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The Impact of Social Support on Diet Quality in Stroke Survivors

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THE IMPACT OF SOCIAL SUPPORT ON DIET QUALITY IN STROKE SURVIVORS

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TABLE OF CONTENTS

LIST OF TABLES & FIGURES

ABSTRACT

Stroke is a leading cause of death and disability in the United States, and nearly 25% of strokes are repeat events. Secondary prevention strategies are needed to reduce the disabling sequelae of recurrences. Dietary modification to include more fruits, vegetables, and polyunsaturated fats is a promising tactic. If stroke leads to disability, patients may not be able to cook or grocery shop for themselves. Thus, one factor that may influence diet quality is social support, but its effect on post-stroke diet has not been assessed. **In this cross-sectional study, we will examine the association between social support and diet quality among stroke survivors.** We will measure participants' perceived social support and diet quality, while analyzing contributory behaviors, like cooking and shopping. We anticipate that patients with greater social support will have a higher quality diet. By establishing this relationship, interventions that increase social support may be utilized in secondary prevention.

CHAPTER 1
INTRODUCTION

1.1 Background

Overview of Stroke

Each year in the United States, 795,000 people will have a stroke. Of these cases, about 185,000 are recurrent events. In 2012, it was estimated that 6.6 million people living in the United States have had a stroke. Current models predict that by the year 2030, an additional 3.4 million people will have a stroke, leading to a 20.5% increase in prevalence.[1] With the aging population living longer, it can be expected that there will be an increasing number of strokes that occur each year, significantly worsening the burden of disease. Additionally, stroke-related costs are forecasted to triple by the year 2030, demonstrating stroke's strain on the economy and healthcare system.[2]

Recurrent stroke rates vary among patients, with cumulative risk increasing with a greater number of years since the initial event. Some studies have found the risk to be as great as 40% ten years after the initial stroke.[3] Current data estimate that 1 in 4 patients who have had a stroke will have another at some point in their life.[1] As such, strokes are a considerable burden on the healthcare system and lead to significant, potentially long-term disability among patients.

There are two main types of stroke: ischemic and hemorrhagic. Ischemic stroke is caused by a blockage in the cerebral vessels, leading to interruption of blood flow and oxygen delivery to the tissue. Hemorrhagic stroke is a bleed directly into the brain parenchyma. Ischemic strokes are more common, comprising approximately 87% of strokes each year.[1] Hemorrhagic strokes tend to have worse outcomes, with a higher risk

of death in the months following the event.[4] Risk factors for first stroke include hypertension, advanced age, diabetes mellitus, atrial fibrillation, previous myocardial infarction, and tobacco and alcohol use.[4] Though the risk factors for ischemic and hemorrhagic stroke tend to overlap, some are more associated with ischemic stroke, such as diabetes, atrial fibrillation, and ischemic heart disease, as these raise risk for atherosclerotic disease.[4] Hemorrhagic stroke risk is more closely associated with hypertension and alcohol use.[1,4] The careful assessment of these risk factors following a patient's first stroke assists in the prevention of further incidents. Similar to first stroke, risk factors for recurrence include prior stroke, hypertension, hyperlipidemia, ischemic heart disease, and diabetes.[5,6] Since many of these are modifiable risk factors, they can be evaluated and treated following a patient's first stroke.

Given the high rate of recurrent strokes, secondary prevention is of vital importance in stroke survivors. Current guidelines emphasize aggressive blood pressure control to less than 140/90 mmHg, statin therapy to combat dyslipidemia, and screening for diabetes mellitus, with glycemic control if indicated.[7] Recent research has investigated nutrition and physical activity as strategies to prevent future strokes, due to their effect on major risk factors like hypertension and diabetes.[7] Available data have not yet linked specific dietary patterns with stroke recurrence, since the exploration of this risk factor is still in the early stages.[7]

Diet for Secondary Stroke Prevention

Secondary prevention guidelines are in place to reduce the high rate of stroke recurrence, as repeat strokes can lead to greater disability and even death. With

aggressive preventive measures, patients may avoid these devastating events. Recent guidelines from the American Stroke Association outline preliminary recommendations regarding diet following stroke.[7] These guidelines recommend that first, patients should be screened for malnutrition following their stroke, due to its association with poor outcomes. However, supplementation with food or micronutrients is not recommended for malnourished patients due to the lack of long-term evidence available. Specific dietary modifications include decreasing sodium intake due to its effect on blood pressure levels. Additionally, though statins are a first line therapy for dyslipidemia following stroke, current guidelines emphasize the importance of implementing dietary changes that will further lower cholesterol levels.[7]

At present, there have been no sufficient trials linking dietary interventions with patient outcomes following stroke. Studies performed in patients at high risk for cardiovascular disease, however, suggest that a Mediterranean style diet is a reasonable choice for risk reduction.[8] This diet is high in fruits, vegetables, fish, and olive oil, and low in sweets and red meat.[7] The American Stroke Association's 2014 recommendations for the secondary prevention of stroke suggest that patients may benefit from following a Mediterranean style diet.[7] The level of evidence for this intervention is Class IIa, Level C, meaning that the evidence favors efficacy and is based on expert opinion, but additional studies are required. This recommendation is based on three large randomized controlled trials of patients with high risk for cardiovascular events[9] or known coronary artery disease.[10,11] These trials aimed to determine if the Mediterranean diet would lead to improved cardiovascular outcomes. Two studies obtained compelling evidence of reduced mortality due to cardiac events in the Mediterranean diet group,[10,11] and the other

found that markers of cardiovascular risk (e.g. lipids, blood pressure) were reduced with the dietary intervention.[9] However, as these trials did not specifically enroll stroke patients, they can only be used to guide secondary prevention measures. Although research related to the nutritional aspect of prevention is ongoing, improvement of diet is considered to be a standard recommendation for stroke patients.[7]

Stroke Recovery and Social Support

The potential severity of disability after stroke underlines the importance of prevention of recurrent events. Physical decline after stroke can cause permanent disability, often requiring long-term care or assistance with independent activities of daily living. Long-term physical effects include a wide range of neurological deficits, ranging from sensory loss and hemiplegia to aphasia and paralysis, depending on the site of the stroke.[12] Loss of speech and motor function is devastating to patients and may prevent them from being able to work or return to their normal daily activities. In addition to the physical decline after stroke, psychiatric comorbidities, such as anxiety and depression, are also common among survivors.[13] Patients experiencing recurrent stroke are likely to have greater physical and cognitive disability.[14,15] Thus, to minimize further disability, secondary prevention is paramount.

Given the high burden of disability that may follow stroke, a patient's social support is an important factor in stroke recovery and prevention. Social support refers to the types of support, assistance, and help that people receive from others, including family members, friends, and community contacts. This support can be emotional (e.g. making the patient feel that they are cared for) or instrumental (e.g. assisting with

cooking or housekeeping).[16] As many patients can no longer function at their previous level following a stroke, instrumental social support is very important as the patient is recovering. Patients may need greater assistance with household tasks and daily activities. Emotional support is equally important, as post-stroke depression may affect up to half of stroke survivors at some point in their recovery period.[17] Studies have found that higher levels of perceived social support predicted a faster recovery and greater levels of functioning following a stroke.[18] Additionally, socially isolated stroke patients were found to have higher rates of post-stroke depression and report a lower quality of life.[19] Data such as these demonstrate the importance of social support in the period following a stroke, as it may lead to improved outcomes.[18] It is hypothesized that social support helps to reduce stress levels and empower patients to make changes in their health behaviors, which are necessary to prevent recurrent stroke.[20]

1.2 Statement of the Problem

A high quality diet may be an effective method to prevent stroke recurrence during the recovery period and in the years that follow. Current literature suggests that hospitals do not routinely address diet quality following a stroke.[21] This is important to note, because diet is intertwined with many risk factors that are strongly associated with stroke. For example, hypertension, diabetes mellitus, and dyslipidemia – known risk factors for stroke – are all affected by diet.[7] Thus, it is important to understand the reasons that patients are able (or unable) to make potentially drastic changes to their eating behaviors following a stroke.

A patient's level of social support may affect their diet quality after stroke. There

are many behaviors that directly contribute to the diet quality of a patient, such as planning meals, shopping for food, cooking, and eating out at restaurants. For example, a 2012 systematic review found that eating out of the home was associated with higher intake of fat and calories and lower intake of micronutrients.[22] Conversely, those who cook dinner at home have a lower intake of total energy, fat, and sugar than those who do not eat at home as frequently. The patients who consumed home-cooked meals were considered to have a higher quality diet.[23] These examples of diet-related behaviors demonstrate their effect on diet composition. Assessing these behaviors among stroke patients can provide valuable insight into methods that will improve diet quality. A patient that receives instrumental support in the form of assistance with meal preparation is an example of the interaction between social support and diet-related behaviors.[16] This person may have a higher quality diet than someone with little social support who does not receive assistance with cooking. This is supported by a 2013 cross-sectional study that found that adults who lived in a household where someone prepared home cooked meals more frequently were more likely to have a higher quality diet than someone who ate out of the home frequently.[23]

At present, studies have not examined the association between diet quality and social support in patients with stroke. In other populations, the association is inconsistent. Some studies of healthy populations show that low social support is associated with non-adherence to diet.[24,25] A 2010 prospective cohort study of healthy adults found that low social support predicted poor adherence to a prescribed diet over the course of one year.[24] An additional study of obese adults utilized a community-based weight loss program to determine the impact of social support on adherence to a diet and exercise program.

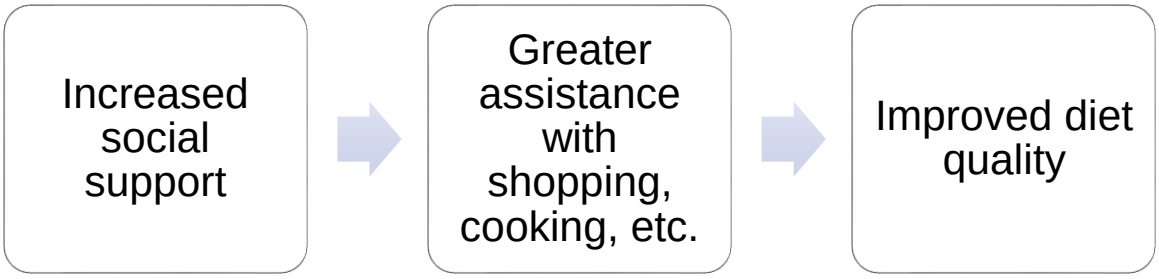
Participants were encouraged to have three family members or friends sign a social support contract, promising to support the participant's adherence to the program. Those who obtained these contracts lost twice as much weight as those who did not.[25] On the other hand, a 2015 study of older adults linked higher levels of baseline social support with reduced diet quality over time. The study found that those with higher support scores were more likely to experience diet deterioration or less improvement in diet quality over the three year study period.[26] Existing evidence does not demonstrate a clear relationship between social support and diet quality.

The potential association between social support, diet-related behaviors, and diet quality can be supported by the stress buffering hypothesis of social support. This model suggests that patients are protected from the harm of stressful events by having adequate social support.[27] In this case, having a stroke may be considered the stressful event, as it may lead to functional impairment and reduced ability to cope with everyday challenges.[27] A stroke survivor's source of social support is able to assist with these new perceived challenges, such as grocery shopping and meal preparation. By assisting with tasks that are necessary for dietary modification following stroke, the person providing social support is buffering the effects of stress. This may allow the patient to better adhere to dietary changes that are important for secondary prevention of stroke. A visual representation of the association between social support, diet-related behaviors, and dietary quality can be found in Figure 1.

In this proposed study, we aim to gain greater insight into the relationship between social support and diet quality. By considering the role of behaviors such as cooking, eating out of the home, and shopping, we will more thoroughly appreciate their

effect on a patient's diet in the critical period following stroke. With an improved understanding of social support and dietary behaviors, we can better implement secondary prevention strategies that will improve the overall quality of patients' diets. We hypothesize that as social support increases, diet quality will proportionally increase. We hope that the results of this study will allow one to assess a patient's level of social support and anticipate the barriers to high quality diet after stroke. This will allow clinicians to determine which patients will need more intensive dietary or social interventions during their recovery period. Tailored secondary prevention measures will benefit patients greatly and may even lead to reduced rates of recurrent stroke.

Figure 1. The relationship of social support, diet-related behaviors, and dietary quality



1.3 Goals and Objectives

Goal: Examine the relationship between social support and diet quality to better inform future dietary interventions to prevent recurrent ischemic stroke.

Objectives:

1) Measure levels of perceived social support and diet quality among ischemic stroke survivors.
2) Identify additional social and clinical variables that are associated with higher levels of social support in this population.

3) Examine behaviors such as cooking, shopping, meal planning, and eating out of the home and their effect on diet quality in this population.
4) Determine if there is a linear relationship between social support and diet quality, with the highest levels of support being linked to the highest diet quality.

1.4 Hypothesis

I. Patients with higher levels of social support will have a higher quality diet, as mediated by assistance with cooking, shopping, planning meals, and eating out of the home less frequently.

II. Patients with a higher household income will have greater levels of social support, and thus will have a higher quality diet.

   a. We believe that this is true because people who live in a high socioeconomic status (SES) household are more likely to have a higher income and a more stable career than someone of a low SES. Those who work steady, predictable hours will have more time to support and spend time with the patient, as opposed to someone who must work multiple jobs and erratic hours to earn a sufficient income.

