Master of Public Health

Integrative Learning Experience Report

DIABETES PREVENTION PROGRAM (DPP): A PROGRAM OF THE CDC, TARGETING PRE-DIABETICS IN JOHNSON COUNTY

by

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Summary/Abstract

The prevalence of type 2 diabetes is rapidly increasing due to much higher incidence of new cases. In the United States, 30.3 million people are living with diabetes ("A Snapshot," 2019). Risk factors for diabetes include having a family history of diabetes, age, being overweight, and getting little or no physical activity. To prevent or delay type 2 diabetes, a greater focus needs to be placed on lifestyles changes including weight loss and physical activity ("DTTAC," 2017).

This public health issue was my area of focus during my time at the Johnson County Department of Health and Environment (JCDHE). While at JCDHE, I assisted with the Diabetes Prevention Program (DPP). DPP is a program of the Centers for Disease Control and Prevention (CDC). This is a year-long lifestyle change program designed to prevent type 2 diabetes in prediabetic adults. Groups of 10-15 participants go through the CDC-approved curriculum as a group and focus on nutrition, physical activity, stress management and problem solving. A trained lifestyle coach facilitates the course. The goal of the program is to help participants lose 5 to 7 percent of starting body weight and increase physical activity minutes to 150 per week ("Prevent T2," 2018). I helped JCDHE's registered dietitian and health educator with this course, by preparing materials prior to class and assisting with the facilitation of the course. Each class included 20 minutes of health education and the rest of open-ended discussion of progress, barriers and tools to overcome obstacles. What was found from the data showed overall weight loss in the participants analyzed. Also, by addressing barriers at each level of the social ecological framework, there was an increased likelihood that participants would continue making progress towards their goals. Understanding and interpreting health behavior theories also allowed us to improve or address self-efficacy, health attitudes, social norms, and perceptions of behavior change.

Subject Keywords: Diabetes, Type 2 Diabetes, Diabetes Prevention Program (DPP)

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Chapter 1 - Public Health Issue and Literature Review

Type 2 Diabetes Prevalence

According to the Centers for Disease Control and Prevention ("A Snapshot," 2019), 30.3 million people are living with diabetes in the United States. This is equal to one out of every ten people or 9.4% of the population. Diabetes is a disease that develops due to high levels of glucose in the blood. Type 2 diabetes occurs when the body does not properly use insulin ("DTTAC," 2017). The most common form of diabetes is type 2 diabetes; this type accounts for 90–95% of all diagnosed cases. Prediabetes occurs in cases of higher than normal blood sugar levels, but not high enough to be diagnosed as type 2 diabetes. More than 84.1 million, or one in three, people have prediabetes ("A Snapshot," 2019). Of these individuals, nine out of ten are unaware of their condition ("A Snapshot," 2019). Risk factors include being overweight, family history of diabetes, and getting little or no physical activity ("A Snapshot," 2019). Age and minority status also play a role ("Diabetes Report Card 2017," 2018). Type 2 diabetes can be prevented or delayed in at-risk populations through lifestyles changes including weight loss and physical activity ("DTTAC," 2017). Implementing these changes can cut the risk of developing type 2 diabetes in half. Without proper lifestyle changes, 15–30 percent of people with prediabetes will develop type 2 diabetes within five years ("A Snapshot," 2019).

The prevalence of diabetes is becoming a major area of concern in the United States. Incident cases are developing every day and the number of prediabetic individuals is rapidly escalating. In 2017, the total medical costs and lost work and wages for people with diabetes equaled $245 billion dollars. Medical costs for diabetics are more than twice as high than those without the condition ("A Snapshot," 2019). Diabetes also increases a person's risk of developing other co-morbid disease such as vision loss, kidney failure, heart disease, stroke and peripheral neuropathy ("A Snapshot," 2019). Improvements in the management of type 2 diabetes have reduced mortalities but have also increased medical costs due to an increased lifespan of treated individuals ("A Snapshot," 2019). A study by Rowley *et al*. (2017), analyzed the future trends of diabetes prevalence in the United States by the year 2030. From this

study it was discovered that the prevalence of diabetes will increase by 54% to 54.9 million people. The total annual medical and societal costs will increase by 53% to $622 billion dollars. Diabetes prevalence has increased rapidly over the past 20 years and will continue to do so unless more emphasis is placed on preventing diabetes from developing in at risk-populations (Rowley *et al*., 2017).

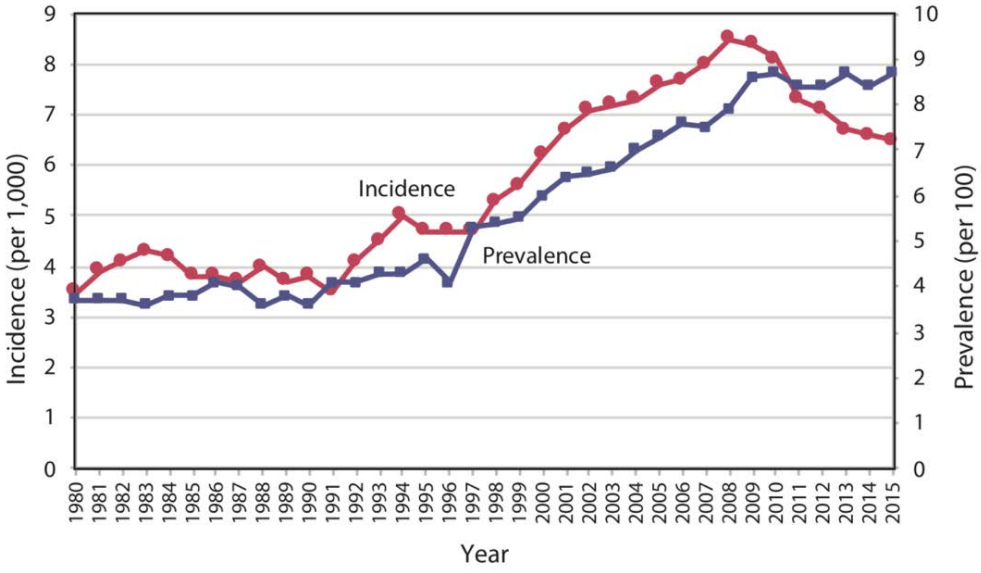

Figure 1.1 Incidence and Prevalence Trends of Diagnosed Diabetes Adults 18 or older in the United States between 1980-2015 ("Diabetes Report Card 2017," 2018)

Diabetes Prevention Program (DPP) in Johnson County

This public health issue is one that I focused on during my time at my Applied Practice Experience site. I completed my APE at the Johnson County Department of Health and Environment (JCDHE). This organization is an accredited health department located in Northeast Kansas. JCDHE offers a variety of services including child care licensing and education, disease investigation and emergency planning, solid waste and pool inspections, community outreach, walk-in clinic availability, health education on chronic disease prevention and Women, Infants and Children (WIC) assistance. During my time at JCDHE, one of my major projects was assisting with the Diabetes Prevention Program (DPP).

DPP is a program of the Centers for Disease Control and Prevention (CDC). This is a year-long lifestyle change program designed to prevent type 2 diabetes in prediabetic adults. Groups of 10–15 participants go through the CDC-approved curriculum as a group and focus on nutrition, physical activity, stress management and problem solving. A trained lifestyle coach facilitates the course. The goal of the program is to help participants lose 5 to 7 percent of starting body weight and increase physical activity minutes to 150 per week ("Prevent T2," 2018). This program will be discussed in more detail in Chapter 2.

Literature Review

For my literature review, I examined two studies that investigated the effect of diet on type 2 diabetes. The first study is a randomized controlled trial that analyzed the effects of soluble fiber intake in Type 2 diabetes patients (De Carvalho *et al*., 2017). The second study is a systematic and meta-analysis that investigated the effects of olive oil intake on Type 2 diabetes risk and management (Schwingshackl *et al*., 2017). I also reviewed two studies that analyzed the effect of physical activity on diabetes or risk of diabetes. One study examined the effects of a pedometer-based behavioral modification program on type 2 diabetes via a randomized controlled trial (De Greet *et al*., 2011). The second study, a systematic review, assessed the effects of postprandial exercise on glucose control in people with type 2 diabetes (Borror *et al*., 2018).

