Effects of DASH Diet and Exercise on Hypertension

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Abstract

Hypertension is a global pandemic which can cause significant complications if left untreated. The silent symptom characteristics associated with hypertension create the urgency for disease management. The purpose of this quasi-experimental study was to identify the effects of DASH diet and exercise on hypertension. The study sample included three, 18-65-year-old adults with a diagnosis of hypertension. The project was conducted at a family primary care clinic in the Midwest. DASH diet and exercise were used for the management of hypertension, and pre and post- blood pressure, dietary intake, and exercise data were measured in the project. The results indicated that DASH diet and exercise can lower blood pressure in a period of four weeks. The reduction of hypertension prevalence promotes prevention of advanced cardiovascular diseases, enhances individual wellbeing, and reduces healthcare cost. The economic burden of DASH diet and exercise is less than management of hypertension within antihypertensives. Future studies will be essential in identifying the barriers that affect the use of DASH die and exercise on hypertension.

Keywords: hypertension, Dietary Approach to Stop Hypertension (DASH), exercise, adherence, motivation, quasi-experiment

DASH Diet and Exercise Use in Hypertensive Adults to Lower Blood Pressure

Hypertension, also known as high blood pressure, is defined as systolic blood pressure above 130 millimeters of mercury (mmHg) and diastolic blood pressure above 80 mmHg (Whelton et al., 2017). Hypertension (HTN) has been identified as the silent killer due to lack of symptoms which requires screening (Winter, Tuttle, & Viera, 2013). Nearly 50% of all adverse cardiovascular diseases like myocardial infarction, kidney failure, stroke, and heart failure are contributed by HTN (Winter et al., 2013). Regardless of numerous studies on the prevention of HTN, prevalence continues to increase (Centers for Disease Control and Prevention [CDC], 2016).

The original Dietary Approach to Stop Hypertension DASH diet study was a randomized controlled trial and compared two diets (Appel et al., 1997). The results obtained from subjects who consumed the DASH diet showed a significant reduction in blood pressure (BP) readings (Appel et al., 1997). The clinic for the current project does not have a specific DASH diet and exercise educational material for patients diagnosed with HTN. Provision of specific DASH diet foods and appropriate exercise plans eliminates confusion and promotes optimal blood pressure (see Appendix A for definitions).

Background and Significance

Seventy-five million Americans have HTN which is equivalent to one in every three adults and leads to 1,100 deaths every day (CDC, 2016). HTN is the leading cause of cardiovascular diseases which are the leading cause of death in the United States (Hirshfield, Downing, Horvath, Swartz, & Chiasson, 2016). HTN is the most significant factor in global

mortality, leading to 9.4 million deaths every year (Lim et al., 2012). The prevalence of HTN worldwide is expected to approach 1.56 billion people by 2025 (Kearney et al., 2005). The risk factors for HTN in the United States include gender, body mass index, ethnicity, age, cigarette smoking, obesity, alcoholism, and poor diet (Whelton et al., 2017). Effective control and treatment of HTN require patient understanding of prevention of risk factors. HTN creates a significant burden on the economy, the health care policy, and the health system (Whelton et al., 2017). The United States Preventive Task Force (USPSTF, 2015) issued a grade A, meaning that it has a high certainty and a substantial net benefit, to the screening of HTN in adults 18 years and older in 2007.

In the U.S high blood pressure is more prevalent in women than men and also more common in African American compared to Hispanics and the Caucasians (Hirshfield et al., 2016). The prevalence of HTN is 1.87 higher in African American adults compared to Caucasian adults (Kearney et al., 2005). The young people affected by HTN accounts for 60%, causing the country to experience a challenge in managing and preventing the disease (Hirshfield et al., 2016). The lack of symptoms related to HTN contributes to poor management which puts more people at risk for cardiovascular diseases (Hirshfield et al., 2016).