1.5 Definitions

Social support: Assistance or help that a patient receives from others, which usually is categorized as emotional or instrumental. Emotional support includes anything that makes someone feel loved or cared for.[16] This can include spending time with someone or being able to confide in them.[28] Instrumental support includes concrete assistance,

such as providing money or assistance with household tasks.[16] Overall, social support is based on relationships with others that involves a transaction of time, resources, or emotional encouragement.[16,28]

Diet quality: Criteria for determining if a diet provides adequate nutrition and variety.[29] It is a measure that is often used to predict risk for future disease or mortality.[30]

Socioeconomic Status (SES): A person's social and economic standing that most often combines measures of education, income, and occupation.[31]

Meal planning: Planning the meals that will be prepared in upcoming days or weeks, including creating shopping lists and menus.

Malnutrition: An imbalance in nutrition, either by overconsumption or underconsumption of calories and nutrients. The term malnutrition is generally synonymous with undernutrition, meaning that a patient has insufficient intake or increased nutritional requirements. Malnourished patients do not obtain enough calories, protein, or nutrients to maintain and repair tissue in the body. Malnutrition is associated with weight loss, higher rates of morbidity and mortality, reduced function, and decreased quality of life.[32]

Mediterranean Diet: This diet is high in fruits, vegetables, olive oil, and nuts. Intake of poultry and fish is moderate and intake of red meat, dairy, and sweets is low. Wine may be consumed in moderation.[8] Data show that this diet may reduce the risk of cardiovascular events.[8-11]

Food Diversity: A measure of the variety of foods consumed in a diet. The number of unique foods consumed, the distribution of food groups in the diet, and the health value of the foods are taken into consideration. Greater food diversity tends to correlate with better health outcomes.[33]

Social Network: The collection of those with which a person has regular social interactions, including family, friends, neighbors, and community members. This takes into consideration both local and distant contacts with whom the person has a strong relationship. Strong social networks tend to be associated with higher levels of self-perceived health.[34]

Alternative Healthy Eating Index (AHEI): A standardized score that measures dietary quality. This score reflects the adequate intake of beneficial food groups, such as fruits, vegetables, and whole grains. It also measures the moderation of unhealthy components of the diet, like saturated fats and sodium. Higher scores reflect better adherence to American dietary guidelines.[35]

Dietary Approaches to Stop Hypertension (DASH) score: A standardized score that reflects adherence to the DASH diet. This diet is low in sodium, red meat, and added sugars. It is high in fruits, vegetables, low-fat dairy products, whole grains, and lean meats. Data show that following the DASH diet contributes to a lower blood pressure.[36]

MedDiet Score (MDS): A standardized score that reflects adherence to the Mediterranean Diet. Higher scores indicate frequent consumption of fruits, vegetables, olive oil, nuts, and fish and little consumption of red meat, refined grains, and alcohol.[37]

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CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

The literature search was conducted through the Medline database. Studies were eligible if they were published in the year 2000 or later. Only randomized controlled trials, observational studies, qualitative studies, and systematic reviews were analyzed. Editorials and letters in research journals were excluded. This strategy provided a recent, peer-reviewed base of literature. To examine the full scope of the literature, the review was conducted in two parts. First, the effect of diet on stroke prevention was examined. Then, the influence of social support on diet quality was analyzed.

2.2 Dietary Impact on Stroke Prevention

The goal of the first Medline search was to assess the relationship between diet and secondary prevention of stroke. The following search terms were used:

((diet quality.mp) OR (dietary quality.mp) OR (dietary patterns.mp)) AND exp Cerebrovascular Disorders/pc [Prevention & Control].

This search was limited to articles in English published after 2000, and returned 480 results. After a review of titles for relevance and duplicates, 52 articles remained. I reviewed each abstract and selected 29 articles relevant to the research question. Little information was available on secondary prevention of stroke and dietary quality, so many articles in this review assess diet as a risk factor for first stroke. Articles that focused on single nutrients or food groups in stroke prevention were not selected because the aim of this review is to assess the effect of overall diet quality on prevention. Publications on

diets considered to be high quality, such as the Mediterranean diet, were included. Table 1 summarizes these findings and can be found at the end of this chapter.

Review of Findings

Observational Studies

Six studies, including four prospective cohort studies and two case-control studies, examined the effect of the Mediterranean diet on stroke incidence and prevention. Each prospective cohort study demonstrated that this diet might have a protective effect against stroke. The first study found that U.S. adults with a Mediterranean Diet Score (MDS) in the top third, indicating better adherence to the diet, experienced a 22% reduction in ischemic stroke incidence, before adjustment ($p=0.047$). However, with adjustment, the significance was attenuated ($p=0.057$).[1] A study of Swedish adults noted that after adjustment for all sociodemographic variables and comorbidities, participants with a MDS score in the top quartile had an ischemic stroke risk 22% lower than those in the lowest quartile ($p<0.01$). Additionally, for each one-point increase in MDS, ischemic stroke risk was reduced by 6% (RR 0.94, 95% CI: 0.90-0.98). Hemorrhagic stroke risk was not associated with the Mediterranean diet, likely due to fewer participants with the diagnosis.[2] Other studies suggest that the association between ischemic stroke and MDS may be mediated by risk factors, including blood pressure variability and carotid artery plaque.[3,4] One study demonstrated an association between a higher MDS and reduced systolic blood pressure variability, which may be a protective factor against stroke (HR 0.48, $p=0.03$).[3] The other study found that MDS was inversely associated with carotid artery plaque thickness and area, but there was no correlation with the presence of carotid plaque. Reduction of the severity of carotid

atherosclerotic disease may lead to decreased stroke risk.[4]

The two case-control studies of the Mediterranean diet compared patients with recent stroke to healthy controls. The first study found that with each one point increase in MDS, there was a 12% reduction in stroke risk (95% CI: 0.82-0.94).[5] The other study noted that participants who adhered closely to a Mediterranean diet (e.g. having a MDS above the median of control subjects' scores) experienced a significant reduction in stroke risk (OR 0.18, p=0.000). When controlling for confounding variables and assessing only ischemic stroke risk, the odds ratio of stroke decreased further (OR 0.09, p=0.001).[6] These six studies demonstrated that the Mediterranean diet might be an effective dietary intervention for ischemic stroke prevention.

Three studies, including one case-control study and two prospective cohort studies, assessed the effect of the Dietary Approaches to Stop Hypertension (DASH) diet on stroke incidence. The case-control study compared healthy controls with patients who have had their first stroke and found that after adjustment, those with a DASH score in the top quartile had a 48% reduction in stroke risk compared in the lowest quartile (p=0.03). Additionally, participants with DASH scores in the highest quartile had a 40% prevalence of stroke, which was lower than the other three quartiles (p=.10).[7] The first prospective cohort study of Swedish adults noted that participants with a DASH score in the highest quartile had a 14% lower incidence of ischemic stroke than those in the lowest quartile (p=0.002). Additionally, with each five-unit increase of the DASH score, which ranges from 0-35, there was an associated 7% reduction in ischemic stroke risk (p=0.002).[8] Another cohort study utilized a population of relatively healthy German adults and found that men with a healthy DASH score, or those who had the best

adherence to the diet, had a 32% risk reduction (95% CI: 0.52-0.89), compared to those with an unhealthy, or low, DASH score. Among women, there was no association between DASH score and stroke risk.[9] These studies found that the DASH diet might be another useful option for dietary modification to prevent stroke.

Two studies assessed the effect of regional dietary patterns, including the Nordic diet in Denmark and the northern and southern Chinese diets, on stroke risk. High adherence to the Nordic diet, which is high in fish, apples, pears, root vegetables, whole grains from oat and barley, and rapeseed oil, was associated with a 14% reduced risk of total stroke ($p=0.022$). High adherers had a 13% reduced risk of ischemic stroke when compared to low adherers, but this was statistically insignificant ($p=0.069$).[10] The next study was a cross-sectional design that assessed the following dietary patterns: northern Chinese (high in wheat flour products and sweet potatoes, low in protein), southern Chinese (high in rice, vegetables, and seafood), and Western (high in beef, eggs, and fruit juice). Those who followed the high-fat Western-style diet had the highest prevalence of stroke (2.02%). Compared to the southern Chinese diet, the adjusted odds ratio for stroke was 1.82 ($p<.0001$) for participants following the northern diet and 1.39 ($p=.02$) for those with a Western dietary pattern. With further adjustment for additional comorbidities, the relationship between Western diet and stroke risk became insignificant.[11] These studies were notable for their findings that the diets high in seafood, fruits, vegetables, and unsaturated fats (e.g. southern Chinese, Nordic) were associated with lower stroke risk.

One prospective cohort study of Dutch adults assessed the effect of broader dietary patterns on stroke risk. The prudent diet, which is rich in plant-based foods, was compared with the Western diet, which is higher in fast food, low-fiber foods, and soft

drinks. The participants who adhered more closely to a prudent diet had a 27% lower stroke risk than those following a Western diet (HR 0.73, 95% CI 0.62-0.86), after adjustment for age and sex. With further adjustment for confounding variables (e.g. waist-hip ratio, blood pressure, and smoking status), the risk reduction was attenuated, but remained significant (HR 0.82, 95% CI 0.69-0.97).[12]

Three studies utilized dietary quality scales, including the dietary quality index (DQI) and Alternative Healthy Eating Index (AHEI), to associate overall diet quality with stroke risk. These included two case-control studies and one prospective cohort study, all of which noted a correlation between high diet quality and reduced stroke risk. The first case-control study compared the diet quality of Korean stroke patients with healthy controls, using two indices: the international dietary quality index (DQI-I) and the diet diversity score (DDS). They found that consuming a diet high in quality and diversity might be a protective factor for stroke. The average DQI-I score was significantly lower in the stroke group (60.3 ± 8.1) than in the control group (65.3 ± 12.3) ($p<0.01$). Additionally, the DDS was lower in the stroke group (3.7 ± 0.7) than in the control group (4.3 ± 0.7) ($p<0.001$).[13] The large, international INTERSTROKE case-control study aimed to quantify the importance of potentially modifiable stroke risk factors, including diet quality as measured by the AHEI score. In all regions, apart from south Asia, a higher AHEI score corresponded with reduced risk of stroke. On average, those in the highest tercile of AHEI scores had a 40% reduction in risk (99% CI: 0.53-0.67) when compared to those in the lowest tercile. Data from south Asia revealed that a higher AHEI score was associated with a higher stroke risk. Overall, international data supported that greater diet quality corresponded with reduced stroke incidence.[14] Finally,

a prospective cohort study conducted among Swedish adults aimed to determine if dietary quality affects the incidence of composite cardiovascular events, which included stroke. Men with a higher DQI score had a 40% reduction in cardiovascular event incidence ($p<0.001$), and women in the high DQI group had a 34% reduction ($p<0.001$), when compared to the low DQI group. Overall, those who adhered to dietary standards had a reduced risk of cardiovascular events, including stroke.[15] These studies demonstrated that a better diet quality as a whole, regardless of which diet is being followed, corresponds with better cardiovascular outcomes and reduced incidence of stroke.

Finally, one prospective cohort study used general measures of dietary improvement to assess their effect on cardiovascular risk, including stroke, among patients with newly diagnosed type 2 diabetes mellitus. Improvement in diet, which was defined as reduced calorie and fat intake and increased fiber, fruit, and vegetable intake, was not significantly associated with reduction in stroke risk. The authors suggested that reduction in alcohol consumption and increased physical activity may have more of an effect on stroke risk than diet.[16] These findings were inconsistent with many of the other observational studies that were reviewed.

Randomized Controlled Trials

One randomized controlled trial provided compelling evidence for the association of diet and stroke risk. The PREDIMED trial assigned participants with high cardiovascular risk to three diet groups: Mediterranean diet supplemented with extra virgin olive oil, Mediterranean diet supplemented with mixed nuts, or control. Participants in the olive oil group had a 33% reduction in stroke incidence ($p=0.04$), and the mixed nut group had a 46% reduction ($p=0.006$), when compared to the control

group. Combined, participants following either Mediterranean diet type had a 39% lower stroke incidence than controls (p=0.005). Given the significant effect of the diet on cardiovascular risk among the large sample of participants, this study was concluded early and data are widely used to support the efficacy of the Mediterranean diet.[17] Many sub-studies of the PREDIMED trial have been conducted to determine which participants experience the greatest benefits from dietary modification with the Mediterranean diet. For example, one sub-study of participants with genetically high risk for cardiovascular disease found that those expressing the high-risk gene had a significantly decreased stroke incidence when following the Mediterranean diet.[18]

Systematic Reviews

Multiple reviews endorsed the DASH and Mediterranean diets as preferred dietary patterns for reducing stroke risk and mortality.[19-23] One review of literature noted that these diets modify major risk factors, such as hypertension, obesity, and dyslipidemia, which make them desirable interventions. Adherence to healthy or prudent diets, which are based on plant foods rather than animal products, were also associated with reduced incidence and mortality of stroke.[19] Another review endorsed the utility of the DASH and Mediterranean diets in decreasing stroke risk, while also noting that the high-fat Western-style diet conferred an increased risk. The authors also reported that a low-fat diet did not have a protective effect. This review called for more research to develop strong recommendations for prevention of stroke with diet.[22]

One meta-analysis of three cohort studies assessed adherence to DASH diet and stroke risk. Each study demonstrated a significant negative association between DASH diet adherence and stroke risk. When analyzing these studies together, it was found that

closely following the DASH diet reduced participants' stroke risk by 19% ($p<0.001$).[24]

Most reviews did not explore the aspect of secondary prevention.[19-23,25] In one review, the authors emphasized the lack of studies that examine the effect of dietary patterns on secondary prevention of stroke as a primary outcome. Because many diet-related risk factors of first and recurrent stroke are the same, guidelines for primary stroke prevention can be extrapolated to secondary prevention measures.[26] However, more focused research on diet and recurrent stroke is necessary.