The first nutritional study by De Carvalho *et al*. (2017), compared the acute effect of soluble fiber intakes from foods and dietary supplements, after a breakfast meal, on the postprandial plasma glucose and plasma insulin in patients with type 2 diabetes. Other studies have shown strong evidence regarding the benefit of high soluble fiber consumption in glucose control patients with type 2 diabetes, but it is still unclear whether these effects of fiber intake are the same for both dietary sources and supplements. The participants were outpatients from the Hospital de Clínicas de Porto Alegre in Brazil (De Carvalho *et al*., 2017). All the participants in this study were diagnosed with type 2 diabetes by the study's attending physician. At the beginning of the study, 56 patients were initially eligible, based on the diagnosis. Of these, 30 were excluded due to not meeting the selection criteria, not willing to participate, lack of

accessibility or participation in another research study. Initially, 26 participants were randomized to the different test meals, but a few other participants were excluded due to discontinuing the protocol, resulting in 19 participants (De Carvalho *et al*., 2017). The remaining participants were randomized to 3 distinct test meals with a crossover component. The participants were assigned to a test meal on three different occasions and each time they were assigned to a different meal. The test meals included a high soluble fiber meal from dietary sources (HFD) with 5.4 grams of soluble fiber. A high soluble fiber meal (HFS) from supplemental sources with 5.4 grams of soluble fiber and a meal with a usual amount of fiber (UF) or 0.8 grams. Each meal occasion was separated by a one-week washout period (De Carvalho *et al*., 2017). Prior to the test meals, the participants were asked to fast for 12 hours, avoid physical activity on the day before, abstain from heavy meals, alcoholic beverages and smoking. The participants were also asked to complete a 24-hour diet recall with the research dietitian. The postprandial responses of plasma glucose & plasma insulin were tested by first taking baseline measurements and then comparing those to the postprandial measurements. The baseline measurements were first done by performing capillary blood glucose tests with a glucometer, before each breakfast test (De Carvalho *et al*., 2017). This step was done to rule out high glucose values at the beginning of the test meals. Any values higher than 180 mg/dL prevented the initiation of the test on that day. After confirming blood glucose levels, the baseline blood samples were taken. For the postprandial measurements, after the baseline samples were taken, the participants were asked to take their usual medical with 150 mL of water. Following their medication, the participants were asked to consume their assigned meal within 20 minutes and to remain seated during the test. Blood samples were then taken at 0, 30, 60, 120 and 180 minutes after the meal (De Carvalho *et al*., 2017). What was found when comparing the incremental area under the curves (IAUCs) for each meal type was that the iAUCs of the HFD and HFS meals were lower than the iAUCs of the UF meals. The iAUCS of the HFD and HFS meals did not differ. No difference was seen between the iAUCs for insulin for the three meals. This study showed that high amounts of soluble fiber had the same effect on the postprandial glycemic response regardless of the source when compared to the usual fiber meal. There was an 18% different in plasma glucose iAUCs

between the breakfasts that were rich in fiber, regardless of the source, and the breakfast with the usual fiber. A difference greater than 16% is considered clinically relevant. The postprandial insulin increased after all three meals, but there was no difference between iAUCs (De Carvalho *et al*., 2017). This clinical trial shows that by increasing soluble fiber rich foods in their diet, diabetic individuals can reduce their postprandial glycemic response after meals. For prediabetic individuals, incorporation of high soluble foods earlier on can lead to a reduced risk of developing type 2 diabetes.

In terms of external validity, the weaknesses of the study included a small sample size. Although the researchers attempted to include participants who met the criteria from the hospital, many participants were excluded due to exclusion criteria, declined participation or were participating in other research. Other participants were lost due to failure to adhere to protocol. Although the sample size was small, the power of the sample size was 90%. Another weakness included that the researchers heavily relied on the manufacturers label information rather than running laboratory analyses of food nutrients on ingredients used in test meals (De Carvalho *et al*., 2017). One final weakness included that most of the participants used in this study showed good glycemic, lipid and blood pressure control practices. The participants were also taken from a hospital setting, which may not represent the general population of diabetic individuals. Individuals in the population with worse metabolic control could have different results. The strengths of this randomized clinical trial included the crossover component, which allowed each subject to be exposed to each different test meal. The participants were randomly assigned to the 3 different test meals via an online computer-generated sequence. The study required participants to complete a 24-hour dietary recall from the previous day before each test meal. This 24-hour recall was completed by the research dietitian. Test meals were also all prepared by the research dietitian. To provide a standard baseline, the study utilized a 1-week washout period between the crossover of test meals. Prior to the meal tests, participants were told to maintain their usual medications, diet and physical activity. The participants in this study were all diagnosed with diabetes by the studies attending physician. Diagnosis of type 2 diabetes was defined as a diagnosis of diabetes after age 35 with no use of insulin during the first year after diagnosis (De Carvalho *et al*., 2017). Prior to the selection of

the participants, inclusion and exclusion criteria were set. The inclusion criteria included participants with HbA1c values of greater than 9%, a BMI of greater than 35 and no current insulin use. The exclusion criteria took into consideration serum creatinine greater than 2.0 mg/dL and comorbid conditions such as digestive disease, severe autonomic neuropathy and recent cardiovascular events. Although the study excluded for various comorbid conditions, the researchers did take into account other confounding factors such as hypertension, BMI, urinary albumin excretion, LDL and HDL, cardiovascular disease, diabetic retinopathy and peripheral neuropathy. The participants were also asked about their physical activity, peripheral vascular disease and smoking status via a sedentary lifestyle questionnaire. The study also included participants who used medications for diabetes (De Carvalho *et al*., 2017). Based on these factors, overall, I feel the study was valid due to the protocol followed and the use of an RCT approach. Although the study did not take into consideration comorbid diseases, it did incorporate confounding factors.

The second nutritional study by Schwingshackl *et al*. (2017), analyzed the association between olive oil intake and the prevention and management of type 2 diabetes. The purpose of this systematic review was to summarize the literature related to this association. Two meta-analyses were conducted. Results from four prospective cohort studies and 29 randomized clinical trials (RCTs) were analyzed to determine the association of olive oil intake on the risk of type 2 diabetes and the effect of intake on HbA1c values. To examine the association between olive oil intake and the management of type 2 diabetes, one meta-analysis and sensitivity analyses were performed (Schwingshackl *et al*., 2017). This meta-analysis explored the effect of olive oil intake on glycemic control. The meta-analysis also investigated that effect of olive oil intake on fasting plasma glucose values. Finally, sensitivity analyses were performed. The results derived from the study regarding the association between olive oil intake and the risk of type 2 diabetes, included that the random effect meta-analysis indicated that the use of olive oil was inversely associated with a lower risk of type 2 diabetes. These results indicated a 16% reduced risk of type 2 diabetes (Schwingshackl *et al*., 2017). The dose-response meta-analysis showed that for each 10 grams/day increase in olive oil intake a 9% reduced risk for type 2 diabetes was associated. Finally, a non-

linear association was detected between olive intake and the risk of type 2 diabetes. For a 13% increase in olive intake, a reduced risk of type 2 diabetes was shown. These findings were present up to 15–20 grams/day of olive oil intake. As for the second association investigating management of type 2 diabetes, the results of the random effect meta-analysis showed a significant reduction in HbA1c values in studies that used olive oil interventions compared to control groups (Schwingshackl *et al*., 2017). The meta-analysis also investigated that effect of olive oil intake on fasting plasma glucose values. These values were found to be reduced in studies that compared olive oil intervention groups to controls. Finally, sensitivity analyses were performed. From these analyses, it was determined that in trials with low risk of bias, olive oil was associated with improvements in HbA1c and fasting plasma glucose. Overall, the analyses conducted in this review showed that olive oil intake was associated with a decreased risk for type 2 diabetes and an improved glucose metabolism (Schwingshackl *et al*., 2017). Previous meta-analysis reviews have looked at the composition of bioactive compounds found in olive oil and have shown associations between monounsaturated fatty acids (MUFA) and a decreased risk of type 2 diabetes.

Analyzing the validity of the study, the weaknesses of this review include that not all studies looked at confounding variables. Only 4 prospective cohort studies were analyzed. Some RCTs were only performed for two weeks (Schwingshackl *et al*., 2017). There was also information and recall bias associated with the measurement of olive intake in the prospective cohort studies, due to the use of FFQs. Bias was also present in the way T2DM cases were measured in some studies. This was due to diagnosis being self-reported only. The RCTs used in this review compared the intervention of olive oil against other dietary patterns, rather than placebos. RCT participants also demonstrated poor adherence to interventions and high drop-out rates. Some studies did not specify whether the olive oil used was pure olive oil or extra virgin olive oil, which could lead to a difference in effects. Finally, the NutriGrade scoring tool did not classify any meta-evidence as high evidence (Schwingshackl *et al*., 2017). The strengths for this systematic and meta-analysis review include that it followed standard protocol using Meta-analysis of Observational Studies in Epidemiology and PRISMA guidelines. This review was registered in PROSPERO and the search protocol and inclusion and

exclusion criteria were set prior to the search process to decrease bias (Schwingshackl *et al*., 2017). The search terms and inclusion and exclusion criteria did a good job of focusing on studies that directly investigated the research question which was to summarize and analyze the literature on the association between olive oil intake and the prevention and management of type 2 diabetes mellitus. This review only focused on studies of higher quality such as prospective cohort studies and RCTs. The search was conducted by two researchers independently to avoid bias due to subjectivity. Any disagreements were resolved by consensus. Publication bias was reduced by incorporating grey literate into the search. Database bias and the English-language bias were also addressed and reduced. The prospective cohort studies looked at multiple confounding variables. The risk of bias in the studies was analyzed using the Cochrane Collaboration's tool. Most of the studies analyzed in this review were considered low bias. Conclusions for the effect of olive oil intake on the management of T2DM were based on low biased studies only. The results from the studies were tested for heterogeneity and pooled to provide collective results. Multiple meta-analysis statistics were utilized to investigate the two associations of olive oil intake on the risk and the management of T2DM (Schwingshackl *et al*., 2017). Finally, a NutriGrade scoring tool was used to assess the meta-evidence provided in this study. I feel like the study is valid due to guidelines that were used in the study. The review included studies of higher quality to provide better examples of evidence. The study utilized various tools to consider the risk of bias and also took into consideration confounding variables.

