12	4	1.5
Turkey Sausage	2 patties	100	1	10	6
Fruit Cup	1 cup	70	17	1	0
Lunch					
Grilled Chicken	4 ounces	120	0	26	1
Romaine Lettuce	2 cups	16	3.2	0	0.2
Red Onion	2 ounces	2	0.5	0	0
Cucumber	2 ounces	35	8	0	0
Vinagrette	2 Tbsp.	160	2	0.2	18
Dinner					
Herb baked Flounder	4 ounces	132	0	27	5.5
Whole Grain Rice	3/4 cup	150	32	3	1
Broccoli	1 cup	31	6	2.6	0.3
Lemon Bar	1 bar (2x2)	110	21	1	3
Snack					
Cashews	1/4 cup	160	8	5	13
Blackberries	1 cup	60	4	2	0.7

MIND Diet- Cycle Day 3					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Oatmeal	1/2 cup	150	27	5	3
Whole Grain Toast	1 slice	70	12	4	1.5
Strawberries	1 cup	49	11.7	1	0.5
Lunch					
BBQ chicken	4 ounces	286	14	38	5
Pinto Beans	1/2 cup	150	27	9	0.5
Collard Greens	1 cup	11	2	1.1	0.2
Whole Grain Roll	1.5 oz roll	100	18	5	1
Butter	1 Tbsp.	100	0	0	11
Dinner					
Quinoa	1 cup	222	39	8	4
Tomato	1/4 cup	8	1.8	0.4	0.1
Onion	2 ounces	2	0.5	0	0
Cucumber	2 ounces	35	8	0	0
Red Pepper	1/4 cup	8	1.8	0.1	0.4
Kale	1/2 cup	16	2.9	1.4	0.3
Banana Pudding	1/2 cup	319	58	1.3	8.9
Snack					
Carrot Sticks	1/2 cup	35	8	1	0
Pistachios	2 ounces	160	8	3	14

MIND Diet- Cycle Day 4					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Eggs	2 large	143	0.7	12.6	9.5
Whole Grain Toast	1 slice	70	12	4	1.5
Turkey Sausage	2 patties	100	1	10	6
Fruit Cup	1 cup	70	17	1	0
Lunch					
Tuna Steak	3.5 ounces	105	0	25.2	0.4
Romaine Lettuce	2 cups	16	3.2	0	0.2
Shredded Carrots	1 ounce	12	2.7	0.3	0
Bell Pepper	1/3 cup	10	2.3	0.5	0.1
Tomato	3 wedges	15	3.6	0.9	0.3
Avocado	1/2 cup	117	6	1.5	10.5
Cucumber	2 ounces	35	8	0	0
Vinagrette	2 Tbsp.	160	2	0.2	18
Dinner					
Whole Grain Pasta	1 cup	200	41	7	1.5
Pasta Sauce	1/2 cup	60	8	2	2.5
Ground Beef	2 ounces	100	0	11.5	5.5
Zucchini and Squash Sautee	1/2 cup	32	2	1.5	2
Whole Grain Roll	1.5 oz roll	100	18	5	1
Butter	1 Tbsp.	100	0	0	11
Seedless Grapes	40 grapes	64	16.5	6	0.3
Snack					
Celery	4 medium stalks	20	3	1	0
Peanut Butter	1 Tbsp.	180	7	8	15

Raspberries	1 cup	64	14.7	1.5	0.8
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MIND Diet- Cycle Day 5					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Oatmeal	1/2 cup	150	27	5	3
Whole Grain Toast	1 slice	70	12	4	1.5
Strawberries	1 cup	49	11.7	1	0.5
Lunch					
Grilled Chicken	4 ounces	120	0	26	1
Black Beans	1/2 cup	110	19	7	1
Whole Grain Rice	3/4 cup	150	32	3	1
Peppers and Onions	1 cup	45	10.5	1.5	0
Fresh Pico de Gallo	1/4 cup	9	2.2	0.4	0.1
Dinner					
Salmon	4 ounces	210	0.8	27	11.2
Romaine Lettuce	2 cups	16	3.2	0	0.2
Tomato	3 wedges	15	3.6	0.9	0.3
Onion	2 ounces	2	0.5	0	0
Cucumber	2 ounces	35	8	0	0
Shredded Carrot	1 ounce	12	2.7	0.3	0
Vinegrette	2 Tbsp.	160	2	0.2	18
Apple Cobbler	3/4 cup	202	29.2	1.5	9
Snack					
Dried Fruit	1/4 cup	100	24	1	0
Cashews	1/4 cup	160	8	5	13