Economic

The financial cost of HTN accounts for 46 billion dollars every year in the United States (CDC (2016). This cost includes the health care services charge, antihypertensive medications, and missed days of work (CDC, 2016). There are approximately 295,000 annual cases of preventable HTN hospitalizations of adults in the United States (Axon, Turner, & Buckley, 2015). The projected direct cost of HTN is expected to triple from $130.7 to $389.9 billion from by 2030 (Johnston et al., 2011). The indirect cost is expected to double from $25.4 to 45.8 billion by 2030

(Johnston et al., 2011). Early recognition and treatment of HTN are essential to the preventing complications associated with the disease and lessening the economic burden (Axon et al., 2015). Allowing self-monitoring of blood pressures has shown to reduce the cost of HTN management. Patients are able to monitor their blood pressures at home at a lower cost than going to the clinic for checkups (Jacob et al., 2017). Inaccurate BP readings related to white coat anxiety in the medical clinic can contribute to higher cost of HTN management which can be avoided through self-monitored BPs (Jacob et al., 2017).

Policy

The involvement of local policy leaders in the prevention and management of HTN is significant to the health of communities. There are limited studies on the supply of healthy foods in the United States (Ver Plog et al., 2015). Policymakers are moving towards creating access to fresh produce and other healthy foods in underserved regions (Ver Pleg et al., 2015). Emphasizing diet and exercise in underserved areas can be a challenge due to limited resources (Nwasuruba, & Egede, 2007). The support of lifestyle modification habits by government officials is significant to the management of HTN (Ferdinand et al., 2010).

Health System

Hypertension is a global burden in public health due to the high prevalence, increased connection to cardiovascular diseases, and premature deaths (Cutler et al., 2008; Lawes, C. M., Hoorn, S. V., Rodgers, A. 2008). HTN is one of the most serious and highly preventable risk factors for coronary artery disease, chronic kidney disease, stroke, vascular disease, and congestive heart failure (Gu et al., 2008; Lawes et al., 2008; Kearney et al., 2005). Early recognition and treatment of HTN are essential to the prevention of complications associated with the disease (Carey, & Whelton, 2018). A team-based approach is critical for the

management of adult HTN (Carey, & Whelton, 2018). The use of clinical practice guidelines by practitioners is critical to the management of HTN (Abrahamson, Fox, & Doebbeling, 2012; Carey, & Whelton, 2018; Lee et al., 2015; Mickan, Burls, & Glasziou, 2011).

Local Issue

The prevalence of HTN has not changed over the decades in the United States regardless of improvement in awareness (Zhang, & Moran, 2017). The overall prevalence of HTN in 2013-2014 was 31.6% (Zhang, & Moran, 2017). The Missouri state where this project was carried reported an increased prevalence of HTN from 20.6% in 2009 to 30.6% in 2011 (Missouri Department of Health and Senior Services, 2013). Heart disease is the leading cause of death with a rate of 178.03 per 100,000 in the Eastern Jackson County (EJC) where the project was carried out (Jackson County Health Department [JCHD], 2017). Two in every ten deaths are caused by heart disease in the EJC (JCHD, 2017).

This project was conducted in an underserved region. People living in underserved areas have a higher prevalence of uncontrolled HTN. Patients residing in underserved areas face multiple comorbidities leading to HTN (Bertoni et al., 2011). Low socioeconomic status has been linked to the increase in stress which in turn has been shown to cause HTN (Bertoni et al., 2011; de Gaudemaris et al., 2002). Lack of financial stability contributes to the poor eating habits found in underserved populations which lead to obesity, a major contributing factor to HTN (Bertoni et al., 2011; Diez-Roux et al., 2009). People living in underserved regions are more likely to consume foods high in sodium, fat and low in fruits and vegetables (Walker, Keane, & Burke, 2010; Larson, Story, & Nelson, 2009; Diez-Roux et al., 2009). The consumption of poor diets in the underserved areas is associated with limited accessibility or affordability of healthy

foods grocery stores which has been described by the US Department of agriculture as “food deserts” (Ver Ploeg, Dutko, & Breneman, 2015).