The first physical activity study, by De Greet *et al*. (2011), analyzed the effects of a pedometer-based behavioral modification program on type 2 diabetes. This behavioral modification program included a face-to-face session and seven telephone follow-ups. The study randomly assigned ninety-two patients to a pedometer-intervention group and a control group (De Greet *et al*., 2011). Participants were recruited from an initial sampling pool via a search of electronic medical records from the endocrinology department of the Ghent University Hospital in Belgium. Participants were continually recruited over a 6-month period. The selection criteria included participants aged 35–75 years, a BMI of 25–35 kg/m^2, an HbA1c value of greater than or equal to 12% and currently being treated for type 2 diabetes. The study focused on participants with

greater or equal to 6 months post-diagnosis (De Greet *et al*., 2011). Participants were also required to have no physical activity limitations. The physical activity level and sedentary behavior were measured using a pedometer, accelerometer and a questionnaire. The participants were asked to wear the pedometers and record their physical activity type, duration and number of steps at the end of each day. The treatments were administered for 24 weeks with a 1-year follow up. The interventions were led by a psychologist and based on principles of cognitive-behavioral therapy and DPP (De Greet *et al*., 2011). The face-to-face session included in the pedometer-intervention, took place at the hospital's endocrinology department and lasted 30 minutes. During the session, participants were given a pedometer and instructed to keep it. The face-to-face session began with a motivational interview phase, followed by an individualized lifestyle plan that addressed where, when and how the behavior changes would occur. Following the session, participants started the 24-week program (De Greet *et al*., 2011). Patient's received a call every 2 weeks for the first 4 weeks of the program and every 4 weeks for the final 20 weeks of the program. The calls were shorter in length, compared to the face-to-face session, but addressed the same ideas. The phone calls provided counseling on goal-setting, self-monitoring, self-efficacy, decisional balance, social support and relapse prevention (De Greet *et al*., 2011). During this time, goals were addressed and participants who succeeded to meet their goals were encouraged to increase their physical activity level after 1 and 3 months. What was found from the study, was that the intervention group increased their steps per day by 2744. The total number of minutes per day of physical activity for the intervention group was 23 minutes. The intervention group also decreased sedentary behavior by 23 minutes per day (De Greet *et al*., 2011). After the 1-year follow up, the intervention group still showed an increase in 1972 steps per day and a total physical activity of 11 minutes per day. The group continued to show signs of decreased sedentary behavior by 12 minutes per day. The results obtained from this study showed lasting positive effects on steps per day, physical activity and sedentary behavior based on a pedometer behavior modification program (De Greet *et al*., 2011).

Evaluating the validity of the study, the weaknesses included utilizing a sampling pool of patients for subject recruitment. Again, this population may not fully represent

the target population of type 2 diabetics. Another issue with the study was the continued recruitment. Continuous recruitment could affect the way treatments are carried out. Starting different participants at various times can lead to errors and bias when administering treatments. Strengths demonstrated by the study include the incorporation of theories and prevention strategies into the treatment. The pedometer-based behavioral program included the principles of cognitive-behavioral therapy and DPP to address barriers preventing participants from reaching individual goals. Another strength included the 1-year follow up to analyze the long-term effects of the treatment. Although the study did not completely encompass the target population, it did demonstrate that the behavioral modification program showed lasting effects on steps, physical activity and sedentary behavior.

The second physical activity study, by Borror *et al*. (2018), reviewed the effects of postprandial exercise on glucose control in individuals with type 2 diabetes. The study utilized a systematic review to address this association. This review adhered to the PRISMA guidelines (Borror *et al*., 2018). Researchers conducted literature searches in PubMed and Google Scholar using keywords such as diabetes, exercise, postprandial, meal, and glycemic or glucose. Two authors screened the articles and selected studies based off inclusion and exclusion criteria (Borror *et al*., 2018). The inclusion criteria included randomized crossover trials, participants diagnosed with type 2 diabetes, exercise initiated within 3 hours of a meal and participants who were not treated with insulin. Studies were excluded if the participants had co-morbid cardiovascular disease. After applying this criteria, 12 studies were selected for analyses (Borror *et al*., 2018). These studies involved 135 participants and varied in timing, duration, intensity, modality and glucose measures. The quality of the studies ranged from 38% to 58%, with a mean of 49%. Exercise interventions ranges from moderate to high-intensity aerobic exercise and two studies included resistance training. What was found was that postprandial aerobic exercise decreased the short-term glucose area under the curve by 3.4 to 26.6% the 24-hour prevalence of hyperglycemia by 11.9 to 65% (Borror *et al*., 2018). The two resistance exercise studies showed a decrease in the short-term glucose area under the curve by 30% and 24-hour prevalence of hyperglycemia by 35%. From the results, it appears that any mode of intensity seems to have a beneficial

effect on hyperglycemia, but increased energy expenditure appears to be the driving factor behind exercise-induced decreases in hyperglycemia (Borror *et al*., 2018). From the studies analyzed in this review, postprandial exercise appears to be a more effective strategy than pre-prandial in type 2 diabetics. Targeting postprandial exercise in type 2 diabetics may be an effective way to improve glucose control. The researchers recommend that individuals with type 2 diabetes focus on increasing their energy expenditure after the largest meal of the day (Borror *et al*., 2018).

When assessing the validity of the study, issues arise with the studies selected. It was difficult for the researchers to consolidate the findings due to the variation in timing intensity and modality of the exercise (Borror *et al*., 2018). Also, glucose measures were not consistent. Although a mean quality of 49% was obtained from the studies, higher quality scores were not present due to the majority of studies not reporting methods of randomization, a justification for sample size, details for subject dropout and the reproducibility of the primary outcome measurements (Borror *et al*., 2018). More research needs to be done to determine the level of exercise, modality and duration most effective in improving glucose control. The researchers do not have concrete evidence to suggest causality but do recommend updating guidelines to include low-moderate-intensity daily exercise for type 2 diabetic individuals.

Chapter 2 - Learning Objectives and Project Description

Learning Objectives

While at JCDHE, one of my major projects was assisting with the Diabetes Prevention Program (DPP). DPP is a program of the Centers for Disease Control and Prevention (CDC). This is a year-long lifestyle change program designed to prevent type 2 diabetes in prediabetic adults. This program is also designed for those who at high risk for type 2 diabetes. DPP helps participants achieve moderate weight loss by eating well and being physically active. Groups of 10–15 participants go through the CDC-approved curriculum and focus on nutrition, physical activity, stress management and problem solving. A trained lifestyle coach facilitates the course. The goal of the program is to help participants lose 5 to 7 percent of starting body weight and increase physical activity minutes to 150 per week, at a moderate pace or more (“Prevent T2,” 2018).

The year-long program consists of 22 modules. The first 16 modules are completed over the first four months and groups meet once a week. The program progresses into bi-weekly meetings between modules 17–20. Finally, classes only meet once a month in final six months of the program. The modules cover a range of topics, from dietary tracking to time management to increase physical activity. Many of the modules address barriers that can arise while undergoing the program. These barriers can include cooking healthier meals, increased food costs, managing stress and time, coping with triggers, eating out, dealing with weight stalls and getting enough sleep. The program emphasizes behavior change and lifestyle modifications rather than quick diet tricks. The curriculum followed in this program is based off a CDC research study that investigated various strategies to determine the best route for prevention (“DTTAC,” 2017).

Project Description

The Diabetes Prevention Program research study was a randomized clinical trial that analyzed strategies used to prevent or delay the development of type 2 diabetes (“The Diabetes Prevention Program,” 1999). The study focused on high-risk individuals

with elevated fasting plasma glucose concentrations and impaired glucose intolerance (IGT). The primary outcome of the study was the development of diabetes. Diagnosis of diabetes was based on fasting plasma glucose concentrations from the 1997 American Diabetes Association criteria. Secondary outcomes of the study included cardiovascular disease and risk factors, changes in glycemia, beta-cell function, insulin sensitivity, obesity, diet, physical activity, health-related quality of life and occurrence of adverse events (“The Diabetes Prevention Program,” 1999).