Multiple reviews identified study limitations and called for additional research regarding dietary intervention for stroke prevention, as strong data are not consistent.[20,22] Current results are not fully generalizable to American patients, as few studies involve participants from the U.S.[20] Another limitation of data is that few trials examine stroke as a primary outcome.[25] Additionally, many studies conducted thus far are prospective, so there are many potential confounding variables. For example, participants may begin to engage in other healthy activities that can reduce stroke risk, like physical activity, so the true effect of diet on stroke risk cannot be fully estimated.[25]

In a review conducted to develop secondary prevention guidelines, the authors endorsed the benefits of tailored nutritional management following stroke, which leads to greater improvements in diet and risk factors. Stroke recurrence and mortality benefits related to this intervention have not yet been assessed.[27] However, this area specific to secondary prevention of stroke remains an exciting prospect for reducing recurrences.

Review of Confounding Variables

In many of the observational studies, multivariate models were used to determine

the relationship between social support and diet quality, with adjustment for sociodemographic and other possible confounding variables. Age and sex were controlled for in almost every study, with little effect on results.[1,3-13,15,16] Anthropomorphic variables were commonly measured at baseline to assess participant characteristics and usually included blood pressure, height, weight, and waist circumference. Adjustment for these variables did not affect significance of results in most studies.[3,8,9,15] SES variables included income, education, occupation, and neighborhood type (e.g. urban), and had little effect on the significance of results. There was an emphasis on comorbidities and family history of early stroke as covariates among these studies, due to stroke or major cardiovascular events being the primary outcome. Adjustment for the presence of hypertension, diabetes, hyperlipidemia, and other chronic diseases did not significantly affect most results.[1-3,8,10] However, multiple studies' results became insignificant with adjustment for comorbidities.[5,7,11,12] Adjustment for health related behaviors, such as smoking, alcohol use, and physical activity, reduced the significance of results in some studies.[7,10] However, one study's results increased in significance with adjustment for smoking and physical activity.[6]

The randomized controlled trial achieved a balance between the characteristics of the treatment groups through randomization. This study adjusted for the diet group that participants were assigned to and baseline adherence to the Mediterranean diet. Adjustment for these variables did not significantly affect results.[17,18]

The literature review on diet quality and stroke risk included many systematic reviews, perhaps due to the need to synthesize data from many studies on this topic. These analyses recognized gaps in the literature and noted variables that may confound

the results of existing studies. For example, in one review, the discussion noted that patterns of food consumption, such as ways in which the food is prepared, seasonal changes in consumption, and the amount eaten, may have an effect on disease outcomes.[22] Another review recognized that "food scarcity, geographic barriers, cultural barriers, and the interface between genes and environment" all contribute to a patient's diet.[20] The authors recommended further exploration of sociocultural variables to improve understanding.[20] One review noted that many studies conducted thus far are prospective in design, which leads to the potential introduction of additional confounding variables over time.[25] These conclusions provide valuable assessment of confounding variables and areas for improvement.

Review of Methodology

Sixteen observational studies, two randomized controlled trials, and nine reviews were analyzed in the first part of the literature review. Of the observational study designs, five were case-control studies, ten were prospective cohort studies, and one was a cross-sectional study. Among case-control studies, most used convenience sampling methods to obtain stroke cases from a hospital, then matched them with healthy controls from the same community.[5,7,13,14] In prospective cohort designs, participants were primarily obtained from existing large-scale study databases containing thousands of patients, with and without comorbidities, which reflects a diverse sample of the population.[1,2,4,8-10,12,15] Of these large prospective cohort studies, only two obtained samples of patients from the United States.[1,4] Sample sizes ranged from 95[6] to 13,477[14] in the case-control studies. Prospective cohort studies had more participants on average, with the largest sample

containing 74,404 participants.[8] These sample sizes were sufficient to provide 80% power to each of the studies.

Several scales were used to measure diet quality. Validated food frequency questionnaires (FFQs) were used to collect dietary information and the results were interpreted into a DASH score,[7-9] MDS,[1,2,4-6] AHEI,[14] or DQI.[13,15] All of these scoring systems are standardized tools that provide excellent reliability and validity.[28-30] The majority of outcome variables in the prospective cohort studies were event related, with incident stroke or cardiovascular event being the primary endpoint. All five case-control studies, the cross-sectional design, and one prospective cohort study used multiple logistic regression to analyze data and adjust for covariates.[4-7,11,13,14] The remainder of the prospective cohort studies utilized Cox proportional hazard ratios to determine the effect of diet on stroke risk.[1-3,8-10,12,15,16] Significance was set to $p < 0.05$ for all observational studies.[1-16]

The randomized controlled trial used the sample recruited for the PREDIMED study, which consisted of over 7000 adults with high cardiovascular risk.[17,18] In the PREDIMED trial, participants were assigned to a diet, with the primary outcome being composite cardiovascular events. Secondary outcome was stroke incidence.[17] The sub-study formed groups based on the presence of a genetic polymorphism in participants and used the same outcome measures.[18] Both studies were powered at 80% and utilized a Cox regression model to analyze data, with significance set to $p<0.05$.[17,18]

The systematic reviews of the literature utilized many common keywords, such as "stroke," "diet pattern," and "diet quality".[19,22] Terms to evaluate specific dietary aspects included "fruit," "vegetable," "Mediterranean diet," and "DASH diet".[19,22,24,27] A variety

of comprehensive databases were used, such as Medline, PubMed, CINAHL, and Embase.[19,22,24,27] Eligible studies included observational and randomized controlled trials. One review excluded cross-sectional study designs, however, because of their inability to determine causation.[19] Finally, the number of studies reviewed ranged from six[24] to 34.[22]

2.3 Social Support and Diet Quality

The goal of the second Medline search was to assess the impact of social support on diet quality. When searching for the effect of social support on diet in stroke patients, only one study was retrieved and is detailed below. Thus, this search was expanded to include the role of social support in diet quality in any adult population. The following search terms were used:

> ((diet quality.mp) OR (dietary quality.mp) OR (dietary patterns.mp)) AND ("social support".mp OR "social network".mp OR "support system".mp OR "psychosocial support system".mp OR "social networks".mp OR "support systems".mp).

This search returned 48 articles. After reviewing titles for relevance and removing duplicates, 25 articles remained. Each abstract was reviewed and 16 articles pertinent to the research question were selected for analysis. One non-English article and five studies of children or adolescents were not included. Three other studies did not use diet quality as a study outcome and were excluded. The remaining studies had social support as an independent or modifying variable and diet quality as a dependent variable. Table 2 summarizes the findings of these studies and can be found at the end of this chapter.

The goal of the study examining social support and diet quality as related to

stroke was to reduce stroke risk factors among the Mexican-American population in Texas, USA. This trial, called the Stroke Health and Risk Education (SHARE) study, enrolled pairs of Mexican Americans at risk of stroke that attended the Catholic church regularly as part of a church-based motivational program to reduce stroke risk factors. The intervention group received education about healthy eating and providing peer support to their partner, while the control group simply received skin cancer prevention education to retain their enrollment. Participants who underwent the intervention consumed 0.25 cups/day more of fruit and vegetables ($p=0.002$) and 123 mg/day ($p=0.04$) less of sodium after 18 months.[31]

Review of Findings

Five articles, including two prospective cohort studies, two cross-sectional studies, and one qualitative study, demonstrated a correlation between social support and diet. These studies in diverse groups, such as working adults, Japanese elderly, and low-income pregnant women, supported the association between strong social support and higher diet quality. The first study of this kind assessed the influence of intra- and interpersonal psychosocial factors on diet quality among relatively healthy adults. High social support was associated with better diet quality as represented by three different diet scores: AHEI ($\beta=.153$, $p<0.001$), MDS ($\beta=.109$, $p=.008$), and DASH score ($\beta=.129$, $p=.003$). However, 93% of patients reported high social support, so there was a small range within which to notice differences in dietary quality.[32] The next study demonstrated that among pregnant women who had spent their childhood in Mexico before moving to the U.S., those reporting high perceived social support had a DQI score 1.4 times higher

than those who had low perceived social support (95% CI: 1.1-1.8, $p<0.01$). However, among women who were raised in the U.S., those who reported high social support had a diet quality score 2.3 times higher than the low support group, but results were not significant (95% CI: 0.9-6.3, $p<0.10$).[33]

Two cross-sectional studies supported the association between social support and diet quality. The first examined social network type, defined as a collection of a person's social interactions, including family, friends, neighbors, and community members,[34] and its relationship with food choices and diet quality among frail elderly patients in South Korea. Participants reported the qualities that they found important when making choices about food (e.g. health, convenience, price). Diet quality was measured by mean adequacy ratio (MAR), which reflects average daily intake of nutrients. This study found that those with a small social network and few community contacts had a 14.5% lower MAR than those with a large social network ($p=0.031$), and this relationship remained significant among participants who reported that they would prefer to eat healthy foods.[35] A study of elderly Japanese participants found that those who ate alone had a 24% lower food diversity score than those who ate with others ($p=0.002$), even after adjusting for possible confounding variables. Eating alone served as a marker for low social support and food diversity score is reflective of diet quality, so these results substantiated the correlation between these variables.[36]

In a 2003 qualitative study of older adults with chronic disease, structured interviews revealed the importance of social support in dietary intake. Participants reported that the quality of their diet relied greatly on what their spouse purchased at the grocery store. Multiple people reported that their spouses helped them stick to their diet

by not buying the foods that they could not eat.[37]

Three studies found some evidence for a relationship between social support and diet quality under certain circumstances. A cross-sectional analysis of lifestyle predictors of poor diet noted that men, but not women, with poor social support were more likely to have a lower DASH score than those reporting high levels of social support. However, when the relationship was fully adjusted, social support no longer had a significant effect on the men's DASH score ($p=0.6$).[38] Another study of adults living in Quebec, Canada found that men categorized in the lowest quintile of social support were found to have a 28% lower diet diversity score than those in the other four quintiles ($p=0.04$), but there was no relationship among women. Additionally, there was no association between social support and the dietary quality score in either sex.[39] Finally, a study of low-income pregnant women assessed social support and diet quality, as measured by the Dietary Quality Index in Pregnancy (DQI-P), which reflects adequate consumption of fruits, vegetables, grains, and vitamins. Results demonstrated that a higher level of "other support" (coming from someone other than a partner) was correlated with a better diet quality ($r=0.38$, $p<0.05$), but support from a partner was not ($r=0.20$, $p=NS$). Many women participating in the study did not have a partner, which likely influenced this result.[40]

Two studies performed a special analysis technique, called a path analysis, to estimate the correlation between social support and diet quality. A path analysis estimates the significance of correlations between sets of variables. It is a tool used to create a map of variables and how they affect each other. A variable's direct effects on an outcome and any additional mediating variables can be visualized using this analysis.[41] The first study

aimed to analyze the effect of social support on dietary quality, measured by DQI-P score, in low-income pregnant women. Simple correlation showed that higher levels of support predicted a higher DQI-P score ($r=.206$, $p<0.05$). The path model, however, showed an insignificant direct effect of social support on diet quality ($\beta=.04$, $p>0.05$), but a significant indirect effect, as social support was found to modify eating habits ($\beta=.19$, $p<0.05$).[42] The next study compared women of high and low educational levels to determine which psychological factors, such as perceived control and self-efficacy, influenced their diet, using a measure of diet quality called the prudent diet score. In the prudent diet score, higher scores reflect better adherence to standard dietary recommendations, like eating plenty of fruits, vegetables, and whole grains. The authors found that social support for healthy eating was weakly associated with an improved diet quality in women of both higher ($r=0.03$, $p=0.011$) and lower educational attainment ($r=0.03$, $p=0.03$), with greater significance among the high education group. Notably, those with lower levels of education reported less social support for healthy eating.[43]

Five articles, including three cross-sectional studies and two cohort studies, did not demonstrate a relationship between social support and diet quality. The cross-sectional studies were performed with low-income women and pregnant women. The first study of this type was designed to create a tool to assess psychosocial indicators of fruit and vegetable intake. Indicators for adequate fruit and vegetable intake included the AHEI score, total servings of fruit and vegetables, total nutrient intake, and serum carotenoid level, which is a blood biomarker for sufficient fruit and vegetable intake. Social support was not significantly associated with any indicators of diet quality.[44] In the next study, the relationship between diet quality and psychosocial factors, including

social support, was assessed among low-income pregnant women. Participants completed a FFQ that was translated into markers of diet quality, including average daily intake of 30 nutrients, weekly intake of seven food groups, and energy intake from protein, carbohydrates, fats, and sugar. Social support was not significantly associated with any measures of diet quality.[45] In the third cross-sectional study, a negative relationship was found between social support and diet quality, as measured by the AHEI score. For those with higher levels of social support, AHEI score was reduced by an average of two points ($p=0.13$), but this did not reach statistical significance. Other environmental variables, such as shopping for healthy food, were significantly associated with higher AHEI scores (1.44 points, $p=0.02$) and improved diet quality.[46]

Of the two cohort studies that did not demonstrate an association between diet quality and social support, the first retrospectively examined Puerto Rican college students' dietary patterns in relation to their level of reported social support. There was no association between the variables. However, a notable finding was that 58.2% of those with greater levels of social support had someone to prepare their food for them on a regular basis ($p<0.05$).[47] Another study of older disabled women found that associations between diet and social support were inconsistent, when controlled for baseline levels of social support and participant characteristics. Diet quality was measured by serum carotenoid level. Interestingly, participants who talked on the phone frequently, which is an indirect measure of social connectedness, had a lower serum carotenoid level ($p<0.05$), indicating lower fruit and vegetable intake. Conversely, low satisfaction with perceived help was associated with increases in serum carotenoids ($p<0.05$). Both relationships were in the opposite direction of what was hypothesized. On the other hand,

participants who left their homes less frequently had decreased carotenoid levels ($p<0.05$), which was consistent with what investigators hypothesized. Emotional support level had no effect on diet quality.[48]

One review article provided a valuable explanation of the impact of social support on diet quality. This article suggested that social support is a vital part of lifestyle modification because family, friends, co-workers, and other sources of support can maintain a patient's motivation to follow a healthy diet. Additionally, these individuals can serve as role models and help the patient overcome challenges that they may be faced with as they take on a major lifestyle change.[49]

Review of Confounding Variables

Many variables adjusted for in the second part of the literature review were similar to those in part one. To account for participant characteristics, nearly every study adjusted for age, and most adjusted for sex or race. Components of SES were also commonly measured and controlled. Income was recorded in four studies.[33,35,47,48] In a study of pregnant women, adjustment for income led to a substantial increase in the significance of the association between social support and diet quality.[33] Education was also found to be an important factor among the studies, with more than half controlling for education level. One study of low-income pregnant women found that the participants' baseline level of nutritional knowledge had little effect on diet quality.[42]

Additional variables that were measured included participant's feelings about themselves and their diet. For example, one study showed that higher perceived control over food preparation was found to improve participants' diet score.[43] Both stress[32] and

distress levels of participants were relevant, with high distress lowering diet scores considerably.[42] Depression was measured in two studies, as it is often intertwined with levels of social support.[36,40] Overall, many variables were found to be important in the analysis of social support and diet, with each study having a unique set of possible confounding variables. Even among this broad base of literature, there may have been other factors that were unaccounted for in the study designs. In the cross-sectional study, the authors noted that variables such as culture and religion may confound the results, but are very difficult to measure.[36] Thus, each study has its strengths in its wide variety of adjusted variables, but is limited by its unknown confounding variables.