Diversity Considerations

According to the U.S census report for 2017 (U.S. Census, 2018), Raytown City has a population of 29,211, and 52.7% are female, 16.1% are under 18 years, and 16.1% are above the age of 65 years. Approximately, 4.7% of the residents are under the age of 5 years, 57.8% of the population are Caucasian, 31.7% are African American, 6.0% are Hispanic, and 0.3% are Alaskan native. There is a high number of residents from Libya in the Raytown area, and foreign-born persons make up 2.8% of the population. Out of the 29,111-total population, 1,856 are veterans. About 93.2% of the residents have a high school education, and 22.5% have a bachelor’s degree or higher. About 10.3% of the population is under 65 years and on disability, and 16.4% of the residents below age 65 years have no health insurance. About 64% of the residents 16 years and are employed in a civil labor force. The median household income is $51, 089, and 12.5% of the residents live below the poverty line. Approximately 95% of the residents speak English, and 3% of the residents speak Spanish.

Problem Statement

Hypertension is the leading modifiable risk factor for cardiovascular disease, stroke, and mortality accounting for one in every three adult Americans, and hypertension can be controlled efficiently using DASH diet and exercise (CDC, 2016).

Purpose Statement

The primary purpose of the Doctor of Nursing Practice project is to determine if DASH diet and exercise, when used as the initial treatment of HTN in a primary care setting, can

contribute to optimal blood pressure. The secondary purpose of this project is to prevent complications associated with HTN.

Intended Improvement

The lack of symptoms associated with HTN is linked to the increased progress of the disease without recognition (Monroe, 2013). The expected increase in the prevalence of HTN creates disease management urgency. HTN is the leading cause of cardiovascular deaths in U.S. (Whelton et al., 2017) HTN is ranked as the third cause of disability in the United States (Ezzati et al., 2002). DASH diet and exercise have been recognized as the initial treatment plans for HTN (Whelton et al., 2017).

Facilitators and Barriers

The main facilitator of the project was the senior nurse practitioner for the Midwest clinic. The clinic staff support was essential to the progress and success of the project. The funding received from the University of Missouri, Kansas City Women's Council Graduate Assistance Fund facilitated the dissemination of the project. The participants' motivation, willingness, and knowledge of HTN served as facilitators. Some of the barriers identified included inability to recruit the projected sample size, schedule conflict, lack of self-monitoring BP machines, food affordability and availability, lack of participant~~s~~ motivation, and inability to break poor habits.

Inquiry

In adults, 18 to 65 years with hypertension, does the DASH diet and physical exercise (150 minutes per week), compared to no diet or exercise modifications, lower BP during four months at a Midwest primary care clinic?

Literature Search

The major databases utilized in this evidence-based project (EBP) included CINHAL, MEDLINE, PUBMED, and Cochrane systemic review; Google Scholar served as a search engine. Keywords included hypertension, DASH diet and hypertension, exercise and hypertension, effects of the DASH diet and exercise on hypertension, lifestyle modifications, and compliance with DASH diet and exercise. An additional manual search was performed using the reference list of the searched studies. Specific search strategies by using terms DASH diet and exercise and hypertension provided 68 studies. Out of the 68 studies, 20 met the criteria for the evidence synthesis, and they were selected for review (see Appendix B). Two studies are systemic reviews level I. Fourteen studies are well designed randomized clinical trials level II. Three studies are level III as they involve well-designed experiments without randomization. One study is a cohort level IV (see Appendix C for Melnyk & Overholt, 2015, adapted).

Synthesis of Evidence

The current HTN treatment guideline by the JNC 8 acknowledges DASH diet as the initial therapy in the prevention, treatment, and management of HTN (James et al., 2014). Not only is the use of lifestyle modification the least invasive method of BP management, but it is also more cost-effective than using medications (Mozaffarian et al., 2015). The pressure to maintain a healthy lifestyle can be overwhelming for the patients which can lead to despair and lack of adherence to DASH diet and exercise (Anthony et al., 2012). Patient's fear associated with the failure of the lifestyle changes to the management of HTN may affect adherence and motivation (Murray et al., 2013). Empowerment contributes to patient proactivity and increases the likelihood of treatment adherence, healthy habits, and optimal control of HTN (Bonaccorsi & Modesti, 2017). The evidence topics for the synthesis of DASH diet and exercise for HTN

management are effects of DASH diet and exercise on hypertension, adherence, early management of hypertension, maintenance, and cost management.