The participants for this study included over 3,000 participants at 27 clinical centers around the United States (“The Diabetes Prevention Program,” 2002). The sample size was calculated using a 90% statistical power and compensated for nonadherence (“The Diabetes Prevention Program,” 1999). The inclusion and exclusion criteria set for subject selection included recruiting nondiabetic individuals with a high risk of progression to type 2 and excluding individuals with conditions that might increase the risk of adverse effects from the intervention or affect the assessment for incident type 2 diabetes. All study participants were overweight and were diagnosed with prediabetes. Of the participants, ~45% were from minority groups and ~20% were of age 65 years or older (“The Diabetes Prevention Program,” 1999). To participate in the study, the participants could not be diagnosed as diabetic prior to the study, based on the 1997 ADA and 1985 World Health Organization (WHO) criteria (“The Diabetes Prevention Program,” 1999). High-risk individuals were classified as participants with fasting plasma glucose (FPG) levels of 95–125 mg/dL. However, to ensure inclusion of all minority ethnic groups, there was no lower limit set for FPG values. The BMI criterion value set at great than or equal to 24 kg/m^2. Once selected initially, participants underwent a four-step combined screening, recruitment and informed consent process (“The Diabetes Prevention Program,” 1999).

This study was a major multicenter clinical research study that examined the ability of two treatment options to prevent or delay the onset of type 2 diabetes. The different treatments included weight loss through dietary changes and increased physical activity and treatment through the oral diabetes drug metformin (Glucophage). At each clinical center, the participants were randomly assigned to one of the three treatment groups: an intensive lifestyle intervention and two masked medication

treatment groups. The medication groups consisted of a drug therapy and a placebo treatment group. The participants were recruited during a 2-year period and were followed prospectively for an additional 3 to 5 years (“The Diabetes Prevention Program,” 1999).

The primary outcome of the study, development of diabetes, was assessed by testing the fasting plasma glucose (FPG) every 6 months and performing an annual 75g oral glucose tolerance test (OGTT) (“The Diabetes Prevention Program,” 1999). The FPG was also measured with the participants displayed symptoms consisted with diabetes. The tests were performed without disruption of the assigned treatments. If participants were found to meet the 1997 ADA criteria for diabetes through the FPG or OGTT results, a second FPG or OGTT test was preformed within 6 weeks. If both tests indicated diabetes, the participant was considered to have reached the primary outcome (“The Diabetes Prevention Program,” 1999). To maintain masking in the study, participants were selected at random to repeat annual OGTT.

All participants, regardless of treatment assigned, received standard lifestyle education material. Written information on the importance of a healthy lifestyle and a 20 to 30-minute individual session with a case manager. Participants were also given guidelines on the Food pyramid and the National Cholesterol Education Program (“The Diabetes Prevention Program,” 1999). This prompted participants to lose 5–10% of their initial weight through diet and exercise and to increase physical activity gradually to 150 minutes per week. Randomization was done via adaptive randomization stratified by clinical center. This type of randomization provides a higher probability of balancing treatment assignments (“The Diabetes Prevention Program,” 1999).

The participants assigned to the lifestyle intervention received intensive individual counseling on diet, exercise, and behavior modification to achieve the goals outlined in the standard lifestyle education. The key difference of this treatment was the a more intense approach (“The Diabetes Prevention Program,” 2002). The participants in this group, set a goal of losing at least 7% of their body weight by eating less fat and fewer calories and by meeting a minimum of 150 minutes of moderate exercise per week (“The Diabetes Prevention Program,” 1999). The 7% reduction in weight and 150-minute activity level were both based on data from previous studies that suggested that

weight loss at this level was achievable within 24 weeks and physical activity at this rate was feasible, maintainable and likely to be beneficial (“DTTAC”, 2017). The participants in this group were assigned fat and calorie intake goals and used self-monitoring techniques to track their dietary intake (“The Diabetes Prevention Program,” 2002). Participants with preexisting coronary heart disease and men 40 years or older, also underwent exercise tolerance tests to modify their individual exercise programs. The focus of this intervention group was on individualization (“The Diabetes Prevention Program,” 1999). This was achieved through individual intake goals and routine meetings with case managers.

The participants in the drug therapy group received 850mg of metformin, which is a drug commonly used to treat diabetes. Participants were started at that dosage once daily and increased to twice per day (“The Diabetes Prevention Program,” 1999). Adherence to the medication was assessed by pill counts and a structured interview of pill-taking behavior. The placebo group was given placebo pills instead of metformin and the same general information as the drug therapy group.

After 3 years, what was found was that members of the lifestyle intervention group greatly reduced their risk for type 2 diabetes. Participants in this group, reduced their risk by 58% when compared to the participants in the placebo group. This result was seen regardless of race, sex, age, or socioeconomic status. For participants aged 60 or older, the results showed a 71% reduced risk when compared to the placebo group. As for the participants in the drug therapy group, a reduced risk of 31% was found when compared to the placebo group (“DTTAC,” 2017). The drug therapy intervention was only about half as effective as the lifestyle intervention. Other findings included: an average weight loss of 14.5 lbs., 49.7% of the participants in the lifestyle group reached or surpassed the 7% weight loss goal, the average weekly physical activity was 224 minutes and 74.4% of the participants in this group reached or surpassed the 150-minute activity goal. One of the most important findings form this study was that weight loss was the most important factor in lowering the risk of type 2 diabetes, regardless of age, sex, ethnic group or level of physical activity (“DTTAC,” 2017).

A secondary follow up was performed at 10 years. Initial participants were recruited for a 10 year follow up. This study was performed to investigate the persistence of the effects found after 3 years in the long-term. All active, nondiabetic, DPP participants were eligible to participate. Of the 3150 participants, 2766 enrolled for the follow up study (“10-year follow-up,” 2009). These participants made up 88% of the initial study population. Of these participants, 910 were from the lifestyle group, 924 form the metformin group and 932 from the placebo group. All three groups, once again, received group-implemented lifestyle intervention. The metformin group received 850mg twice daily (“10-year follow-up,” 2009). The primary outcome was once again the development of diabetes, based on the American Diabetes Association criteria. What was found from this study was that original lifestyle group lost and then partially regained the weight lost. The modest weight loss achieved by the metformin group was maintained. Incidence rates of diabetes during the DPP were 4.8 cases per 100 person-years in the intensive lifestyle group, 7.8 in the metformin group and 11.0 in the placebo group (“10-year follow-up,” 2009). Incidence rates after 10 years were found to be similar. These included 5.9 cases per 100 person-years for the lifestyle group, 4.9 in the metformin and 5.6 for the placebo group. Diabetes incidence in the 10 years since DPP was found to be reduced by 34% in the lifestyle group and 18% in the metformin group, when compared to the placebo (“10-year follow-up,” 2009). It was found that incidence rates were similar in the 10-year study, compared to the 3-year study. However, cumulative incidence of diabetes remained the lowest in the lifestyle group (“10-year follow-up,” 2009).

Analyzing the validity of the DPP study and follow up studies, the weaknesses of the studies included that recruitment was clinic based. The target population of prediabetic individuals is not appropriately represented by focusing on clinical recruitment. Recruitment also included use of mass media, mail, telephone contacts and employment or social groups (“The Diabetes Prevention Program,” 1999). Other weaknesses included the discovery of potential obstacles to retention. Researchers identified obstacles that led to noncompliance of treatments. This included dissatisfaction with randomly assigned treatments, masking of some of the test results and time commitments (“The Diabetes Prevention Program,” 1999). Other barriers that

were identified included cost of transportation, parking and child or elder care. The researchers suggest addressing these barriers in future DPP programs to maximize retention (“The Diabetes Prevention Program,” 1999).

The strengths of the study included using a 90% power to calculate study size. To achieve a 90% statistical power, the effective sample size was found to be 2279 participants (“The Diabetes Prevention Program,” 1999). The researches accounted for noncompliance by adding additional participants to the total number of participants and aiming for a 3000-participant recruitment goal. The study ultimately recruited a total of 3150 eligible participants. The study also utilized adaptive randomization to better balance the treatment assignments. The researchers also addressed differences in ethnicity, age and gender. Of the participants, 45% were minorities, 20% were aged 60 or older and 68% were women (“The Diabetes Prevention Program,” 1999). Although, clinical recruitment did not account for all of the target population, including these at-risk groups did address this issue. The initial study did demonstrate some weaknesses, but the strengths of the study attempted to address those issues. The information obtained from these studies, allowed for the modification of the DPP program to ensure more successful outcomes.