Review of Methodology

Most of the studies assessed in the second part of the literature review were cross-sectional in design, measuring diet quality and social support at a single point in time.[35,36,38-40,42-46] As such, there was little follow-up data available and no data regarding causation. Sampling methods frequently consisted of convenience samples or voluntary participation from clinics or community programs, which can reduce the diversity of the samples. Two studies utilized participants who had already been recruited to a larger trial.[33,48] Few studies utilized probability sampling techniques,[32,38,39] as most drew from populations that were likely to meet their selection criteria. The criteria to participate in these studies varied greatly. Four of the studies only recruited pregnant women.[33,40,42,45] Another five focused on the elderly population, especially those with comorbidities.[35-37,39,48] Finally, two studies reported on adults who were relatively disease-free.[32,38]

The scales used to measure diet quality were similar to those in the first group of

studies. Most studies utilized a validated FFQ to accumulate participants' food data, then converted the information into diet quality scores, such as the DQI,[33,40,42,47] MDS,[32] DASH score,[38] or AHEI.[32,46] Social support was most commonly measured by validated questions that were part of a larger survey. Other standalone measurement scales included the Oslo Social Support Scale,[38] the ENRICHD study's Social Support Index,[32] and the Practitioner Assessment of Network Type.[35] The ENRICHD scale has excellent reliability and validity, but only among patients with coronary heart disease.[50] The Practitioner Assessment of Network Type is considered to be a valid scale, but little data exists regarding its reliability.[51]

To assess the correlations between variables, a variety of statistical tests were utilized. For univariate analyses between social support and diet alone, commonly used tests included Pearson's chi-squared test[40,42,43,45,47] and ANOVA.[36,38,44] Nearly every study used multiple linear regression[32,35,46,48] or multiple logistic regression[33,36,39] for the multivariate analysis. Additionally, two studies used path analysis to explore the relationships between many variables.[42,43] All studies except one used $p < 0.05$ as the level of statistical significance, with the other using $p < 0.2$.[33] Each study was powered at 80%, except for one which had 90% power.[43] Sample sizes ranged from 37 for the qualitative study[37] to 9223 for a large cross sectional study.[38] The majority of studies had a sample size between 100-500 participants.

2.4 Conclusions

In summary, there has been a great deal of research performed on primary prevention of stroke with diet. Data regarding the role of diet in secondary prevention,

however, are not sufficient. At this time, research supports that that a high quality diet and adherence to the Mediterranean and DASH diets may prevent stroke incidence.[17] This underlines the need for dietary modification following stroke in order to reduce the risk of recurrences.

This literature review demonstrated that the effect of social support on diet quality is not consistent among studies. Some articles report a positive correlation, while some report no effect at all. The impact of social support on diet quality has never been explored in the population of stroke patients. With more information about the association between these variables among stroke survivors, new avenues for stroke prevention can be explored. Confounding variables such as socioeconomic status and comorbid conditions have been assessed in many studies, yet systematic reviews still recognize gaps that must be addressed. For example, lifestyle factors and food preparation variables, such as assistance with cooking, were not accounted for in most studies. These factors may mediate the relationship between social support and diet quality, but the association has not yet been explored. The proposed study intends to fill this gap and contribute to a more comprehensive base of knowledge for the assessment of diet quality in stroke patients and prevention of recurrent stroke.

Table 1. Summary of Findings – The effect of diet on stroke prevention

Author/Year	Study Design	Population	Significant Findings
Apostolopoulou, 2012	Review	Recent articles assessing diet and stroke prevention	No studies assess secondary prevention of stroke as a primary outcome. The Mediterranean and DASH diets appear to aid in stroke prevention.
Boden-Albala, 2015	Review	Recent articles that explore the effect of diet on stroke prevention	DASH and Mediterranean diets appear to reduce stroke incidence. Strong data for a preferred dietary pattern does not yet exist.
Corella, 2013	RCT	Adults with the TCF7L2-rs7903146 genetic polymorphism in the PREDIMED study	Prevalence of stroke was three times higher in the high-risk participants following control diet, compared to those in the Mediterranean diet group. Nearly equivalent prevalence of stroke in high risk and low risk participants in the Mediterranean diet group, but data were insignificant.
Estruch, 2013	RCT	Men 55-80 and women 60-80 without cardiovascular disease but at high risk	The Mediterranean diet supplemented with olive oil group had a 33% stroke risk reduction; Mediterranean diet supplemented with nuts had a 46% risk reduction; Mediterranean diet groups combined had a 39% risk reduction, compared to control diet.
Gardener, 2014	Prospective cohort	Residents of Northern Manhattan over 40 years old with no history of stroke	Greater adherence to Mediterranean diet was inversely associated with being in 75th percentile of plaque thickness; top quintiles of diet scores had lower total carotid plaque area than lower diet score groups. Diet score was not associated with plaque presence.
Hansen, 2016	Prospective cohort	Men and women age 50-64 living in Denmark	14% reduced risk of total stroke among high adherers to Nordic diet; insignificant reduction in risk of ischemic stroke among high adherers.
Hlebowicz, 2013	Prospective cohort	Men born 1923-45 and women born 1923-50 living in Malmo, Sweden with no cardiovascular history or diabetes diagnosis	Men with a high quality diet had a CV event incidence 40% lower than those with a low quality diet; Women with a high quality diet had a 34% reduction in CV event incidence. Stroke incidence was not specifically reported and was part of total cardiovascular event incidence.
Hookway, 2014	Review	Systematic reviews and RCTs regarding nutrition and secondary stroke prevention	Notable finding: tailored management of diet following stroke leads to greater improvements in diet and stroke risk factors; stroke recurrence and mortality benefits have not been assessed at this time.
Kastorini, 2011	Case-control	Patients with first acute coronary syndrome or acute stroke matched with healthy controls	Greater adherence to Mediterranean diet was associated with lower stroke risk. Each point increase in MDS corresponded with a 12% stroke risk reduction.

Kontogianni, 2014	Review	Observational studies and RCTs published before May 2014 regarding dietary patterns and stroke risk	Mediterranean diet and DASH diet likely confer a reduced risk of stroke and reduced mortality.
Lakkur, 2015	Review	Articles assessing utility of Mediterranean Diet	Few trials evaluate the Mediterranean Diet's effect on stroke as a primary outcome. Many prospective studies were assessed, where residual confounding may color results. Little data exists about diet quality's relationship to stroke subtype.
Larsson, 2016	Prospective cohort	Swedish adults age 45-83 with no stroke history	14% reduction in ischemic stroke risk among the highest DASH quartile, when compared to the lowest quartile; 7% reduction in ischemic stroke risk with each five-point increase in DASH score.
Lau, 2015	Prospective cohort	Patients with history of stable coronary artery disease	A high MDS score confers about half the risk of stroke in this population, compared to a lower score. High MDS was associated with lower blood pressure variability.
Li, 2011	Cross-sectional	Chinese adults over 45 years	Participants following a Western diet had the highest prevalence of stroke. With adjustment, the northern Chinese diet pattern (OR 1.82) and the Western diet pattern (OR 1.39) conferred an increased risk of stroke, compared to the southern Chinese diet pattern.
Lim, 2011	Case-control	Korean patients with first stroke matched with controls	Participants with stroke had a lower DQI score and less dietary diversity than controls.
Long, 2014	Prospective cohort	Adults age 40-69 with newly diagnosed diabetes	Diet improvement (reduction in calorie intake, reduced fat intake, increased fiber intake, increased fruit and vegetable intake) did not significantly affect stroke risk.
Niknam, 2015	Case-control	Cases of first stroke matched with healthy controls	Those with high DASH scores were 48% less likely to have a stroke than low scoring participants; top quartile had 15% lower stroke risk than lowest quartile.
O'Donnell, 2016	Case-control	Cases of acute first stroke matched with healthy controls	All regions, except south Asia, had a lower stroke risk with higher AHEI scores; highest tercile of AHEI scores had a 40% risk reduction. South Asian participants with high AHEI scores had a higher stroke risk.
Prabhakaran, 2014	Review	Studies assessing stroke risk factor management	DASH and Mediterranean diets appear to reduce stroke incidence. There is no data for secondary prevention of stroke and preferred diet.
Salehi, 2013	Review	Cohort studies of DASH diet and cardiovascular risk	Analysis of three cohort studies together showed 19% reduction in stroke risk when closely following DASH diet.
Sherzai, 2012	Review	Epidemiological studies of stroke, food groups, and dietary patterns	Existing data support that DASH and Mediterranean diets are superior in decreasing stroke risk.

Sherzai, 2015	Review	Recent articles related to stroke risk factors	The PREDIMED trial provides strong data for use of the Mediterranean diet; there is no data available for dietary patterns and secondary prevention of stroke.
Stricker, 2013	Prospective cohort	Dutch men and women age 20-69, no history of myocardial infarction or stroke	Principal component analysis: the group with the highest prudent diet adherence had a 40% stroke risk reduction, and the Western diet group had 49% risk increase, when adjusted for age and gender. K-means cluster analysis: 27% reduction in stroke risk with prudent diet.
Tektonidis, 2015	Prospective cohort	Swedish women born 1914-1948 with no history of cancer	Highest quartile of MDS had 23% stroke risk reduction when adjusted for age and 22% reduction when adjusted for all other variables; each MDS point increase conferred a 6% risk reduction.
Tikk, 2014	Prospective cohort	German men age 40-64 and women age 35-64	Among men, a healthy DASH diet score conferred a 32% stroke risk reduction; there was no association between DASH score and stroke risk in women.
Tsivgoulis, 2015	Prospective cohort	U.S. adults without stroke history	22% reduction in ischemic stroke risk among those in highest tercile of MDS score, but statistics became less significant (p=0.057) after adjustment for covariates.
Yau, 2010	Case-control	Cases of first stroke matched with healthy controls	Odds ratio for stroke among those following Mediterranean diet is significantly lower (OR 0.18) than those not adhering to the diet; Odds ratio of ischemic stroke was 0.09 for participants following Mediterranean diet.

Table 2. Summary of Findings – The effect of social support on diet quality

Author/Year	Study Design	Population	Significant Findings
Ferranti, 2013	Prospective cohort	Healthy adults working at a university health center	The group reporting high social support had higher diet quality scores than the low support group, as measured by AHEI (15.3% higher), MDS (10.9% higher), and DASH score (12.9% higher). 93% reported high social support, so there were few low support participants for comparison.
Foreyt, 2006	Review	N/A	Sources of support maintain motivation to follow a healthy diet. Supporters serve as role models and help patients overcome challenges that they face when implementing lifestyle modification.

Fowles, 2011	Cross-sectional	Low-income pregnant women in their first trimester in central Texas	Positive simple correlation between social support and diet quality. Insignificant direct effect of social support on diet quality in path model; significant indirect effect of social support on eating habits.
Fowles, 2012	Cross-sectional	Low-income pregnant women in their first trimester in Austin, Texas	High social support from others was correlated with better diet quality. There was no correlation between partner support and diet quality.
Harley, 2006	Prospective cohort	Low income pregnant women of Mexican descent enrolled in prenatal care in California	Women who had grown up in Mexico and reported high social support had a diet 1.4x better than their low social support counterparts. Women with U.S. childhood and high social support had diet 2.3x better, but this was statistically insignificant.
Harrington, 2011	Cross-sectional	General population of Ireland	Men with low social support had a lower DASH score, but upon adjustment for variables, the association became insignificant. Social support did not affect diet quality among women.
Hartman, 2015	Cross-sectional	Low-income, overweight African American women	Higher levels of social support had an insignificant negative association with diet quality.
Hurley, 2005	Cross-sectional	Women with low-risk singleton pregnancies	No association between social support and dietary intake or quality.
Kim, 2016	Cross-sectional	Elderly adults with low SES in South Korea	A small social network and few contacts are associated with a 14.5% lower quality diet than those with a large social network, as measured by the MAR. Among those who valued eating healthy food, small social networks had a diet 42.7% worse than large social networks.
Kimura, 2012	Cross-sectional	Japanese community dwelling adults age 65 or older	Eating alone was associated with a lower food diversity score, which implies a poor quality diet.
Lawrence, 2010	Cross-sectional	UK women attending baby clinics and children's play sessions	Weak association between social support for healthy eating and diet quality in both levels of educational attainment, but greater significance among high education attainers
Loeb, 2003	Qualitative	Older adults living with chronic illness	Diet quality was dependent on what spouses/significant others purchased at the store. Spouses help participants stick to their diet by not purchasing foods that they are not able to eat.
Nicklett, 2012	Prospective cohort	Community-dwelling women aged 65+ with a physical disability	Inconsistent associations between social support and diet quality. (E.g. Low satisfaction with help predicted increase in serum carotenoid levels; Leaving home less frequently predicted decrease.)