Effects of DASH Diet and Exercise on Hypertension

The combination of DASH diet and exercise contribute to a significant decrease in BP compared to DASH alone or exercise alone (Blumenthal et al., 2010; Edwards et al., 2011; Saneei, Salehi-Abargouei, Esmaillzadeh, & Azadbakht; Ziv et al., 2013; Paula et al., 2015). Lifestyle modifications are the initial nonpharmacologic approach to management and prevention of HTN (Appel, 1997; Beilin et al., 2001; Burke et al., 2005; Whelton et al., 2010). DASH diet and exercise management provide better control than other lifestyle modifications (Burke et al., 2005; Kuller et al., 2006; Whelton et al., 1998).

Left ventricular hypertrophy and arterial stiffness are some of the cardiac structural effects of HTN (Boutouyrie et al., 2002; Casala et al., 1986). Lowering of BP is associated with regression of left ventricular mass and a decrease in rates of cardiovascular events (Devereux et al., 2004). Increased BP is linked to arterial stiffness which causes an increase in pulse wave velocity and increased rates of cardiovascular mortality rates (Boutouyrie et al., 2002; Topouchian et al., 2007; Watabe et al., 2004). DASH diet combined with exercise produces a significant reduction in pulse wave speed which leads to decrease in BP (Blumenthal et al. (2010; Topouchian et al., 2007; Watabe et al., 2006). By utilizing both the DASH diet and exercise, one would ensure that the maximum treatment is achieved to promote the best results possible in the control and management of HTN.

DASH Diet and Exercise Adherence

DASH diet and exercise adherence are associated with a significant reduction in BP (Epstein et al., 2012; Blumenthal et al., 2010; Kwan et al., 2013; Mozaffarian et al., 2015;

Shahrani et al., 2016). A follow-up, training, and duration affect patient adherence to the DASH diet and exercise (Elmer et al., 2006; Shahrani et al., 2016). Consisted follow up of the patient while transitioning to a new lifestyle is significant to adherence (Elmer et al., 2006; Jeffery et al., 2000; Molazem, Rezaei, Mohebbi, & Keshavarzi, 2013). Common goals between the patient and the provider play a significant role in DASH and exercise adherence (Jeffery et al., 2000; Molazem et al., 2013).

Patient motivation on DASH diet and exercise is essential to adherence and maintenance (Abolfotouh, Soliman, Abolfotouh, & Raafat, 2011; Kwan et al., 2013; Schunk, & Usher, 2012). Nutrition counseling is vital to the maintenance and adherence to both DASH diet and exercise. The use of support, and motivation of patients during lifestyle modification have a higher reduction in BP compared to lack of follow up (Couch et al., 2008; Nowson, Patchett, & Wattanapenpaiboon, 2009). The decrease in compliance with time is associated with lack of follow up and motivation (Couch et al., 2008; Cox et al., 2006; Obarzanek et al., 2007; Racine, Troyer, Warren-Findlow, & McAuley, 2011; Troyer, Racine, Ngugi, & McAuley, 2010). Smartphone applications have been utilized for patient-centered care in lifestyle modifications to incorporate reminders, feedback, support, and promote adherence (Chow et al., 2015; Johnston et al., 2015; Martin et al., 2015; Varnfield et al., 2014; Yudi et al., 2016).

Early Hypertension Management with DASH and Exercise

When introduced early in prehypertensive patients, DASH diet and exercise can serve as a monotherapy (Elmer et al., 2006; Jarl, Tolentino, James, Clark, & Ryan, 2014;). Most studies have focused on weight reduction as a result of DASH and exercise which causes BP reduction (Juraschek, Miller, Weaver, & Appel, 2017; Neter 2003). Effective DASH diet and exercise is more effective when utilized in subgroups for close monitoring and follow up than a general

population approach (Ebrahim & Smith, 1998; Mulrow et al., 2008; Neter et al. 2003). Borderline HTN treated with DASH diet and exercise can prevent serious complications related to the disease (Lloyd-Jones, Evans, Larson, O'Donnell, & Levy,1999; Sagie, Larson, & Levy,1993).