Chapter 3 - Results

Overview

The DPP program is a year-long program that consist of 22 modules. For the first four months of the program, groups meet weekly. The program shifts to bi-weekly meetings after module 16. Ultimately, meetings are monthly during the final six months of the program. Each DPP group consists of 10 to 15 participants. The groups spend their meetings discussing CDC curriculum with a large focus on nutrition, physical activity and addressing barriers. The overall goal of the program is for each participant to achieve a 5 to 7 percent weight loss and an increase in physical activity to 150 minutes per week.

During my time at JCDHE, I observed the first two months of weekly meetings of two different DPP groups. One group consisted of retired adults, aged 60+ and another of middle-aged working adults. Participants were self-referred to the DPP program but had to qualify as prediabetic per a risk assessment. Each week, groups met at 2:00 pm and 5:15 pm at JCDHE. I helped JCDHE's registered dietitian and health educator with this course, by preparing materials prior to class and assisting with the facilitation of the course. Each class included 20 minutes of health education and the rest on open-ended discussion of progress, barriers and tools to overcome obstacles.

For the first two weeks we introduced the program and its goals. The dietitian described the DPP program in more detail and explained the importance of the weight loss and physical activity goals. Throughout the course, the dietitian assured the participants that the information presented in this program was all science-based evidence from the CDC of lifestyle changes that help prevent or delay type 2 diabetes.

What sets this health promotion program apart is its emphasis on self-efficacy and decision making. The dietitian never pushed specific diets, foods or physical activity routines on the participants. She only provided the information, tools and assistance to accomplish weight loss and behavior change goals.

Another trait that sets this program apart is its facilitation style presentation. The dietitian spent a third of the class time presenting educational information and the rest of the course assessing the understanding of the material and how to directly apply it to

the participants current behavior to make lifestyle modifications. Each class, the dietitian would assess each participant's progress and concerns with a 10 to 15-minute open discussion. This initially was very short with limited information shared amongst the group. As the weeks progressed, the participants in each group became more open with one another. Participants began to share barriers preventing them from making progress and this made it easier for the dietitian to address these concerns as a group. This open-ended discussion allowed the participants to communicate with one another and provide emotional support and understanding. Each week the dietitian listened to their concerns and came up with tools that would help the participants overcome obstacles such as high food cost, time management, stress management and temptation.

Other than tracking purposes for the weight loss and physical activity goals, numbers were never an emphasis of the course. Each week before class, the dietitian would weigh participants individually and discuss their progress toward their 5 to 7 percent weight loss goal. The dietitian encouraged each participant after weigh-ins, even if the weight loss was small. This information was never shared to the group. During the weigh-in's the dietitian would also ask the participants their total number of minutes of physical activity from the week before. She never asked for more details, such as the specific activity type, level of intensity or how many times the participant exercise. The goal behind this was so that participants did not feel forced to meet certain requirements. The dietician wanted them to make their own decisions to make a change if their current physical activity level was not making a weight loss difference.

Although numbers were tracked for the weight loss and physical activity goals, the dietitian did not want participants to get discouraged if change was not immediate. She constantly stressed to each group that the goal was to accomplish weight loss and increased physical activity over a year's time. The goal of the program was not rapid weight loss, but rather lifestyle modifications.

To assist with reaching the physical activity goal, the dietitian provided tools to address barriers such as access to a gym or exercise equipment, motivation and accountability. For the "Track Your Activity" module, the dietitian discussed various ways to track physical activity. A few methods discussed were paper tracking, physical

activity phone applications and Fitbit or smart watch monitoring. All DPP participants received a complimentary Fitbit watch for being a member of the program. The dietitian encouraged participants to monitor their step count as a simple way to increase their physical activity. Some participants increased their step count from 3000 to 8000 per day. We also provided participants with live physical activity demonstrations for the “Get More Active” module. JCDHE has a physical activity room for employees, which participants had access to before or after class. During this module, another health educator with a background in exercise science led a physical activity demonstration using resistance bands in the JCDHE physical activity room. Through this activity, we provided participants with a few resistance band activities they could easily do at home. Participants also received a complimentary JCDHE resistance band to use at home. We targeted the activities to each group by age. For the older group, we focused on chair activities that required little to no balance. For the middle-aged group, we focused on higher intensity activities that required more balance. We also presented the two groups with physical activity apps, such as the *7 minute* workout phone application, which guides users in a short workout with verbal cues and visual indicators.

To assist with the weight loss goal, the dietitian provided tools to address barriers such as tracking food consumption. For the “Track Your Food” module, the dietitian discussed methods to monitor food consumption via paper tracking and nutrition or health phone applications. The dietitian never set restrictions or asked the participants to go on a diet. Her goal was to emphasis eating more nutritious foods rather than the difference between and good and bad foods. She did not want to make participants feel like they could never again consume their favorite food. Instead she wanted them to find a healthier replacement or attempt to moderate unhealthy food. I had the opportunity to discuss moderation through portion control for the “Eat Well to Prevent T2” module. During this module, I discussed various tools with participants to aid in measuring food portions. These methods included visual indicators, measuring cups or scales and using smaller serving plates. Examples of the handouts presented during this module are located in the appendix.

Other tools the dietitian provided to reach weight loss goals was information on the cost of healthy foods, not knowing what or how to cook and dealing with

temptations. Most of the participants in the older group were Medicare recipients. This made it difficult for them to buy groceries higher in costs. The dietitian addressed this concern by suggesting cost-effective alternatives to more expensive products. She would also bring products into class to show participants what they looked like and where they could be found. To address the concern of healthy cooking, the dietitian performed cooking demonstrations for the two groups. One demonstration was over a vegetable medley and another on smoothies. For the vegetable medley, the dietitian emphasized using a variety of vegetables of different colors to consume a variety of nutrients. She encouraged participants to use healthier oils such as olive or canola and little seasoning to reduce the sodium in the medley. For her smoothies, the dietitian used no added sugar and instead used the sugars from frozen fruit. She also encouraged adding vegetables such as spinach to the smoothies to help participants obtain their daily fruit and vegetable serving. The dietitian also provided substitution recipes for foods that led to temptation such as potato chips, hamburgers and rice.

Results

The following results are from a paired comparison between beginning weights of participants and ending weights of participants at the 7-week mark of the DPP program. These data were analyzed using SAS statistical software and a paired *t-test* analysis. This type of statistical analysis compares pre- and post-weights of participants before and after 7-weeks of the DPP course. The data consists of the weights of 13 participants pooled from both DPP groups. The participants in the DPP groups were majority female and Caucasian.

t-Test: Paired Two Sample for Means

	Variable 1	*Variable 2*
Mean	241.2230769	235.8692308
Variance	4118.39859	3670.050641
Observations	13	13
Pearson Correlation	0.996181968	
Hypothesized Mean Difference	0	
df	12	
t Stat	2.957461098	
P(T<=t) one-tail	0.005988511	
t Critical one-tail	1.782287556	
P(T<=t) two-tail	0.011977022	
t Critical two-tail	2.17881283	

Table 3.1 *t-test*: Paired Two Sample for Means

The TTEST Procedure

Difference: WTbefore - WTafter

N	Mean	Std Dev	Std Err	Minimum	Maximum
13	5.3538	6.5271	1.8103	-1.5000	24.1000

Mean	95% CL Mean		Std Dev	95% CL Std Dev	
5.3538	1.4096	9.2981	6.5271	4.6805	10.7745

DF	t Value	Pr > |t|
12	2.96	0.0120

Figure 3.1 Summary Statistics of the difference

Chapter 4 - Discussion

Interpretation of Results

The results obtained are from a paired *t-test* comparison between beginning weights of participants and ending weights of participants at the 7-week mark of the DPP program. The data consists of the weights of 13 participants pooled from both groups. SAS statistical software was used to analyze the data. A *t-test* statistical analysis compared pre- and post-weights of each participant before and after 7-weeks of the DPP course.

The results of the paired *t-test* are shown in **Table 3.1**. The test shows that there was a significant difference in the weight of participants before (M=241.2 lbs, SD= 6.5 lbs) and after (M= 235.9 lbs ,SD= 6.5 lbs) 7 weeks of the DPP course; t(12)=2.96, p=0.05. The summary statistics of the difference is displayed in **Figure 3.1**. This SAS output provides the mean, standard deviation, and standard error of the difference. The results suggest that the DPP course does have an effect on the weight of the participants. The weight change achieved through the 7 weeks of DPP was 5.4 lbs. (95%CI: 1.4—9.3 lbs.).

Social Ecological Framework

To fully assess the effectiveness of a program it is also important to consider how the social ecological framework and behavior change models are addressed. By addressing these factors, we can better influence health and health behaviors in individuals. The social ecological framework provides a perspective that enables us to consider the influence of individual and environmental factors on health and health-related behaviors (“Theory,” 2005). There can be many factors that lead to certain health behaviors and can make addressing them very complex. By placing a larger emphasis on the factors beyond the individual allows us to be less likely to blame the individual and more likely to address the underlying determinants of health and health behavior. The is critical for prevention strategies that require action upstream rather than downstream approaches.