MIND Diet- Cycle Day 6					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Eggs	2 large	143	0.7	12.6	9.5
Whole Grain Toast	1 slice	70	12	4	1.5
Turkey Sausage	2 patties	100	1	10	6
Fruit Cup	1 cup	70	17	1	0
Lunch					
Shrimp	3 ounces	100	0	21	1.5
Romain Lettuce	2 cups	16	3.2	0	0.2
Tomato	3 wedges	15	3.6	0.9	0.3
Whole Grain Croutons	1/4 cup	70	9	2	2.5
Parmesan Cheese	2 Tbsp.	40	0	4	3
Vinagrette	2 Tbsp.	160	2	0.2	18
Dinner					
Grilled Pork Chop	4 ounces	220	0	27.2	12
Sweet Potato	1 medium (5 inches long)	112	26.2	2	0.1
Sauteed Cabbage	4.5 ounces	35	2.6	8	0.1
Whole Grain Roll	1.5 oz roll	100	18	5	1
Butter	1 Tbsp.	100	0	0	11
Pineapple Rings	4 rings	120	30	2	0
Snack					
Greek Yogurt	1 cup	120	9	22	0.5
Strawberries	1 cup	49	11.7	1	0.5

MIND Diet- Cycle Day 7					
Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Breakfast					
Oatmeal	1/2 cup	150	27	5	3
Whole Grain Toast	1 slice	70	12	4	1.5
Strawberries	1 cup	49	11.7	1	0.5
Lunch					
Chili- Ground beef and Kidney Beans	1 cup	300	30	28	10
Cold Cucumber Salad	3/4 cup	168	13.1	1.7	12.9
Whole Grain Crackers	9 crackers (15 grams)	35	7	1	0
Dinner					
Whole Grain Pasta	1 cup	200	41	7	1.5
Grilled Chicken	4 ounces	120	0	26	1
Spinach	1 cup	7	1.1	0.9	0.1
Tomato	1/2 cup	25	5	1	0
Onion	2 ounces	2	0.5	0	0
Bell Pepper	1/2 cup	9	2.2	0.5	0
Vinagrette	2 Tbsp.	160	2	0.2	18
Ice Cream	1/2 cup	130	14	2	7
Snack					
Pistachios	2 ounces	160	8	3	14
Blueberries	1 cup	84	21.4	1.1	0.5

**Alternative
Menu Options**

Food	Serving Size	Calories (kcal)	Carbohydrates (grams)	Protein (grams)	Fat (grams)
Proteins					
Baked Chicken	4 ounces	232	0	31	11
Hamburger	4 ounces	200	16	14	9
Deli Turkey	4 ounces	120	4	20	2
Deli Ham	4 ounces	160	8	20	4
Deli Chicken	4 ounces	100	2	16	2
Low-fat Yogurt	6 ounces	170	33	7	1.5
Grains					
Brown Rice	3/4 cup	150	32	3	1
Grits	1 cup	143	31	3	0.5
Cheerios	1 cup	100	20	4	2
Raisin Bran	1 cup	190	46	5	1
Whole Grain Sandwich Bread	1 slice	100	18	5	1.5
Whole Grain Hamburger Bun	1 bun	120	23	6	2
Whole Grain Wrap	1 wrap (45 grams)	169	31	4	4
Snacks					
Hummus	2 Tbsp.	80	4	2	6
Peanut Butter Crackers	6 crackers	190	23	4	10
Graham Crackers	8 crackers	130	24	2	3
2% Milk	1 cup	123	12	8	5
Nutragrain Bars	1 bar	120	24	2	3
Popcorn	2 cups	65	11	2	2

Appendix G: Definition of Keywords/Terms

- Alzheimer's Disease (AD): irreversible, progressive brain disorder that slowly destroys memory and thinking skills and, eventually, the ability to carry out simple tasks (What is Alzheimer's Disease, 2017).
- APOE- genotyping: the presence of this gene indicates a genetic predisposition to developing AD
- Dietary pattern: the quantity, variety, and combination of food or beverage in a diet and the frequency they are habitually consumed (Sanchez-Villegas, 2018).
- Flavonoids: part of the cellular structure of most fruits and vegetables and are responsible for its vivid color (Devore, 2012).
- Food Frequency Questionnaire (FFQ): a list of questions (variable in length) that specifies common portion sizes (i.e. ½ cup of blueberries) and asks how often the reader has consumed this food, typically over the last 1 year. Answers exist on a scale and typically range from “almost never” to “more than 6 servings a day”.
- Low density lipoprotein (LDL): deposits cholesterol into the lining of the arteries and is known as the “bad” cholesterol.
- HHS: Hospital Housekeeping Services; Foodservice consulting company for Sovah Health at Danville, and all other LifePoint hospitals.
- Nutrition Care Manual (NCM): professional practice resources for registered dietitian nutritionists, with client education materials and current evidence-based nutrition recommendations for all ages.

- Proportional hazards model: used to explain the effect of explanatory variables on hazards rates. (for example: dietary intake and its effect on AD development)
- Regular diet: In the acute care setting, this is a term used to describe the standard menu option given to a patient with no restrictions (Appendix B).
- Seven Pillars of Brain Health: vascular health, stress management, quality sleep, mental stimulation, healthy diet, social engagement, regular exercise (Preventing Alzheimer's Disease, 2020)
- Therapeutic diet: this is a meal plan that controls and limits particular nutrients or foods. This is typically a modification of a regular diet.