Pagan, 2013	Retrospective cohort	Puerto Rican university students that have completed their 1st or 2nd year, 21 or older	No association between social support and diet quality. Those with more social support were more likely to have someone to cook for them on a regular basis.
Shatenstein, 2004	Cross-sectional	Adults from Quebec, Canada, age 55-74	Men with the lowest social support had a lower diet diversity score than those with higher support. This association did not exist among women. There was no association between diet quality score and social support in either men or women.
Townsend, 2005	Cross-sectional	Low-resource women living in low-income communities	Social support was not associated with any indicators of diet quality and was deleted from the tool to evaluate diet.

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CHAPTER 3
METHODS

3.1 Study Design

This will be a cross-sectional study of patients who have recently had an ischemic stroke. The patients will be recruited from the Yale New Haven Hospital Stroke Center. Data collection will occur during the hospitalization for the stroke.

3.2 Population and Sampling Methods

The population of this study will be patients who have had an ischemic stroke in the past seven days. We will use a convenience sampling method to obtain study participants from Yale New Haven Hospital (YNHH) who are admitted to the stroke service. Patients will be included if they have had an ischemic stroke within the past seven days, can provide consent to participate in the study, and were independent prior to the stroke, as indicated by a modified Rankin scale (mRS) score of 0-2. Ischemic stroke will be defined according to the American Heart Association criteria, which establishes that ischemic stroke is an episode of neurologic dysfunction due to brain, spinal cord, or retinal cell death attributable to ischemia, based on neuropathological, neuroimaging, and/or clinical evidence of permanent injury.[1] Exclusion criteria include patients who have had a transient ischemic attack (TIA) or hemorrhagic stroke, those who cannot provide informed consent (e.g. aphasic or comatose patients), and patients screening positive for dementia on the six-item cognitive impairment test (6CIT)[2] or with a dementia diagnosis. Full inclusion and exclusion criteria are found in Table 3.

Table 3. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Confirmed ischemic stroke, per AHA definition Stroke occurred < 7 days ago Able to provide informed consent to participate in the study Living independently prior to stroke, or with minor disability as measured by mRS ≤ 2	Hemorrhagic stroke or TIA Stroke occurred > 7 days ago Unable to provide informed consent to participate in the study (e.g. aphasic or cognitively impaired) Dementia (diagnosed or positive screen) Unable to take food by mouth (e.g. requiring a feeding tube) Significant disability prior to stroke (mRS > 2)

3.3 Subject Protection and Confidentiality

This study will be approved by the Yale School of Medicine Institutional Review Board (IRB) prior to its initiation. Each member of the research staff will have completed the human subject protection training and HIPAA training prior to protocol submission. If any financial or non-financial conflicts of interest are held by any member of the staff, they will be disclosed to the IRB. We will complete the IRB Protocol Application form and submit it electronically to the online IRB system. Once approved, the study will begin recruitment.

This study will likely be eligible for expedited review, as it poses no more than minimal risk to participants. Along with the protocol application, we will submit a waiver of consent, as the study will not negatively affect the welfare or rights of participants. If the waiver is approved, patients will still consent to study participation, but a signed informed consent form will not be required. Participants will receive information about the purpose of the study and what their involvement entails. Each participant will review

the consent document, which can be found in Appendix A. The consent form explains the risks and benefits of the study. Because the study is based primarily on survey data, there is no physical risk in participation. However, although personal data will be kept strictly confidential, there is the possibility of a data breach and release of personal information. There are no personal benefits to the participants, but they will be informed that they are assisting in improving knowledge about stroke recurrence reduction. Additionally, they will receive a gift certificate redeemable for a meal at the YNHH cafeteria.

As there is minimal privacy risk in this study, we will also submit a waiver of HIPAA authorization, with a plan in place to keep protected health information confidential. Participants will be assigned a study ID that will take the place of any personal identifiers on any study documents. A file linking the patient's medical record to the study ID will be created. The key containing the study IDs and the corresponding participant data will be stored on a password-protected computer located in the office of the principal investigator (PI). Only the PI and research assistants will have access to this file. Health information obtained from the medical record will include the patient's date of birth and details of their stroke diagnosis (e.g. stroke subtype, NIH stroke scale at presentation, location of stroke, date of occurrence). These data will be strictly confidential and will not be released to any outside sources. All medical information will be de-identified. Data that are reported in the publication will be anonymous. All survey data will be directly entered by the research assistant into a secure, password-protected REDCap database using an iPad.

During the consent process, patients will be notified that their participation is voluntary and they may end their participation at any time. On the informed consent

form, they will be provided with the phone number of the principal investigator and the Yale Privacy Officer if they have any questions about the study or the research process.

3.4 Recruitment

Subjects will be recruited from the YNHH inpatient stroke service. The PI will conduct a daily review of the overnight admissions to the stroke unit. Patients with a confirmed ischemic stroke who are likely to meet eligibility criteria (e.g. no known history of dementia, not aphasic) will be approached for an in-person screening interview. A research assistant will review the purpose of the study, assess the participant's interest in participation, and conduct a preliminary screen to determine the patient's eligibility and review the consent form. The preliminary screen will include a confirmation of the patient's stroke, the 6CIT dementia screen, and an assessment of pre-stroke function and disability, as measured by the mRS. These preliminary screening tools can be found in Appendix B. If the patient screens positive for dementia or is unable to provide informed consent due to cognitive impairment or aphasia, they will not continue with the study. Eligible patients that agree to participate will be asked to review the consent document. After this, the research assistant will proceed with data collection. This may occur at any time within a week of admission. All data collection will take place while the patient is still hospitalized. Recruitment will continue in this fashion until the adequate sample size of 241 is reached (see sample size calculation below).

3.5 Study Variables and Measures

Predictor Variable

The main predictor variable in this study is the level of social support. This will be measured within one week of stroke. Social support will be measured by the Multidimensional Scale of Perceived Social Support (MSPSS).[3] This is a standardized scale that consists of 12 questions regarding social support from family, friends, and others. Data show that this scale has good validity and internal reliability across diverse populations, including healthy adults, pregnant women, children, and adolescents.[4,5] Patients respond using a Likert scale, with values of 0-7. These responses are totaled and divided by 12 to determine the final score, which will be a continuous variable between 0 and 7.[3] A copy of this scale can be found in Appendix C.

Study Outcomes

The primary outcome variable in this study is diet quality. This will be measured within one week of stroke occurrence, but will reflect the participant's diet in the two weeks preceding the stroke. To assess diet quality, the participant will complete a standard 125-item food frequency questionnaire (FFQ), which can be found in Appendix D. Participants will be asked to complete these questions based on their diet in the two weeks prior to their stroke. This FFQ has been validated in several large studies.[6-8] FFQs will be sent to the Fred Hutch Nutritional Assessment Center for analysis. The center will return nutritional analysis and nutrient intake for participants.

These results will then be translated into an AHEI-2010 score, which is a recent update of this standardized scale. This score reflects adherence to U.S. dietary guidelines and is based on food and nutrients that predict risk of chronic disease.[9] It has been found to be reliable among diverse populations, is valid, and can detect meaningful differences

in diet quality.[10] To determine the patient's score, the number of daily servings of each food group is totaled. Food groups include whole fruits, vegetables, whole grains, and dairy. The FFQ analysis will determine the average number of servings of each group that the participant eats per day. Unhealthy foods, such as empty calories and refined grains, are also considered in the final score. For these groups, low intake, which is preferred, leads to a higher awarded point value. For example, a patient whose diet contains less than 19% of empty calories will receive the highest point value for that category.[11] The score for each participant will be calculated using the Stata software program. The AHEI scores will be continuous from 0 to 100, with 100 being the best quality diet. Higher scores are associated with lower risk of chronic disease (e.g. diabetes and heart failure) and cardiovascular mortality.[9]

Covariates

The sociodemographic variables recorded will include age, sex, race, ethnicity, marital status, household income, and educational attainment. These variables will be operationalized in several ways. Age will be a continuous variable. Sex will be dichotomous: male or female. Race will be categorized into five groups: white, black, Asian, Native Hawaiian/Pacific Islander, and American Indian/Alaska Native. Groups may be consolidated after data collection, based on the number of participants who fall into each category. Ethnicity will be a dichotomous variable: Hispanic or non-Hispanic. Marital status will be categorical: single (never married), married, separated/divorced, or widowed. Household income will be separated into five categories: < $25,000/year, $25,000-$50,000/year, $50,000-$75,000/year, $75,000-$100,000/year, and >

$100,000/year. Education will be also be a categorical variable with five options: less than high school, high school graduate, some college (no degree), college degree (Associate's or Bachelor's), and postgraduate degree (Master's, Ph.D., or other).

The interview will include an assessment of comorbid conditions. The patient will be asked if they have any of the following conditions: hypertension, diabetes mellitus, atrial fibrillation, coronary artery disease, peripheral vascular disease, congestive heart failure, carotid artery disease, prior stroke, prior myocardial infarction, and hyperlipidemia. Comorbid conditions will be translated into categories: 0 comorbidities, 1-2 comorbidities, 3+ comorbidities. The tool to collect information about sociodemographic data and comorbid conditions can be found in Appendix E.

The patient's pre-stroke functional status will be determined during the preliminary screen. Functional status will be measured using the modified Rankin scale, which gives a score of 0-6 based on the patient's level of disability. As this variable is measured in whole numbers only, it will be considered a categorical variable with values from 0-2, as participants with scores above 2 will be excluded.

Effect Modifiers

There are several variables that may lie on the causal pathway between social support and diet quality. Possible effect modifiers include eating out of the home and assistance with grocery shopping, cooking, and meal planning. The association between diet and social support may be mediated by assistance with these diet-related behaviors. An example of effect modification is the association between high levels of social support and high diet quality that may only be present in those who rarely eat out of the

home. In those who eat out of the home regularly, there may be no association between social support and diet quality.

A survey to assess these effect modifiers will be created for this study and administered during the interview, with questions regarding diet-related behaviors. Responses will be categorized into three separate groups to determine the amount of help that patients receive: little assistance, moderate assistance, and high assistance. Additionally, some questions on the survey will assess frequency of eating out of the home. Responses will be categorized into three groups: eats out of the home frequently, eats out of the home sometimes, and eats out of the home rarely.

To develop this survey, we will begin by conducting cognitive interviews with the first 25 participants that are enrolled in the study. Research assistants will be trained in cognitive interviewing prior to initiation of the study. These interviews will assess the participants' comprehension of the survey questions and establish the range of responses that should be included in the final version of the survey.[12] For example, when a participant responds to a question, the research assistant will ask the participant what the key terms in the question mean to them. This will allow us to determine if terms such as "meal planning" are understandable to the participant. Then, the participant will be asked why they answered the question in that manner and if the question was difficult to answer. This will help us assess if the question is worded clearly. With this data, we can further develop an accurate survey to assess diet-related behaviors. Examples of these preliminary survey questions and prompts for cognitive interview questions can be found in Appendix F. Once these interviews are complete, we will edit the survey questions based on the responses. The next 25 participants enrolled in the study will pilot the

revised version of the survey. We will confirm that these participants provide an appropriate range of responses to the questions. This will ensure that the answer choices reflect a wide range of patient experiences and are accurately measuring assistance with diet-related behaviors.

3.6 Data Collection

Data will be collected by research assistants administering surveys and entered directly into the REDCap database on the study iPad. A short form to record sociodemographic characteristics and comorbidities and a survey to assess diet-related behaviors will be created specifically for this study. The social support survey is a standardized tool that has been used in many other studies to measure support. Diet quality data will be collected with a standardized, self-administered FFQ. These data will be translated into an AHEI-2010 score, as described in the previous section.

3.7 Sample Size

The desired sample size for this study will be 241. This is based on results of the cross-sectional sample size calculator from OpenEpi.[13] The study will be powered at 80%. Two-sided significance will be set at 95%, so p values less than 0.05 will be considered statistically significant. The ratio of participants with low social support to those with high social support varied from 0.1 to 0.5 in studies conducted among elderly Asian patients and working adults in Ireland, Canada, and the U.S.[14-19] The average value of this ratio among these studies was estimated to be 0.3. Using data from the literature review, the percentage of participants with low social support and a high quality diet was

estimated.[17,20] One study reported the number of patients in the high quality diet group with poor support. I divided the number of participants in this group (22) by the total number of study participants (218), which provided a result of 10%.[17] The other study provided a value of 20%,[20] so the average percentage of participants with low support and a high diet quality was estimated to be 15%. Finally, I repeated this process to find the percentage of patients with high social support and a high quality diet, which was estimated to be about 35%.[17,20] Using these values, a sample size of 241 will be sufficient to power the study at 80%. Sample size calculation can be found in Appendix G.

3.8 Statistical Analysis

Descriptive characteristics of the participants, including age, sex, race, and sociodemographic variables, will be reported as means with standard deviations. Social support will be a continuous variable with values between 0 and 7. Diet quality will be reported as an AHEI score between 0 and 100. We will use Pearson's correlation to find the relationship between these two continuous variables. This assumes that diet quality is normally distributed among the population. We will next perform a univariate linear regression with social support as the predictor and AHEI as the outcome.