DASH Diet and Exercise Maintenance

Little is known about the maintenance of the DASH diet and exercise (Hinderliter et al., 2017; Jarl et al., 2014; Wing, Venditti, Jakicic, Polley, Lang,1998). The focus has been on short-term effects of the DASH diet and exercise (Blumenthal et al., 2010). Long-term maintenance of the DASH diet and exercise is an ongoing challenge for health care providers (Blumenthal et al., 2010; Juraschek et al., 2017; Neter 2003). When DASH diet and exercise interventions focus on weight loss, most patients stop the treatment plan once they attain their goal weight (Hinderliter et al., 2017). Maintenance of the DASH diet and exercise can be influenced by the patient's economic status (Appel et al. 2003). The increased cost of DASH diet foods can affect patients' compliance due to lack of affordability (de Gaudemaris et al., 2002; Tobe et al., 2005). Patients living in food desert areas may have difficulties accessing fresh produce; hence, poor diet maintenance (Bertoni et al., 2011; Mackenbach et al., 2017; Nash et al., 2015; Ver Ploeg et al., 2015). The busy lifestyle of many patients can influence the maintenance of the DASH diet and an exercise regimen (Magobe, Poggenpoel, & Myburgh, 2017; Pelletier, & Laska, 2012). Lack of time is the most reported barrier to the maintenance of diet and exercise in adults (Greaney et al., 2009; Kearney, & McElhone, 1999; Welch, McNaughton, Hunter, W., Hume, & Crawford, 2009).

DASH Diet and Exercise Cost-effectiveness

Less is known about the cost of DASH diet and exercise compared to the cost of medication on the management of HTN (Forster, Veerman, Barendregt, & Vos, 2011; Polar, & Sturm, 2009; Rehm, Monsivais, & Drewnowski, 2015). Most studies have focused on the cost of food at an individual level (Darmon, & Drewnowski, 2008; Drewnowski, & Specter, 2004; Lee, Ralston, & Truby, 2011; Rao, Afshin, Singh, & Mozaffarian, 2013). The side effects of antihypertensives can contribute to work absenteeism and less productivity as opposed to lifestyle modification interventions which have no side effects (Rehm et al., 2015). The cost of antihypertensive drugs creates a higher economic burden relative to that of diet and exercise (Polar, & Sturm, 2009). The annual cost of hypertension-related illnesses is $46 million which is significantly higher than the predicted cost of lifestyle modifications (Ghadieh, & Saab, 2015; Monsivais et al., 2015; Ohno et al., 2016).

Health Belief Model

The health belief model (HBM) is a psychological theory discovered by Hochbaum, Rosenstock, and Kegels in the 1950s (Rosenstock, 1974)). HBM has been applied to numerous studies seeking to understand the individuals' attitude and beliefs. The HBM contains six concepts which include perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy (see Appendix D; Rosenstock, 1974). The HBM was applied to the project on the use of the DASH diet and exercise for the management of HTN. This model focuses on behavioral change at the individual level (Rosenstock, 1974). The HBM was utilized to identify the participants' perception of the management of HTN using DASH diet and exercise.

Methods

Institutional Review Board

The primary Institutional Review Board **(**IRB) was UMKC. There was no secondary IRB needed for this project as Truman Medical Center pavilion clinic accepted the primary UMKC IRB (see Appendix E). The project was categorized as Evidence-Based Quality Improvement (EBQI), Not Human Subjects Research. The project involved noninvasive interventions, and the project was designed to improve the health of society.

Ethics

Ethical considerations included privacy and confidentiality, and data obtained from the patient charts were protected by coding patients. The use of patient names was avoided during data analysis to preserve their identity and prevent cyber exploitation. While retaining subjects was significant for the project, allowing the patients to self-withdrawal from the intervention promotes autonomy and patients' rights (Melnyk & E. Fineout-Overholt 2015). The subjects were given adequate information on the interventions and their expectations and were allowed to make an informed decision. It is possible to obtain routine data from the patients without consent to enhance the validity of data, but simple courtesy to the subject should be considered (Walley, 2006; Hutton & Ashcroft, 2000). The student investigator did not have any conflict of interest.