In order to improve prevention strategies and reduce the prevalence of type 2 diabetes, many levels of the social ecological framework must be targeted. At the individual level, this program targets the participants referred to the DPP program. To achieve the program's goals, it is important to personalize the program to best suit the individual needs of each participant. The dietitian addressed group concerns but also took the time to meet with participants one-on-one to address individual barriers. By focusing on each participants characteristics, social economic status, knowledge, attitudes and beliefs the dietitian was better able to help them work towards their goals.

At the interpersonal level of the social ecological model, the targets of change are the social influences in each participant's lives. Many social factors can influence health behavior including family, work and social norms. To address these factors, the dietitian asked the participants to make healthy eating behaviors not only for themselves but their families as well. One participant was accompanied by her husband every week. This type of emotional support makes it more likely for the participant to continue making progress towards healthy behaviors. Social norms can also play a huge role on one's self-efficacy to perform certain health behaviors. We found this to be the case with the older group of participants. What was observed was that behavior change was more difficult to achieve with the older group than with the middle-aged group. The dietitian believed part of the issue was the generational gap and the effects of social norms. Older adults come from a generation where it was believed a diet must be followed in order to lose weight. The society they grew up in accepted dieting trends as the answer to a healthier lifestyle. It was difficult for these participants to believe that they could lose weight by making simple changes. This was an area the dietitian focused on with the older group to improve their self-efficacy and health attitudes.

DPP currently accepts self-referrals to the program, but participants do need to meet risk factors to qualify for the program. To ensure continued success of DPP, more emphasis needs to be placed on medical referrals. At the institutional level, it is crucial that hospitals and clinics are on board with preventive measures when it comes to at-risk populations. Risk factors for type 2 diabetes include being overweight, ethnicity, age, family history of diabetes, and getting little or no physical activity. For the program to be successful, medical providers must educate patients about the importance of

taking action to prevent type 2 diabetes. For DPP to be successful, the focus needs to be on prevention first and treatment second.

Factors in the community must also be assessed to prevent or delay type 2 diabetes. It is important to consider the demographic of the community and focus on the dissemination of information. To raise awareness of the importance of preventative strategies in the community, programs must emphasize the importance of getting blood sugars tested and leading a healthy and active lifestyle. The DPP program is effective when risk is determined early on, so that preventative strategies can be utilized. The DPP's goal is reduce the prevalence of diabetes.

At the policy level, modifications to food labels can greatly benefit lifestyle change. In the DPP course, participants were taught to read food labels thoroughly. The dietitian explains to the participants how to determine the amount of added sugars and how to compare the amount in specific food to the suggested daily values. The new food label laws that will go into full effect by the year 2020, will make it easier for consumers to determine servings per container, serving sizes, calories and added sugars. The new label will also contain updated daily values for nutrients and declare nutrient amounts contained in the food in percentages ("New and Improved Nutrition Facts Label," 2019).

Health Behavior Theories

Many theories can describe behavior change and can be applied when reviewing the DPP program. Behavior change models use targeted approaches to develop positive behaviors and to promote and sustain individual, community and society behavioral change ("Theory," 2005). Programs that are effective, use a combination of models to address the multiple levels of the social ecological framework and lead to a greater success of change. Three major types of behavior change theories include the Social Cognitive Theory, Theory of Planned Behavior and the Health Belief Model ("Theory," 2005). Theories provide a systematic way of understanding situations and the barriers that influence behavior.

Social Cognitive Theory includes six concepts: reciprocal determinism, behavioral capability, expectations, self-efficacy, observational learning (modeling) and

reinforcements. Reciprocal determinism is the interaction of the person, behavior and the environment in which the behavior is performed (“Theory,” 2005). The concept considers the individual, interpersonal and community levels of the social ecological framework. To lead to behavior change, the DPP emphasizes making adjustments to individual attitudes and beliefs as well as targeting barriers in the environment that influence those attitudes. Behavioral capability is the knowledge and skill to perform a give behavior (“Theory,” 2005). This concept is addressed with the DPP curriculum. Information is shared with participants that will provide them with the tools and skills to perform a behavior change. Expectations or the anticipated outcomes of the behavior change are addressed with the two goals set by the DPP program. These include a 5 to 7 percent weight loss and an increase in physical activity to 150 minutes. Self-efficacy plays a critical role in the success of participants in the DPP program. The extent to which each participant feels capable of successfully meeting the goals of DPP depends on their confidence level. Confidence to reach behavior goals is achieved through four ways: 1) Active Mastery experiences, 2) Vicarious experiences, 3) Verbal persuasion and 4) Emotional arousal (“Theory,” 2005). Active mastery experiences are obtained from a history of doing something similar in nature. Some of the DPP participants mentioned taking part in weight-watchers or other diet programs. Other participants stated they have struggled with weight management their entire lives with little success. This type of failure can lead to low self-efficacy when it comes to achieving behavior change. Observational learning was experienced through vicarious experiences in the DPP course. This occurs naturally because of the group setting. As the weeks progressed, some participants began losing weight and motivated the others to continue with their behavior change goals. Participants also often shared recipes and healthy food products before class. They also motivated each other when barriers inhibited weight loss and physical activity that week. Verbal persuasion and Emotional arousal were provided by the dietitian. She often offered words of encouragement and made the course exciting by emphasizing the idea of a lifestyle change rather than making participants feel restricted.

The Theory of Planned Behavior includes three main components that lead to intention and eventually behavior change. The three components of this theory include

behavioral attitude, subjective norms and perceived behavioral control. Behavioral attitude focuses on the individual and considers their personal beliefs related to the outcome ("Theory," 2005). Individual attitudes were analyzed in the DPP course through one-on-one meetings with the dietitian. In these meetings, the dietitian would go over specific barriers and current attitudes on the behavior change. The dietitian gauged where the participant was in the process and offered assistance to help them overcome each barrier and continue making progress towards change. Subjective norms focus on the societal and environmental factors that contribute to behavior. The factors addressed in the DPP program focused around prevention. The program aims to modify societies prospective of after-the-fact treatment and instead raise awareness of simple steps that prevent or delay type 2 diabetes now. The participants in the DPP course were already less influenced by social norms than the general population by their participation in the course. They were already aware of the importance of preventative strategies, but still had to deal with factors outside the classroom from their family, friends and community. Some participants described how difficult it was for them to refuse temptations on the weekends when getting together with close friends or family. Other participants asked for tools when attending luncheons. Finally, perceived behavior control is the extent to which individuals believe they can control their behavior. This is based off the individual's perception as to whether factors can influence their behavior change and to what extent or power ("Theory," 2005). This again depends on the influence of society. Some participants in the DPP course were more influenced by these factors and allowed them to have more power over their choices. These participants made slower progress towards their goals.

The Health Belief model highlights the perceptions of behavior change. These perceptions include perceived susceptibility, severity, benefits and barriers. The Health Belief model also considers the concepts of cues to action and self-efficacy. Perceived susceptibility is the individual's belief of the chances of getting a condition ("Theory," 2005). In the DPP course, the perceived susceptibility of participants was very high. This is what interested them in the course and kept them continuously coming back weekly. The participants were aware of their increased risk of developing type 2 diabetes due to risk factors including elevated blood glucose levels. Some of them also

exhibited other risk factors such as family history, being overweight, age and ethnicity. Perceived severity is the idea about the seriousness of a condition and its consequences (“Theory,” 2005). Again, perceived severity was very high in DPP participants. They understood the consequences of developing type 2 diabetes and wanted to reduce their risk before the condition developed and worsened. Perceived benefits relate to the effectiveness of taking action to reduce risk (“Theory,” 2005). The DPP course highlights the benefits of taking action throughout the entirety of the course. The dietitian emphasized to the groups the impact of gradual weight loss and physical activity. She reinforced the idea that small steps could lead to huge outcomes. Perceived barriers analyze the costs of taking action. Barriers were discussed weekly in the classes. These barriers ranged from cost of food to time management. Cues to action are factors that activate a readiness to change. These cues were provided in the form of tools and vicarious experiences. Participants were given a multitude of tools to utilize in their journey. These included recipes, grocery shopping lists, food consumption logs, exercise examples, exercise equipment and live demonstrations. Participants were also called to make bigger attempts when they saw the success of others in the group.

Chapter 5 - Competencies

Student Attainment of MPH Foundational Competencies

Competency #6: *Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels.*

To properly address how structural bias, social inequities, and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels, I attended both internal and external Health Equity Council meetings. The external Health Equity Council meetings included members of community hospitals, ethnic organizations, political activists, health insurance and the health department. This group focused on how to properly provide affordable housing in Johnson County. The council discussed ways to change the structural bias in the community to allow for the acceptance of middle- and lower-class groups into the county. The internal Health Equity Council, made up of health department staff, focused on addressing issues with access to health care regardless of social class and race. Through my time in these meetings, I learned about the barriers present in the community and the complexity of solving these issues.