Next, a multivariate linear regression will be performed to control for the following sociodemographic characteristics: age, sex, race, ethnicity, marital status, household income, and educational attainment (Model 1). Additional variables that will be adjusted for in Model 2 include the following: the variables in Model 1, the number of comorbidities, pre-stroke functional status, and level of assistance with diet-related

behaviors. We will use a multiple linear regression model, again assuming that the outcome will be normally distributed.

Finally, a mediation analysis will be performed to assess the role of diet-related behaviors in the pathway between social support and diet quality. To perform this analysis, we will use a multi-step linear regression with significance examined at each step.[21] The univariate linear regression of the effect of social support on diet quality, as described above, will be the first step. Then, a simple linear regression will be performed with social support as the predictor and the first diet-related behavior, such as assistance with cooking, as the outcome. The next simple linear regression will use cooking as the predictor and diet quality as the outcome. These simple regressions establish that there are significant relationships between the variables on the pathway and allow us to proceed to the final step, which is a multiple linear regression with social support as the predictor, assistance with cooking as an adjustment variable, and diet quality as the outcome. If social support no longer significantly predicts diet quality when assistance with cooking is controlled for, then cooking fully mediates the relationship. If both variables are still significantly associated with diet quality, then cooking is a partial mediator of the relationship. This implies that although the diet-related behavior mediates the relationship, social support itself still has a significant effect on diet quality.[21] This stepwise process will be repeated for each diet-related behavior variable.

3.9 Timeline and Resources

This study will take over one year to complete. YNHH discharged over 800 patients with ischemic stroke from the York Street and Saint Raphael's campuses in the

year 2015, or about 67 patients per month. If half of these patients are eligible for the proposed study (about 33 patients per month) and half of the eligible participants consent (about 16 patients per month), the study will take approximately 15 months to complete. The study will conclude when each enrolled participant completes their interview.

This study will be completed with available resources. Research assistants will be employed to interview patients and analyze data. Participants will be provided with a meal coupon for completion of their interview. The cost of establishing an account with the Fred Hutch center, which will perform FFQ analysis, is $100. Each FFQ booklet is $0.75 and it costs $6.80 to process each one, which is a total cost of $1,819.55. The fees for using the REDCap service are approximately $100 per month and the cost of an iPad for data entry is $429. Finally, general office materials such as paper, printer ink, and mailing supplies will be a moderate cost to the study.

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CHAPTER 4
CONCLUSIONS

4.1 Advantages and Disadvantages

The first major advantage of this study is that it is a novel research question. Stroke patients have never been assessed for the effect of social support on diet quality. Although other studies have assessed these two variables together, they have not been measured in this specific population. The association between social support and diet quality has been inconsistent in research thus far, so this study will add to existing knowledge regarding this relationship. Few studies have examined the linear relationship between level of social support and diet quality. This study will analyze the data to determine if the variables are positively correlated, with high levels of social support predicting high diet quality. This information will allow providers to assess their patient's social support and possibly predict that patient's diet quality. Additionally, the proposed study will provide more information about stroke survivors' level of social support, as little information on this topic exists.

Another advantage of this study is its assessment of diet-related behaviors, such as cooking and shopping. These variables add another layer of complexity to the data and allow us to learn more about why patients eat the way that they do. Prior studies of diet quality and social support have not assessed these behaviors as possible mediating variables. They will likely provide a great deal of insight into a patient's diet quality and the barriers to dietary modification following a stroke.

Finally, this study will not require a great deal of resources and can be conducted

among a population that is easily accessible. A large amount of data can be collected quickly and easily. Data will be collected only once, so there will be no loss to follow-up.

Disadvantages to this study include the cross-sectional design, which does not provide information about causation or temporality. With data collection closely following the incident stroke, changes in social support due to any resulting disability will not have occurred yet. Additionally, the dietary assessment will reflect the patient's pre-stroke diet. We are ultimately interested in how social support affects the diet quality following stroke, so these variables will contribute to existing knowledge but cannot precisely assess this relationship. However, we are accessing a convenience sample that will allow us to obtain preliminary data to inform future interventions. We could survey participants three months after their stroke in order to obtain more data regarding these variables, but we are concerned that many patients may not attend stroke clinic, which would lead to sampling bias. Thus, with this study design, we can capture a greater majority of patients for our sample.

Unknown confounding variables may alter the results and lead to biased outcomes. Another potential source of bias is the information reported in the FFQ. Due to social desirability to eat healthy foods, it is possible that patients will report a higher intake of nutritious foods and a lower intake of unhealthy foods. This may lead to overestimation of the quality of the diet. In addition, memory deficits may follow the stroke and lead to reduced accuracy of diet reporting.

Finally, the generalizability of this study is limited. Because it is taking place in the Northeast, the data will be most applicable to this area, as dietary patterns vary in different regions of the country.[1] Since the study is being conducted among stroke

survivors, the data will only be applicable to this group.

After the initial study is completed, if results are significant, repetition would be useful to account for some of these disadvantages. For example, the study could be conducted in different areas of the country to see if the results remain the same, or if different dietary patterns lead to altered results. If the study identifies other possible confounding variables, they can be controlled for in future iterations. Additionally, a similar study design repeated months after the incident stroke would be useful in the assessment of changes in social support level following the stroke. This information paired with evaluation of changes in dietary quality would contribute to knowledge about the influence of social support on diet quality after stroke.

4.2 Clinical Implications

The goal of this study is to learn about the relationship between social support and diet quality among stroke survivors and to assess the role of diet-related behaviors. By doing so, we will learn if there is a linear relationship between social support and diet, with participants with the highest levels of social support also having the highest quality diet. If this relationship exists, we can screen stroke survivors for social support levels and make predictions about what the quality of their diet will be when they leave the hospital. Those who have low levels of social support can receive additional support, whether it is from a group of survivors or community members. Additionally, these patients may benefit from more assistance with planned dietary interventions. This may be in the form of increased diet education or consultations with a nutritionist. These targeted interventions may lead to improved diet quality and better outcomes. With the

increased amount of information regarding social support, clinicians will be able to predict which patients will need more guidance regarding nutrition and request additional assistance.

By improving the diet quality of stroke survivors, the rate of stroke recurrence may decrease. At this point, dietary interventions are recommended for patients who have had a stroke. For example, increasing fruit and vegetable intake and reducing red meat intake are both included in current guidelines for secondary prevention.[2] In addition, the Mediterranean diet and DASH diet have both been found to reduce the risk of stroke and cardiovascular events in a number of trials.[3-6] Reviews of existing data have endorsed the utility of tailored dietary interventions following stroke, noting that they may lead to greater improvements in diet quality.[7] By exploring the behaviors that enable patients to make these dietary changes, interventions can be implemented as needed. It may be possible to improve the diet quality of patients at a disadvantage, with the ultimate goal of reducing their risk of recurrent stroke. Assessment of the social factors that help patients adhere to their diet following their stroke can aid in the development of novel methods to prevent recurrent stroke and reduce mortality of survivors. Our next step, after completing this research, will be to design a dietary intervention for stroke survivors for the secondary prevention of stroke that includes family members, caregivers, and spouses.

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APPENDIX A: Participant Consent Form

Consent for Participation in a Research Project
200 FR 2 (2014-2)
The Impact of Social Support on Diet Quality In Stroke Survivors
Sarah Rocks, PA-SII

Purpose:
You are invited to participate in a research study designed to examine your diet following your stroke. You have been asked to take part because you have recently been diagnosed with a stroke and meet the additional criteria for inclusion in this study.

Procedures:
If you agree to take part, your participation in this study will involve completing an interview with a research assistant and a survey about the foods that you eat. Additionally, the research staff will ask you about the details of your stroke and medical conditions that you may have. We anticipate that your involvement will require 1-2 hours of your time. You will receive a meal coupon for the Yale New Haven Hospital cafeteria for completing the study.

Risks and Benefits:
You may feel uncomfortable with the nature of some questions, such as those regarding your income and education. There are no physical risks associated with this study. However, there is the possible risk of loss of confidentiality. Every effort will be made to keep your information confidential; however, this cannot be guaranteed. Although this study will not benefit you personally, we hope that our results will add to the knowledge about preventing stroke recurrence.

Confidentiality:
All of your responses will be confidential. Only the researchers involved in this study and those responsible for research oversight will have access to any information that could identify you. Your personal information and survey responses will be coded with a number instead of your name or any other identifiers. The key that matches this number with your name will be stored on a password-protected computer. Any hard copies of this data will be stored in a locked file cabinet in the office of the principal investigator. Only the research team will have access to this data. When we publish any results from this study we will do so in a way that does not identify you.

Except as permitted by law, your health information will not be released in an identifiable form outside of the Yale University research team and collaborating researchers' institution. Examples of information that we are legally required to disclose include abuse of a child or elderly person, or certain reportable diseases. Note, however, that your records may be reviewed by those responsible for the proper conduct of research such as

the Yale University Human Research Protection Program, Yale University Human Subjects Committee or representatives of the U.S. Department of Health and Human Services. The information about your health that will be collected in this study includes: the date of your stroke, type of stroke, and functional outcome after stroke, as reported by your neurologist. We will also ask you for information regarding other conditions you may have, such as hypertension, atrial fibrillation, or diabetes mellitus.

Information may be re-disclosed if the recipients are not required by law to protect the privacy of the information. At the conclusions of this study, any identifying information related to your research participation will be destroyed, rendering the data anonymous.

By signing this form, you authorize the use and/or disclosure of the information described above for this research study. The purpose for the uses and disclosures you are authorizing is to ensure that the information relating to this research is available to all parties who may need it for research purposes.

This authorization to use and disclose your health information collected during your participation in this study will never expire.

Voluntary Participation:
Your participation in this study is voluntary. You are free to decline to participate, to end your participation at any time for any reason, or to refuse to answer any individual question without penalty. Your decision whether to participate or not will have no effect your relationship with Yale New Haven Hospital or Yale University.

You may withdraw or take away your permission to use and disclose your health information at any time. You may withdraw your permission by telling the study staff. If you withdraw your permission, you will not be able to stay in this study. When you withdraw your permission, no new health information identifying you will be gathered after that date. Information that has already been gathered may still be used and given to others until the end of the research study, as necessary to insure the integrity of the study and/or study oversight.

Questions:
If you have any questions about this study, you may contact the principal investigator, Sarah Rocks, (203) 232-7398.

If, after you have signed this form you have any questions about your privacy rights, please contact the Yale Privacy Officer at 203-432-5919.

If you would like to talk with someone other than the researchers to discuss problems or concerns, to discuss situations in the event that a member of the research team is not available, or to discuss your rights as a research participant, you may contact the Yale University Human Subjects Committee, 203-785-4688, human.subjects@yale.edu. Additional information is available at http://your.yale.edu/research-support/human-research/research-participants

APPENDIX B: Preliminary Screening Tools

GIG CYMRU NHS WALES | Bwrdd Iechyd Hywel Dda Health Board

Six Item Cognitive Impairment Test (6CIT)

(6CIT - Kingshill Version 2000, Dementia screening tool)

Patient's Details:	**Date:** **Name of Assessor:**

Question	Score Range	Score
1. What year is it?	**0 – 4** Correct - 0 points Incorrect – 4 points	
2. What month is it?	**0 – 3** Correct – 0 points Incorrect – 3 points	
3. Give the patient an address phrase to remember with 5 components, eg **John, Smith, 42, High St, Bedford**		
4. About what time is it (within 1 hour)	**0 – 3** Correct – 0 points Incorrect – 3 points	
5. Count backwards from 20-1	**0- 4** Correct - 0 points 1 error – 2 points More than I error – 4 points	
6. Say the months of the year in reverse	**0- 4** Correct - 0 points 1 error – 2 points More than I error – 4 points	
7. Repeat address phrase **John, Smith,** **42, High St,** **Bedford**	**0 – 10** Correct - 0 points 1 error – 2 points 2 errors – 4 points 3 errors – 6 points 4 errors – 8 points All wrong – 10 points	
TOTAL SCORE	**0 – 28**	**/28**

Outcome from Score

0-7 = normal	**Referral not necessary at present**
8- 9 = mild cognitive impairment	**Probably refer**
10-28 = significant cognitive impairment	**Refer**

MODIFIED RANKIN SCALE (MRS)

Patient Name: _____
Rater Name: _____
Date: _____

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

TOTAL (0–6): _____

APPENDIX C: Social Support Scale

Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988)