Funding

The project was estimated to cost about $433.40 (see Appendix F for cost table). The estimated budget was lower than expected due to the lower sample of participants who completed the project. The project cost was ~~Advanced Practice Nurses of the Ozarks (APNO)~~ $656.00 with the majority of the cost related to dissemination of the project results. The student investigator received $250.00 from the Graduate women's fund at UMKC. Most of the participants chose to self-monitor their blood pressures at home or~~-~~ a pharmacy due to schedule conflicts. The cost of the project was overall managed through self-funding. The student

investigator was self-funded for the dissemination of this project. The project site allowed the student investigator to use the clinic sphygmomanometers to check blood pressures.

Setting and Sampling

The evidence-based project was implemented at a Midwest primary care clinic Raytown, Missouri. The family nurse practitioner at the clinic helped to facilitate the project. The sample size hypothesized for the project was 30, but the student investigator was able to recruit 15 participants. Out of the 15 participants, three completed the project. The inclusion criteria involved participants aged 18 to 65 years with systolic blood pressure greater than 130 mmHg or diastolic blood pressure greater than 80mmHg. Participants were recruited through regular clinic visits and phone calls to potential subjects. Exclusion criteria included pregnant patients and patients unable to access the DASH diet, blood pressure monitoring or unable to exercise due to mobility problems.

EBP Intervention~~s~~

This EBP intervention involved ten steps (see Appendix G for the project steps). The first step involved searching from the clinic data for potential participants who had a systolic blood pressure greater than 130 mmHg and a diastolic blood pressures greater than 80 mmHg. Step two included recruitment of 15 participants, who met inclusion criteria, during clinic appointments or phone calls. Step three addressed the collection of two previously recorded blood pressures from the participant's electronic medical record. Step four involved the calculation of the average of the two blood pressures from each selected participant which was recorded as the baseline blood pressure.

Once all the baseline blood pressures and dietary intake were obtained from the candidates, step five involved the first meeting on October 29, 2018 when the participants were

informed about the expectations of the project and the specifics of DASH diet and exercise. The student investigator led the initial meeting which was conducted through a phone call to the participant. The student investigator prepared a folder for each participant. The folder included the exercise, blood pressure, and exercise logs to be completed by the participants. The folder also included exercise description, DASH diet foods, and a pamphlet with educational information for the participants on hypertension. The participants were requested to keep a record of two blood readings each day and the number of days they consumed the DASH diet and exercised each week for four months. The participants provided verbal consent allowing the use of their de-identified information for data analysis.

Step six involved the second meeting, November 19, 2018. The student investigator coordinated the meeting which was completed through a phone conversation between the student investigator and the participant, individually. The participant was asked to keep a record of two readings each day, and the average of the two was to be recorded. The student investigator calculated the average of the weekly BP readings. Step seven involved the student investigator meeting with each subject to discuss any concerns or limitations of the interventions. The student investigator provided motivational interviewing to the participants to enhance lifestyle change.

Step eight was the third meeting on December 10, 2018. The student investigator met one on one with the participants and identified needs to be addressed and provided motivation. The subsequent four meetings were held on December 26, or 31, 2018; January 14, 2019; January 28,2019; and February 11, 2019. The four meetings involved the same process as the second and third. The last meeting was held on February 25, 2019, and it was conducted over the phone by the student investigator with each participant individually. See Appendix H). The student investigator created an online feedback tool for the participants to provide project feedback.

Participants were asked to provide feedback based on three questionnaires (see Appendix I). The participant data was deidentified to promote honest feedback and protect their identity.