Competency #9: *Design a population-based policy, program, project or intervention.*

To design a population-based policy, program, project or intervention I created a training PowerPoint and resource document for school officials to use to teach students about the health risks of teen vaping. This is an area of concern in middle and high schools in Johnson County. Over the past year, school officials have been dealing with escalating rates of teen vaping with no strategy for prevention. The training material was provided to school officials at JCDHE's vaping workshop, Train the Trainer, held in early April. At this workshop, I also had the opportunity to present this information to area school officials including counselors, principles and school officers.

Competency #14: *Advocate for political, social or economic policies and programs that will improve health in diverse populations.*

The competency of advocating for political, social or economic policies and programs that will improve health in diverse populations was addressed by updating smoke-free department resources. This was done by updating a brochure and performing research on third-hand smoking. The research on third-hand smoke was done to assist with the development of a grant in the upcoming year that will focus on creating third-hand smoke free policies in daycares and childcare centers.

Competency #19: Communicate audience-appropriate public health content, both in writing and through oral presentation.

Communication of audience-appropriate public health content, both in writing and through oral presentation was also addressed via the vape training PowerPoint. Public health content was delivered through the information included in the PowerPoint and orally presented to the school officials. The vape PowerPoint includes content on vaping devices, components, health risks and prevention strategies. This competency was also addressed through the facilitation of the Diabetes Prevention Program (DPP) classes. I had the opportunity of facilitating activities for this program. One of the activities was on portion control and the tools that the groups could use to help with portion estimation. Another way this competency was addressed was via the blog posts on the Live Well JOCO website. The blog posts I created were on National Nutrition Month and Diabetes Alert Day 2019.

Competency #21: Perform effectively on interprofessional teams.

The competency of performing effectively on interprofessional teams was addressed via Health Equity Council meetings and the collaboration of different departments on projects. The vaping workshop, Train the Trainer, was organized by various county staff members and also community members from the Lung Cancer Association and Kansas Department of Health and Environment (KDHE). Organizing the training material and presentations for this workshop, required interaction from each organization on a regular basis. Another project that also required the application of this

competency was organizing events for National Public Health Week (NPHW). NPHW planning required the collaboration of many different professionals from numerous departments. To celebrate NPHW, I organized activities focused on environmental health, nutrition, tobacco education, and sexual violence and prevention. To accomplish this, it required months of planning, meetings, and education on the various health topics. Through the activities of NPHW, I also participated in the creation of a public health proclamation that was signed by Governor Laura Kelly. The students who assisted in creating the proclamation were invited to attend a signing ceremony at the state capital on March 29th.

Table 5.1 Summary of MPH Foundational Competencies

Number and Competency		**Description**
6	Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels.	This was attained by attending Health Equity Council meetings.
9	Design a population-based policy, program, project or intervention.	Created training materials on the health risks of teen vaping.
14	Advocate for political, social or economic policies and programs that will improve health in diverse populations.	Performed by working on smoke-free research for the county and expanding knowledge regarding tobacco policies.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation.	Communication of health content was delivered through the Diabetes Prevention Program.
21	Perform effectively on interprofessional teams.	Attained through collaboration and engagement with professionals of various fields.

Table 5.2 MPH Foundational Competencies and Course Taught In

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
Evidence-based Approaches to Public Health					
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	x		x		
2. Select quantitative and qualitative data collection methods appropriate for a given public health context	x	x	x		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	x	x	x		
4. Interpret results of data analysis for public health research, policy or practice	x		x		
Public Health and Health Care Systems					
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		x			
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels					x
Planning and Management to Promote Health					
7. Assess population needs, assets and capacities that affect communities' health		x		x	
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs					x
9. Design a population-based policy, program, project or intervention			x		
10. Explain basic principles and tools of budget and resource management		x	x		
11. Select methods to evaluate public health programs	x	x	x		
Policy in Public Health					
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		x	x	x	
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		x		x	
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		x			x
15. Evaluate policies for their impact on public health and health equity		x		x	
Leadership					
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		x			x
17. Apply negotiation and mediation skills to address organizational or community challenges		x			
Communication					
18. Select communication strategies for different audiences and sectors	DMP 815, FNDH 880 or KIN 796				
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	DMP 815, FNDH 880 or KIN 796				

22 Public Health Foundational Competencies Course Mapping	MPH 701	MPH 720	MPH 754	MPH 802	MPH 818
20. Describe the importance of cultural competence in communicating public health content		x			x
Interprofessional Practice					
21. Perform effectively on interprofessional teams		x			x
Systems Thinking					
22. Apply systems thinking tools to a public health issue			x	x	

Student Attainment of MPH Emphasis Area Competencies

Competency #1: Information literacy of public health nutrition

The emphasis area competencies for nutrition were each covered through coursework, but two competencies were addressed in my project. The competency of information literacy of public health nutrition was addressed by providing DPP participants with nutrition education for each module. Not only was the information provided, it was also clearly explained to the participants. The dietitian made an effort in each class to present the nutrition information in a manner that was easier to comprehend. She also followed up on presentations with handouts that contained only the essential information needed. She asked questions of the participants and she explained the information and revisited the topic at the next meeting. I assisted the dietitian with preparation of materials for each class. I also addressed this competency when educating the groups about portion control. To make the information easier to comprehend I incorporated an interactive activity which involved guessing portion sizes based off images. The participant closest to the actual portion size won a prize. This activity was done to provide the information to the participants in a way that would be easier for them to remember. The activity also gauged their level of understanding regarding portion sizes. My goal by incorporating an interactive activity, was that the participants would learn the information easier and also realize how not measuring portions could lead to an overconsumption of food.

Competency #3: Population-based health administration

The second competency addressed through my project was the population-based health administration competency. This competency was addressed by observing the administration of a health service program. I observed what was taught and in what manner and also the effectiveness of the DPP program based on how well it incorporated factors from the social ecological framework. I also analyzed how health behavior models applied to this type of behavior change program. By utilizing the knowledge taught in my courses, I was able to analyze the effectiveness of the program based on these concepts.

Table 5.3 Summary of MPH Emphasis Area Competencies

MPH Emphasis Area:		
Number and Competency		**Description**
1	Information literacy of public health nutrition	Examine the acquisition of public health nutrition knowledge and skills and evaluate how to select information efficiently and effectively for public health practice.
2	Compare and relate research into practice	Examine chronic disease surveillance, policy, program planning and evaluation, and program management, in the context of public health nutrition.
3	Population-based health administration	Develop and examine the administration of population-based food, nutrition and health services.
4	Analysis of human nutrition principles	Examine epidemiological concepts of human nutrition in order to improve population health and reduce disease risk.
5	Analysis of nutrition epidemiology	Critique nutritional epidemiological research design methods.