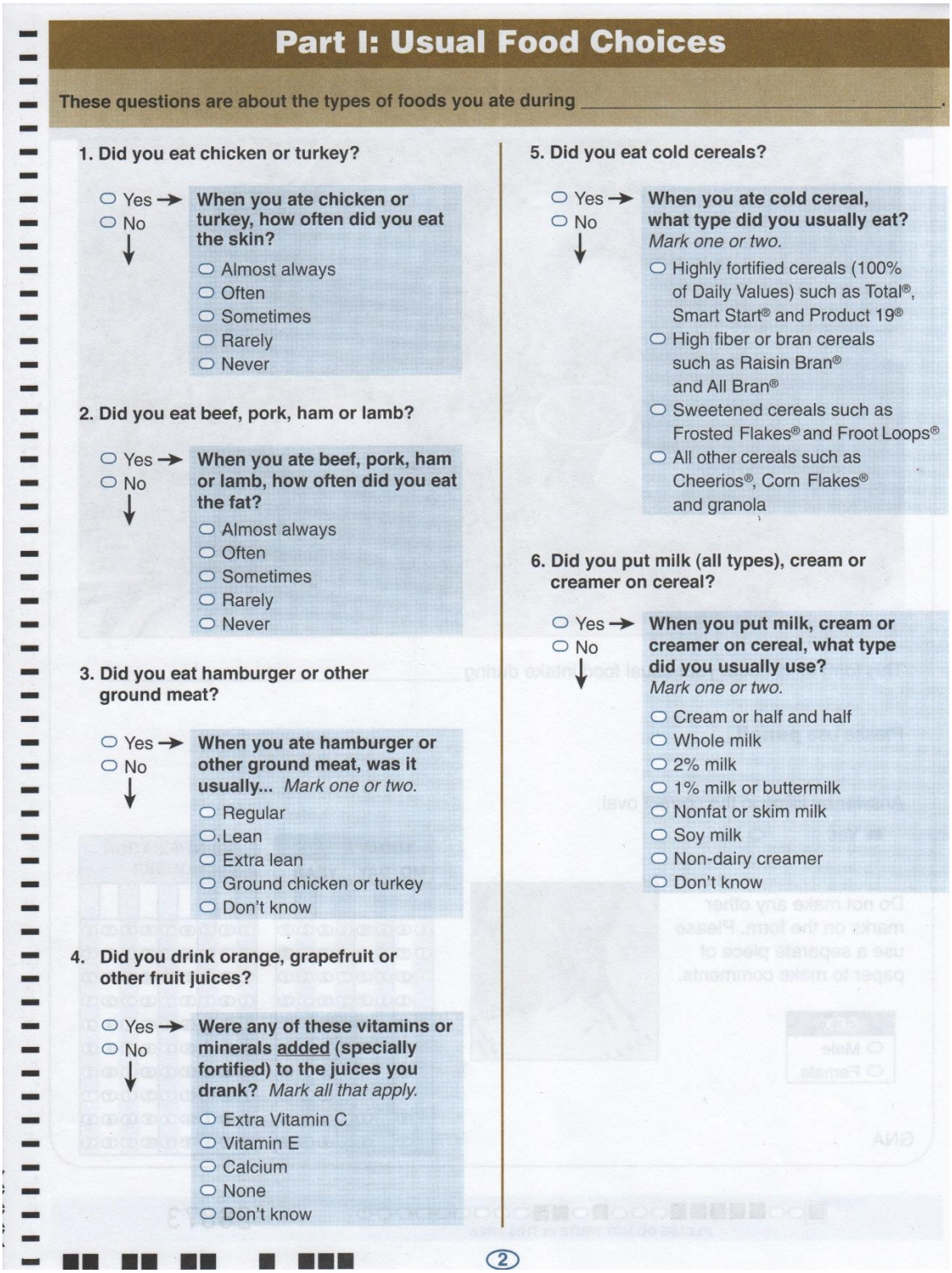
Instructions: We are interested in how you feel about the following statements. Read each statement carefully. Indicate how you feel about each statement.

Circle the "1" if you **Very Strongly Disagree**
Circle the "2" if you **Strongly Disagree**
Circle the "3" if you **Mildly Disagree**
Circle the "4" if you are **Neutral**
Circle the "5" if you **Mildly Agree**
Circle the "6" if you **Strongly Agree**
Circle the "7" if you **Very Strongly Agree**

1.	There is a special person who is around when I am in need.	1	2	3	4	5	6	7	SO
2.	There is a special person with whom I can share my joys and sorrows.	1	2	3	4	5	6	7	SO
3.	My family really tries to help me.	1	2	3	4	5	6	7	Fam
4.	I get the emotional help and support I need from my family.	1	2	3	4	5	6	7	Fam
5.	I have a special person who is a real source of comfort to me.	1	2	3	4	5	6	7	SO
6.	My friends really try to help me.	1	2	3	4	5	6	7	Fri
7.	I can count on my friends when things go wrong.	1	2	3	4	5	6	7	Fri
8.	I can talk about my problems with my family.	1	2	3	4	5	6	7	Fam
9.	I have friends with whom I can share my joys and sorrows.	1	2	3	4	5	6	7	Fri
10.	There is a special person in my life who cares about my feelings.	1	2	3	4	5	6	7	SO
11.	My family is willing to help me make decisions.	1	2	3	4	5	6	7	Fam
12.	I can talk about my problems with my friends.	1	2	3	4	5	6	7	Fri

The items tended to divide into factor groups relating to the source of the social support, namely family (Fam), friends (Fri) or significant other (SO).

APPENDIX D: Food Frequency Questionnaire



Part I: Usual Food Choices

These questions are about the types of foods you ate during _____.

1. Did you eat chicken or turkey?

- ○ Yes → **When you ate chicken or turkey, how often did you eat the skin?**
  - ○ Almost always
  - ○ Often
  - ○ Sometimes
  - ○ Rarely
  - ○ Never
- ○ No ↓

2. Did you eat beef, pork, ham or lamb?

- ○ Yes → **When you ate beef, pork, ham or lamb, how often did you eat the fat?**
  - ○ Almost always
  - ○ Often
  - ○ Sometimes
  - ○ Rarely
  - ○ Never
- ○ No ↓

3. Did you eat hamburger or other ground meat?

- ○ Yes → **When you ate hamburger or other ground meat, was it usually...** *Mark one or two.*
  - ○ Regular
  - ○ Lean
  - ○ Extra lean
  - ○ Ground chicken or turkey
  - ○ Don't know
- ○ No ↓

4. Did you drink orange, grapefruit or other fruit juices?

- ○ Yes → **Were any of these vitamins or minerals added (specially fortified) to the juices you drank?** *Mark all that apply.*
  - ○ Extra Vitamin C
  - ○ Vitamin E
  - ○ Calcium
  - ○ None
  - ○ Don't know
- ○ No ↓

5. Did you eat cold cereals?

- ○ Yes → **When you ate cold cereal, what type did you usually eat?** *Mark one or two.*
  - ○ Highly fortified cereals (100% of Daily Values) such as Total®, Smart Start® and Product 19®
  - ○ High fiber or bran cereals such as Raisin Bran® and All Bran®
  - ○ Sweetened cereals such as Frosted Flakes® and Froot Loops®
  - ○ All other cereals such as Cheerios®, Corn Flakes® and granola
- ○ No ↓

6. Did you put milk (all types), cream or creamer on cereal?

- ○ Yes → **When you put milk, cream or creamer on cereal, what type did you usually use?** *Mark one or two.*
  - ○ Cream or half and half
  - ○ Whole milk
  - ○ 2% milk
  - ○ 1% milk or buttermilk
  - ○ Nonfat or skim milk
  - ○ Soy milk
  - ○ Non-dairy creamer
  - ○ Don't know
- ○ No ↓

7. Did you put milk (all types), cream or creamer in coffee or tea?

- ○ Yes → **When you put milk, cream or creamer in coffee or tea, what type did you usually use?** *Mark one or two.*
  - ○ Cream or half and half
  - ○ Whole milk
  - ○ 2% milk
  - ○ 1% milk or buttermilk
  - ○ Nonfat or skim milk
  - ○ Soy milk
  - ○ Non-dairy creamer
  - ○ Don't know
- ○ No ↓

8. Did you drink milk (all types)? *Also include beverages made with milk, such as lattes, cappuccinos, mochas or hot chocolate.*

- ○ Yes → **When you drank milk or beverages made with milk, was it usually...** *Mark one or two.*
  - ○ Whole milk
  - ○ 2% milk
  - ○ 1% milk or buttermilk
  - ○ Nonfat or skim milk
  - ○ Soy milk
  - ○ Don't know
- ○ No ↓

9. Did you use salad dressing?

- ○ Yes → **When you used salad dressing, what type did you usually use?** *Mark one or two.*
  - ○ Regular, including oil and vinegar
  - ○ Low or reduced fat
  - ○ Fat free or nonfat
- ○ No ↓

10. Did you use mayonnaise?

- ○ Yes → **When you used mayonnaise, what type did you usually use?** *Mark one or two.*
  - ○ Regular
  - ○ Low or reduced fat
  - ○ Fat free or nonfat
- ○ No ↓

11. Did you eat cookies or cakes?

- ○ Yes → **When you ate cookies or cakes, how often were they fig bars, angel food cakes, or other types of low or nonfat cookies or cakes?**
  - ○ Almost always
  - ○ Often
  - ○ Sometimes
  - ○ Rarely
  - ○ Never
- ○ No ↓

12. In your household, what kinds of fat were usually used when cooking, for example to flavor vegetables or fry meat? *Mark up to four.*

- ○ Butter
- ○ Butter blended with oil or margarine
- ○ Stick margarine
- ○ Regular tub margarine
- ○ Diet or light margarine (tub or liquid)
- ○ Olive oil
- ○ Canola oil
- ○ Other oils such as corn, soybean, peanut and safflower
- ○ Lard, bacon fat or meat drippings
- ○ Didn't use fat or used non-stick spray (Pam®)

13. What kinds of fat did you use at the table, for example on breads, vegetables or potatoes? *Mark up to four.*

- ○ Butter
- ○ Butter blended with oil or margarine
- ○ Stick margarine
- ○ Regular tub margarine
- ○ Diet or light margarine (tub or liquid)
- ○ Olive oil
- ○ Sour cream
- ○ Didn't use fat

PLEASE DO NOT WRITE IN THIS AREA

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Part II: Usual Food Use

These questions are about foods you ate during _____

14. Mark the column to show how often, on average, you ate the following foods. Mark your usual serving size as small, medium or large.

- A small serving is about one-half (1/2) the medium serving size or less.
- A large serving is about one-and-a-half (1 1/2) times the medium serving size or more.

EXAMPLE: This person ate spaghetti with meat sauce every Saturday. They usually ate about 1 1/2 cups.

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Spaghetti, lasagna, and other pasta with tomato and meat sauce	○	○	○	●	○	○	○	○	○	1 cup	○	○	●

CEREALS, BREADS, SNACKS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Cold cereals	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Cooked cereals and grits	○	○	○	○	○	○	○	○	○	1cup	○	○	○
Milk on cereals	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Pancakes, French toast and waffles	○	○	○	○	○	○	○	○	○	2 pieces	○	○	○
Muffins, scones, croissants and biscuits	○	○	○	○	○	○	○	○	○	1 medium	○	○	○
White breads, including bagels, rolls and English muffins	○	○	○	○	○	○	○	○	○	2 slices or 1 medium	○	○	○
Whole grain breads and rolls	○	○	○	○	○	○	○	○	○	2 slices or 1 medium	○	○	○
Plain tortillas as a side dish (include flour and corn)	○	○	○	○	○	○	○	○	○	2 small or 1 medium	○	○	○
Cornbread and corn muffins	○	○	○	○	○	○	○	○	○	2 slices or 1 medium	○	○	○
Butter or margarine on breads, cereals, pancakes, etc.	○	○	○	○	○	○	○	○	○	2 pats or 2 teaspoons	○	○	○
Jam, jelly, honey, syrup and sugar (including in coffee, tea and cereal)	○	○	○	○	○	○	○	○	○	2 Tbsp.	○	○	○
Granola bars and cereal bars such as Nutri-Grain Bars®	○	○	○	○	○	○	○	○	○	1 bar	○	○	○
Sports or meal replacement bars such as Power Bars® and Clif Bars®	○	○	○	○	○	○	○	○	○	1 bar	○	○	○

CEREALS, BREADS, SNACKS (continued)

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Low or nonfat potato chips, tortilla chips, corn chips and pretzels	○	○	○	○	○	○	○	○	○	2 handfuls or 1 sm. bag	○	○	○
Regular potato chips, tortilla chips, corn chips and puffs	○	○	○	○	○	○	○	○	○	2 handfuls or 1 sm. bag	○	○	○
Plain popcorn (no butter) or lowfat microwave popcorn	○	○	○	○	○	○	○	○	○	4 handfuls	○	○	○
Buttered or regular microwave popcorn	○	○	○	○	○	○	○	○	○	4 handfuls	○	○	○
Low or nonfat crackers such as saltines	○	○	○	○	○	○	○	○	○	6 medium	○	○	○
Whole grain crackers such as Triscuits® and rye crispbread	○	○	○	○	○	○	○	○	○	6 medium	○	○	○
Regular crackers such as Ritz® and club crackers	○	○	○	○	○	○	○	○	○	6 medium	○	○	○
Peanut butter, peanuts and other nuts and seeds	○	○	○	○	○	○	○	○	○	2 Tbsp. (spreads) or 1/4 cup (nuts)	○	○	○

MEAT, FISH, EGGS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Eggs (egg substitute, mark "NEVER")	○	○	○	○	○	○	○	○	○	2 eggs	○	○	○
Bacon and breakfast sausage	○	○	○	○	○	○	○	○	○	3 strips or 2 links	○	○	○
Low or reduced fat hot dogs and sausage	○	○	○	○	○	○	○	○	○	1 hot dog or 2 ounces	○	○	○
Regular hot dogs and sausage such as bratwurst and chorizo	○	○	○	○	○	○	○	○	○	1 hot dog or 2 ounces	○	○	○
Lunch meats such as ham, turkey and lowfat bologna	○	○	○	○	○	○	○	○	○	2 slices	○	○	○
All other lunch meat such as bologna, salami and Spam®	○	○	○	○	○	○	○	○	○	2 slices	○	○	○
Canned tuna, tuna salad and tuna casserole	○	○	○	○	○	○	○	○	○	1/2 can tuna or 1 cup casserole	○	○	○
Beef, pork, ham and lamb	○	○	○	○	○	○	○	○	○	4 ounces	○	○	○
Ground meat, including hamburgers and meatloaf	○	○	○	○	○	○	○	○	○	1 medium patty or 3 ounces	○	○	○
Liver, chicken liver and organ meats	○	○	○	○	○	○	○	○	○	4 ounces	○	○	○
Fried chicken, including nuggets and tenders	○	○	○	○	○	○	○	○	○	1 large piece or 6 nuggets	○	○	○

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26873

MEAT, FISH, EGGS (continued)