Change Organization Theory

The transtheoretical model of organizational change was the change model. The model involves six constructs which include pre-contemplation, contemplation, preparation, action, and maintenance (Melnyk, & Fineout-Overholt, 2015). The pre-contemplation stage involved the lack of interest in the DASH diet and exercised education to patients within four months by the TMC clinic staff to the. The contemplation stage involved included the readiness of TMC staff to take get involved in educating patients on DASH diet and exercise for HTN management within four months (Melnyk, & Fineout-Overholt, 2015). In the preparation stage, the TMC staff was willing to carry out the education of patients with HTN on the use of the DASH diet and exercise in 30 days (Melnyk, & Fineout-Overholt, 2015). In the action stage, the TMC staff adopted the DASH diet and exercise education to patients diagnosed with HTN less than four months (Melnyk, & Fineout-Overholt, 2015). The maintenance stage involved the use of DASH diet and exercise material by the TMC clinic staff to educate the patients with HTN in more than four months (J. Prochaska, J. O. Prochaska, & Levesque, 2001).

EBP Model

The EBP model for the project was the Stetler model of research utilization. The Stetler model consists of five phases which include preparation, validation, comparative, translation and evaluation (Melnyk, & Fineout-Overholt, 2015). In the preparation phase, the student investigator identified the significance of HTN management using the DASH diet and exercise. The student investigator utilized the validation phase by looking for relevant evidence-based studies. In the comparative evaluation phase, the student investigator developed a decision using

the utilization criteria. In the application phase, the student investigator plans to apply the information in hand to carry out the project. The last phase involved evaluation of the DASH diet and exercise on BP.

Project Sustainability

The interest of the Midwest clinic facilitator on use of DASH diet and exercise for HTN management may promote the project sustainability. The use of easily reliable means of communication like text messaging and phone calls during the meetings promoted the sustainability of the project. Based on the previous studies, the use of DASH diet and exercise have shown to lower the BP effectively. The future of this project may be sustained through the education of potential patients with hypertension using the results obtained. The student investigator provided the staff with pamphlets containing patient education on DASH diet and exercise on hypertension. The availability of self-monitoring blood pressure machines may sustain this project by promoting self-care. Sustainability of this project may depend on the provision of DASH diet foods to the participants or referral to the community-based program to help with the provision of healthy foods.

Study Design

The project utilized a quasi-experimental design, one group. The project involved the selection of potential participants from the clinic electronic health records. Patients who met the project criteria were selected. The student investigator contacted the group selected through person to person contact during clinic visits or phone calls. The pre-BP readings were recorded before the DASH diet and exercise interventions. The post and pre-BP readings were obtained after the interventions and compared.

Validity

The internal validity of the project was based on the use of DASH diet and exercise for the treatment of HTN as it has been shown to yield positive results (Blumenthal et al., 2010; Whelton et al., 2017). The use of recent evidence from studies promoted the internal reliability of the project, and reliable measuring tools served as a precursor to the internal validity of the project. The external validity was enhanced by a diverse participant sample.

Measured Outcomes

The project targeted measurement of the participants' dietary intake, exercise, and blood pressure. Daily logs for the DASH diet, exercise, and blood pressure were provided to the participants for recording data. Participants were educated on how to enter data into the logs. The participants kept a diary on the number of days they consumed the DASH diet each week and a log of the number of minutes exercised in a given week. The BPs were recorded twice daily by the participants, morning and evening. Also, the office recorded BPs were utilized if the participants visited the clinic for a BP check.

Measurement Instruments

The project utilized three measurement tools which included blood pressure, dietary log, and exercise log (see Appendix J). The participants kept a daily log of BP readings. The DASH diet was measured using a daily dietary intake log by the participants showing the foods consumed. There is a strong correlation between blood pressure management using DASH diet and exercise logs (Whelton, 2017). The participants maintained an exercise log showing the length of exercise in minutes. It was critical for the participants to maintain a routine intake of DASH diet foods consumed and complete the dietary intake in days per the log instructions. The validity and reliability of the measurement instruments were based on their application in

published evidence-based studies and research (Blumenthal et al., 2010; Edwards, Wilson, Sadja, Ziegler, & Mills, 2011). Permission was not required for the use of the measurement instruments.