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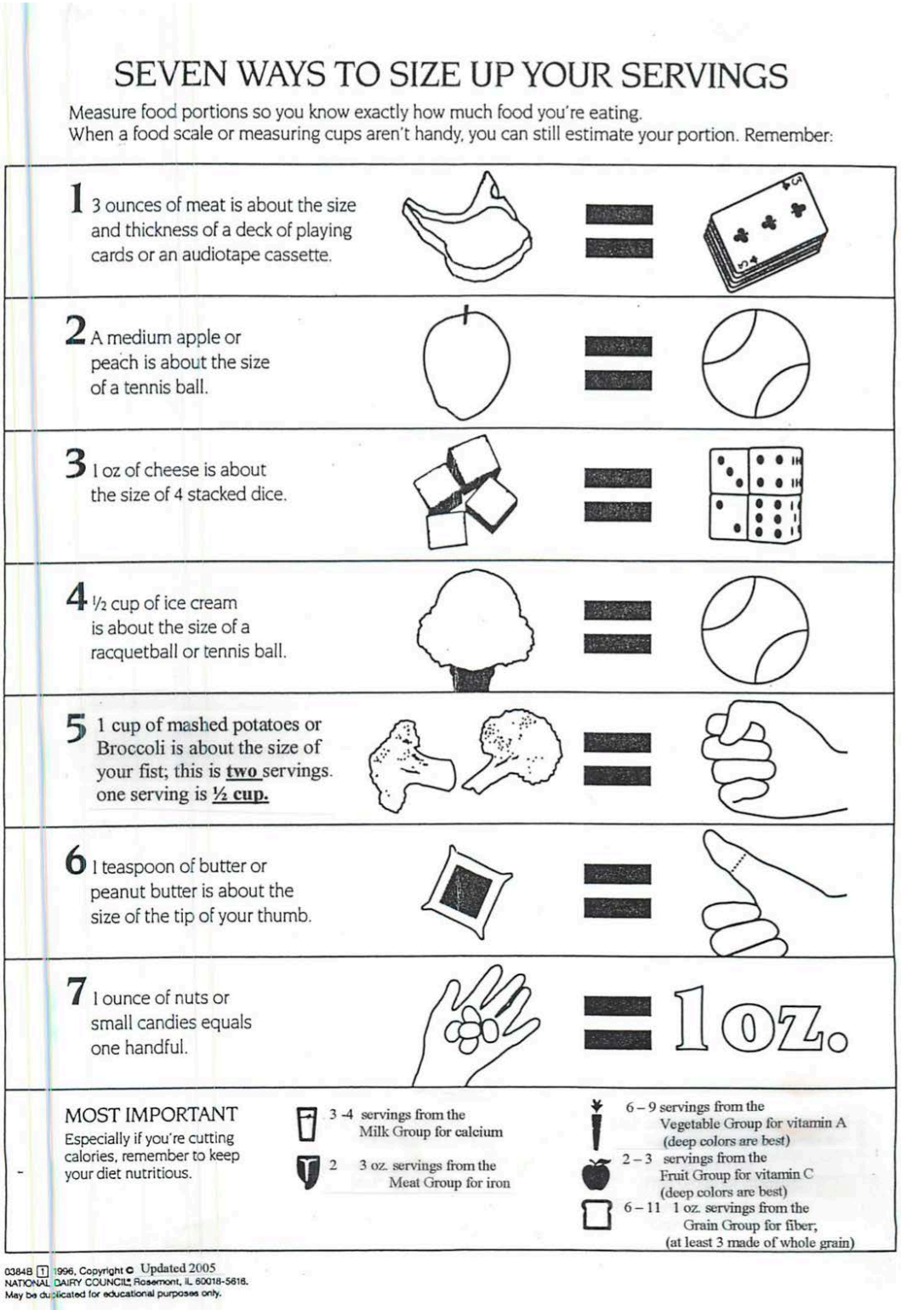
Appendix

Examples of portion control handouts



SEVEN WAYS TO SIZE UP YOUR SERVINGS

Measure food portions so you know exactly how much food you're eating.
When a food scale or measuring cups aren't handy, you can still estimate your portion. Remember:

1 3 ounces of meat is about the size and thickness of a deck of playing cards or an audiotape cassette.

2 A medium apple or peach is about the size of a tennis ball.

3 1 oz of cheese is about the size of 4 stacked dice.

4 ½ cup of ice cream is about the size of a racquetball or tennis ball.

5 1 cup of mashed potatoes or Broccoli is about the size of your fist; this is **two** servings. one serving is **½ cup.**

6 1 teaspoon of butter or peanut butter is about the size of the tip of your thumb.

7 1 ounce of nuts or small candies equals one handful.

= 1 oz.

MOST IMPORTANT
Especially if you're cutting calories, remember to keep your diet nutritious.

3 -4 servings from the Milk Group for calcium

2 3 oz. servings from the Meat Group for iron

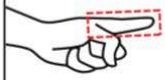
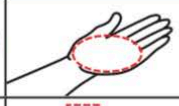
6 – 9 servings from the Vegetable Group for vitamin A (deep colors are best)

2 – 3 servings from the Fruit Group for vitamin C (deep colors are best)

6 – 11 1 oz. servings from the Grain Group for fiber; (at least 3 made of whole grain)

Serving-Size Chart

DAIRY COUNCIL of CALIFORNIA
Healthy Eating Made Easier

FOOD	SYMBOL	COMPARISON	SERVING SIZE
Dairy: Milk, Yogurt, Cheese			
Cheese (string cheese) 		Pointer finger	1½ ounces
Milk and yogurt (glass of milk) 		One fist	1 cup
Vegetables			
Cooked carrots 		One fist	1 cup
Salad (bowl of salad) 		Two fists	2 cups
Fruits			
Apple 		One fist	1 medium
Canned peaches 		One fist	1 cup
Grains: Breads, Cereals, Pasta			
Dry cereal (bowl of cereal) 		One fist	1 cup
Noodles, rice, oatmeal (bowl of noodles) 		Handful	½ cup
Slice of whole-wheat bread 		Flat hand	1 slice
Protein: Meat, Beans, Nuts			
Chicken, beef, fish, pork (chicken breast) 		Palm	3 ounces
Peanut butter (spoon of peanut butter) 		Thumb	1 tablespoon

HealthyEating.org

MM/07-17/2,800

Examples of physical activity resistance exercise

DAILY BURN

https://dailyburn.com/life/fitness/resistance-band-exercises-workout/

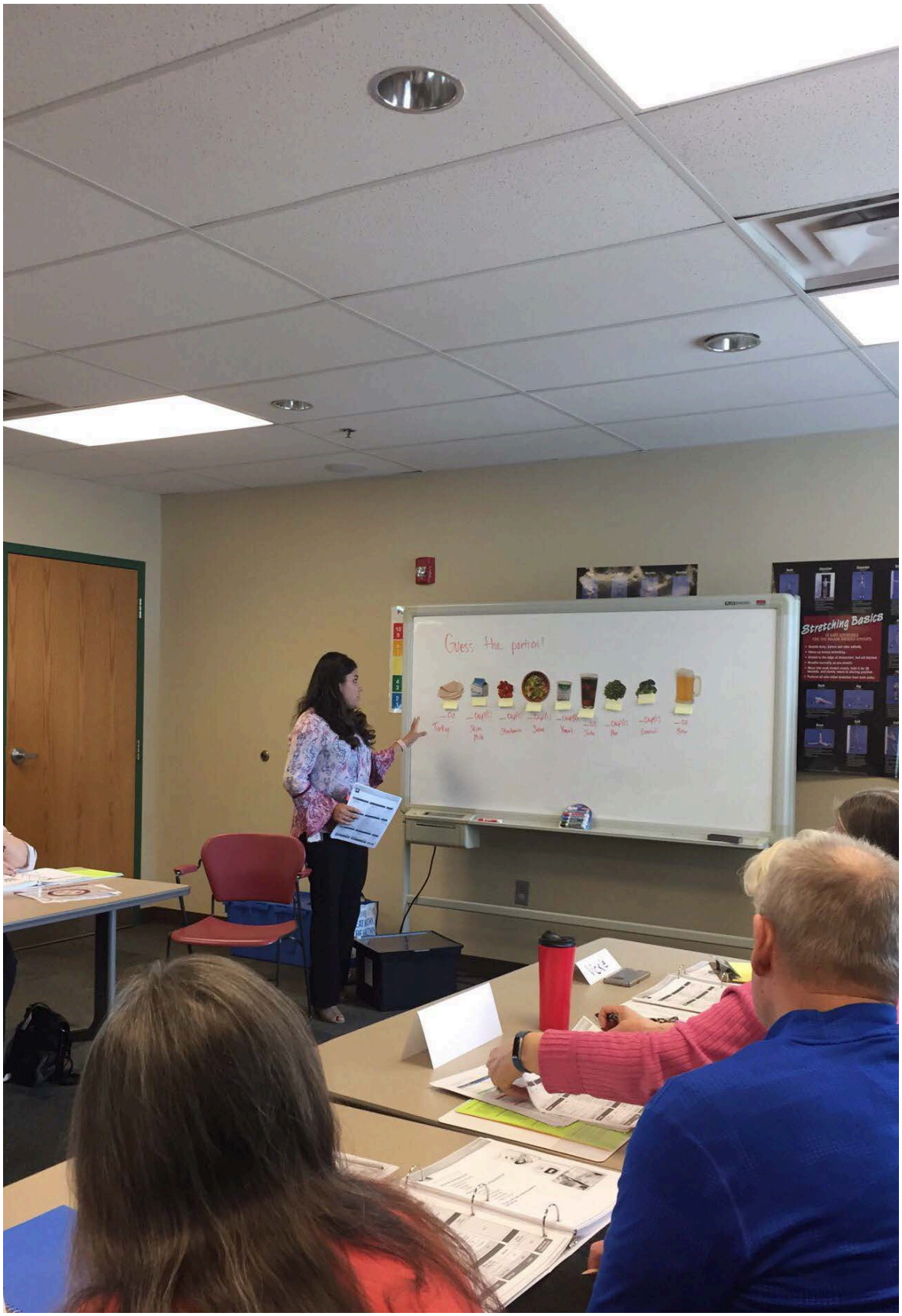
10 Total-Body Resistance Band Exercises

Looped Resistance Band

1. Band Pull Apart

Targets: Chest, triceps, rhomboids (upper back)
How to: Stand with your feet shoulder-width apart and head facing forward **(a)**. Hold a resistance band in front of you with your arms extended straight out. There should be 4-6 inches of band left at the ends where your grip stops **(b)**.

Images from portion control lesson


Guess the portion!
Stretching Basics