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Chicken and turkey (roasted, stewed, grilled or broiled)	○	○	○	○	○	○	○	○	○	1 large or 2 small pieces	○	○	○
Fried fish, fish sandwich and fried shellfish (shrimp and oysters)	○	○	○	○	○	○	○	○	○	3 ounces or 1 sandwich	○	○	○
Shellfish, not fried (shrimp, lobster, crab and oysters)	○	○	○	○	○	○	○	○	○	3 ounces or ½ cup	○	○	○
White fish (broiled or baked) such as sole, halibut, snapper and cod	○	○	○	○	○	○	○	○	○	4 ounces	○	○	○
Dark fish (broiled or baked) such as salmon, mackerel and bluefish	○	○	○	○	○	○	○	○	○	4 ounces	○	○	○

SPAGHETTI, MIXED DISHES, SOUPS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Stew, pot pie, curries and casseroles with meat or chicken	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Chili with meat and beans	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Spaghetti, lasagna and other pasta with tomato and meat sauce	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Spaghetti and other pasta with tomato sauce (no meat)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Pasta with oil, cheese, or cream sauce, including macaroni and cheese	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Asian-style (stir-fried) noodles and rice such as chow mein, fried rice and Pad Thai	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Pizza	○	○	○	○	○	○	○	○	○	2 slices	○	○	○
Tofu, tempeh and products such as tofu hot dogs, soy burgers and tofu cheese	○	○	○	○	○	○	○	○	○	3 ounces, 1 hot dog or 1 burger	○	○	○
Burritos, tacos, tostadas and quesadillas	○	○	○	○	○	○	○	○	○	1 medium	○	○	○
Enchiladas and tamales	○	○	○	○	○	○	○	○	○	1 medium	○	○	○
Vegetable, minestrone and tomato soup	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Cream soups such as chowders, potato and cheese	○	○	○	○	○	○	○	○	○	1 cup	○	○	○

SPAGHETTI, MIXED DISHES, SOUPS (continued)

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Bean soups such as pea, lentil and black bean	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Miso soup	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Ramen noodle soup	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Other soups such as chicken noodle	○	○	○	○	○	○	○	○	○	1 cup	○	○	○

DAIRY PRODUCTS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Cottage cheese and ricotta cheese	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Low or reduced fat cheese, including cheese used in cooking	○	○	○	○	○	○	○	○	○	1 slice or 1/4 cup shredded	○	○	○
All other cheese (American, cheddar or cream), including cheese used in cooking	○	○	○	○	○	○	○	○	○	1 slice, 1/4 cup shredded or 2 Tbsp. cream	○	○	○
Yogurt, all types except frozen	○	○	○	○	○	○	○	○	○	6 ounces	○	○	○

VEGETABLES and GRAINS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Mark all vegetables you ate, including in salads, mixed dishes, sandwiches and stir-fries.													
Green salad (lettuce or spinach)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Salad dressing (all types)	○	○	○	○	○	○	○	○	○	2 Tbsp.	○	○	○
Fresh tomatoes	○	○	○	○	○	○	○	○	○	1 medium or 4 slices	○	○	○
Carrots	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Green peppers and green chilies	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Red peppers and red chilies	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○

VEGETABLES and GRAINS (continued)	HOW OFTEN DID YOU EAT THESE FOODS? NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	→ Medium serving size	AMOUNT? S	M	L
Mark all vegetables you ate, including in salads, mixed dishes, sandwiches and stir-fries.													
Broccoli	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Cauliflower, cabbage and Brussels sprouts	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Green or string beans	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Green peas	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Corn and hominy	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Summer squash and zucchini	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Winter squash such as acorn, butternut and pumpkin	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Yams and sweet potatoes	○	○	○	○	○	○	○	○	○	1 medium	○	○	○
Cooked greens such as spinach, mustard greens and collards	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Onions and leeks	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Fresh garlic, including in cooking	○	○	○	○	○	○	○	○	○	1 clove	○	○	○
Avocado and guacamole	○	○	○	○	○	○	○	○	○	1/4 medium or 1/4 cup	○	○	○
French fries, fried potatoes and hash browns	○	○	○	○	○	○	○	○	○	3/4 cup	○	○	○
Potatoes (boiled, baked or mashed)	○	○	○	○	○	○	○	○	○	1 medium or 3/4 cup	○	○	○
Refried beans	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
All other beans (baked, lima or chili without meat)	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Coleslaw	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Potato, macaroni and pasta salads made with mayonnaise or oil	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Brown rice, whole wheat pasta and other whole grains (as a side dish)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
White rice, noodles and other grains (as a side dish)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Butter, margarine, sour cream and other fat added to vegetables, potatoes and rice	○	○	○	○	○	○	○	○	○	1 pat or 1 teaspoon	○	○	○

26873

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8

SAUCES and CONDIMENTS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Cheese sauce and cream sauce	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Meat gravies	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Ketchup	○	○	○	○	○	○	○	○	○	2 Tbsp.	○	○	○
Salsa (as dip or on foods)	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Mayonnaise and mayonnaise-type spreads	○	○	○	○	○	○	○	○	○	2 Tbsp.	○	○	○

FRUITS

	HOW OFTEN DID YOU EAT THESE FOODS?									→	AMOUNT?		
	NEVER or less than once per month	1 per month	2-3 per month	1 per week	2 per week	3-4 per week	5-6 per week	1 per day	2+ per day	Medium serving size	S	M	L
Apples, applesauce and pears	○	○	○	○	○	○	○	○	○	1 medium or 1/2 cup	○	○	○
Bananas	○	○	○	○	○	○	○	○	○	1 medium	○	○	○
Peaches, nectarines and plums	○	○	○	○	○	○	○	○	○	1 medium or 1/2 cup	○	○	○
Apricots (fresh, canned or dried)	○	○	○	○	○	○	○	○	○	2 medium or 4 halves	○	○	○
Dried fruit (other than apricots) such as raisins and prunes	○	○	○	○	○	○	○	○	○	1/4 cup	○	○	○
Oranges, grapefruit and tangerines (not juice)	○	○	○	○	○	○	○	○	○	1 orange or 1/2 grapefruit	○	○	○
Berries such as strawberries and blueberries	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○
Cantaloupe, orange melon and mango	○	○	○	○	○	○	○	○	○	1/4 melon or 1/2 mango	○	○	○
Watermelon and red melon	○	○	○	○	○	○	○	○	○	1 medium slice	○	○	○
Any other fruit such as grapes, fruit cocktail, pineapple and cherries	○	○	○	○	○	○	○	○	○	1/2 cup	○	○	○

SWEETS

	HOW OFTEN DID YOU EAT THESE FOODS?									→ AMOUNT?			
	NEVER or less than once per month	**1** per month	**2-3** per month	**1** per week	**2** per week	**3-4** per week	**5-6** per week	**1** per day	**2+** per day	**Medium serving size**	**S**	**M**	**L**
Low or nonfat frozen desserts such as lowfat ice cream, frozen yogurt and sherbet	○	○	○	○	○	○	○	○	○	1 scoop	○	○	○
Ice cream and milkshakes	○	○	○	○	○	○	○	○	○	1 scoop or 1 shake	○	○	○
Pudding, custard and flan	○	○	○	○	○	○	○	○	○	3/4 cup	○	○	○
Doughnuts, pies and pastries	○	○	○	○	○	○	○	○	○	1 medium piece or slice	○	○	○
Cookies and cakes	○	○	○	○	○	○	○	○	○	2 med. cookies or 1 piece of cake	○	○	○
Chocolate, candy bars and toffee	○	○	○	○	○	○	○	○	○	1 regular bar or 2 pieces	○	○	○
Other candy such as Lifesavers®, licorice and jelly beans	○	○	○	○	○	○	○	○	○	4 pieces or 12 jellybeans	○	○	○

PLEASE ANSWER THESE THREE IMPORTANT QUESTIONS!

	NEVER or less than once per week	**1-2** per week	**3-4** per week	**5-6** per week	**1** per day	**2** per day	**3** per day	**4** per day	**5+** per day
	Note that the frequency headings are different.								
How often did you eat foods that were cooked in fat (pan-fried, sautéed, or deep-fried)? *Count all fat such as margarine, butter, oil or lard.*	○	○	○	○	○	○	○	○	○
How often did you eat a serving of vegetables? *Do not count potatoes, salad or beans.*	○	○	○	○	○	○	○	○	○
How often did you eat a serving of fruit? *Do not count juices.*	○	○	○	○	○	○	○	○	○

BEVERAGES and ALCOHOL

	HOW OFTEN DID YOU DRINK THESE BEVERAGES?									→	AMOUNT?		
	NEVER or less than once per month	**1-3** per month	**1** per week	**2-4** per week	**5-6** per week	**1** per day	**2-3** per day	**4-5** per day	**6+** per day	**Medium serving size**	**S**	**M**	**L**
	Note that the frequency headings are different.												
Milk (all types) as a beverage	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Latte, cappuccino, mocha or hot chocolate	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Coffee (not lattes or mochas)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Tea, unsweetened or diet	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Tea, presweetened, bottled or instant	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Milk, cream or creamer added to tea and coffee	○	○	○	○	○	○	○	○	○	1 Tbsp.	○	○	○
Tomato juice, V-8® and other vegetable juices	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Orange juice and grapefruit juice	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Other 100% fruit juice such as apple, grape and cranberry	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Fruit drinks fortified with Vitamin C such as Hi-C®, and Kool-Aid®	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Meal replacement drinks and shakes such as Slim-Fast® and Ensure®	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Diet soft drinks (include energy drinks)	○	○	○	○	○	○	○	○	○	12 ounces or 1 can	○	○	○
Regular soft drinks (include energy drinks)	○	○	○	○	○	○	○	○	○	12 ounces or 1 can	○	○	○
Water (tap, bottled or sparkling)	○	○	○	○	○	○	○	○	○	1 cup	○	○	○
Beer (all types)	○	○	○	○	○	○	○	○	○	12 ounce can or bottle	○	○	○
Red wine	○	○	○	○	○	○	○	○	○	1 medium glass (6 oz)	○	○	○
White or rosé wine	○	○	○	○	○	○	○	○	○	1 medium glass (6 oz)	○	○	○
Liquor and mixed drinks	○	○	○	○	○	○	○	○	○	1 shot (1½oz) or 1 mixed drink	○	○	○

APPENDIX E: Participant Characteristic Survey

Study ID: _____ Age: _____

General Participant Information

What is your sex?

☐ Male ☐ Female

What is your race?

☐ White ☐ American Indian/Alaska Native ☐ Native Hawaiian/Pacific Islander
☐ Black or African American ☐ Asian ☐ Other

Are you of Hispanic, Latino, or Spanish Origin?

☐ Yes ☐ No

What is your marital status?

☐ Single (never married) ☐ Married ☐ Separated/Divorced ☐ Widowed

What was your total household income before taxes during the past 12 months?

☐ Less than $25,000 ☐ $25,000 to $50,000 ☐ $50,000 to $75,000
☐ $75,000 to $100,000 ☐ $100,000 or greater

What is the highest level of education that you have completed?

☐ Less than high school ☐ High school graduate ☐ Some college, no degree
☐ College degree (Associate, Bachelor's) ☐ Postgraduate degree (Master's, Ph.D., or other)

Health Information

Do you have any of the following health conditions? Please mark all that apply.

☐ High blood pressure ☐ Diabetes mellitus ☐ Atrial fibrillation
☐ Coronary artery disease ☐ Congestive heart failure ☐ Peripheral vascular disease
☐ Carotid artery disease ☐ Hyperlipidemia ☐ Prior stroke
☐ Prior myocardial infarction

APPENDIX F: Diet-Related Behaviors Pilot Survey

The following questions are preliminary survey questions that will be piloted among the first group of study participants. Following the first question in each section are examples of prompts that may be used to conduct the cognitive interview. Interviewers will be trained in cognitive interviewing and may ask additional questions in order to obtain more information about participants' responses.

Eating out of the home:

1. How often do you eat out of your home?

What does eating out of the home mean to you?
What are some examples of places that you go to eat?
How did you come up with this answer?

2. When you go out to eat, do you eat with others?

3. At what types of places do you go out to eat?

Grocery shopping:

1. Does someone help you with grocery shopping?

Why did you answer the question this way?
What does grocery shopping mean to you?
Who provides this help?

2. How often do you shop for groceries?

Cooking habits:

1. In the last month, have you received help with dinner preparation?

What does dinner preparation mean to you?
Was this question easy or difficult to answer?
When you think of this time frame, what does it mean to you?

2. How often do you prepare dinner for yourself or others?

3. How often do you receive help with dinner preparation?

4. How often do you receive help with preparation of meals other than dinner?

Meal planning:

1. How often do you plan meals for yourself or others?

What does meal planning mean to you?
How well do you remember this information?
Was this question easy or difficult to answer?

2. How often do you create a shopping list before you go to the grocery store?
3. Do you plan to buy healthy foods when you go to the grocery store?
4. Do you receive help with creating grocery shopping lists?
5. Does anyone help you with planning upcoming meals?

APPENDIX G: Sample Size Calculation

Sample Size: X-Sectional, Cohort, & Randomized Clinical Trials	
Two-sided significance level(1-alpha):	95
Power (1-beta, % chance of detecting):	80
Ratio of sample size, Unexposed/Exposed:	0.3
Percent of Unexposed with Outcome:	15
Percent of Exposed with Outcome:	35
Odds Ratio:	3.1
Risk/Prevalence Ratio:	2.3
Risk/Prevalence difference:	20

	Kelsey	Fleiss	Fleiss with CC
Sample Size - Exposed	181	164	185
Sample Size- Unexposed	55	50	56
Total sample size:	236	214	241

References

Kelsey et al., Methods in Observational Epidemiology 2nd Edition, Table 12-15
Fleiss, Statistical Methods for Rates and Proportions, formulas 3.18 &3.19
CC = continuity correction

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