Quality of Data

The calculated sample size for the project using Gpower based on medium effect 0.5, power of 0.8, and alpha .05 for a two-tailed t-test was 26 participants. The projected sample for the project involved 30 participants. The student investigator was able to recruit 15 participants. Out of the fifteen participants who enrolled for the project, three completed the project. The student investigator collected pre-intervention data based on the information from the EMR and from personal interviews. Some of the 12 participants who did not complete the intervention provided various reasons and others opted out without any reasons (see Appendix K for uncompleted participants pre intervention data).

Analysis plan

The analysis plan projected for this EBQI was the use of comparison analysis and paired t-tests, but due to the small sample, descriptive statistics were reported for the results. The student investigator analyzed the data using mean, mode, and median of the BP, DASH diet intake days, and exercise in minutes. Due to the small sample, the student investigator opted not to report the participants by age, gender, or ethnicity to protect the identity of the participants.

Results

Settings and Participants

The EBQI project took place at a primary care clinic in an underserved area of Midwest Raytown, Missouri after approval from IRB. Participants, who met project criteria through EMR review, were recruited during clinic visits and through phone calls Fifteen participants were

recruited. The project was initiated in November 2018 and completed in February 2019. Data was analyzed in March. Out of the 15 participants, three completed the project.

Actual Intervention Course

The participants were given the choice of clinic visits, phone calls, or Facetime which is an audio-visual application. Most participants chose to meet by phone. The student investigator made the phone call to the participants on the scheduled follow up days. The student investigator provided motivational interviewing to promote lifestyle modification encouragements to the participants. If the student investigator was unable to make any contact with a participant, a text message was sent to request the participant to reply with the appropriate time when the student investigator can make a call. Most participants were very proactive in testing and letting the student investigator know about the best time to call, but sometimes, multiple calls and text messages were made to get in an attempt to contact the participant. Phone calls were conducted at different times for all the participants. The face to face meeting was the least preferred method due to schedule conflicts between the student investigator and the participants.

Outcome Data

The primary outcome of this project was to decrease blood pressure using DASH diet and exercise. There were no participant reported lifestyle modifications for the management of BP prior to this project. The results obtained from the three participants showed a slight decrease in blood pressure. The data revealed that the most DASH diet days and minutes appeared to align with a decrease in both systolic and diastolic BP. There was a SBP decrease of -5, -9, -6 across the three participants, and the DBP decreased by -8, -9, -4, respectively, based on the average of the two last readings (see Appendix L).

Discussion

Success

The slight improvements noted on the participant readings supports that DASH diet and exercise contribute to BP control, especially when followed routinely. Most participants were not able to consume DASH diet regularly due to affordability and availability of DASH diet foods. The promotion of the use of DASH diet and exercise to manage HTN should be a core value for health care providers. The lack of side effects associated with the use of DASH diet and exercise compared to antihypertensive medication should prompt support by the stakeholders. Creating awareness to close the gap that exists in food desert regions, such as the clinical site for this current project, could enhance the management of HTN without adverse reaction to medication.

Project Strengths

The student investigator continued to provide educational material on DASH diet and exercise to patients with hypertension who were not able to participate in the project. The organizational culture and staff of the clinic were supportive in educating the patients on the importance of DASH diet and exercise for management of HTN. The student investigator provided pamphlets to the clinic staff and providers to educate patients with HTN on the use of DASH diet and exercise on hypertension. The clinic senior nurse practitioner was supportive of the project and continues to educate patients on the significance of DASH diet and exercise for the management of HTN.

Results Versus Literature

Management of HTN continues to pose a challenge due to the nature of HTN symptoms. Due to the lack of symptoms associated with HTN, most patients who have HTN seek diagnoses when the disease is advanced. Advanced HTN should include the use of DASH diet and exercise in conjugation with antihypertensive medication to yield the best results. Early recognition of

HTN is essential to the use of DASH diet and exercise at the time of initial monotreatment. The American College of Cardiology and American Heart Association support DASH diet and exercise as the initial treatment of hypertension (Whelton et al., 2017). The JNC supports the DASH diet and exercise as the first treatment for hypertension. The new guidelines on the classification of HTN create an early recognition and application of DASH diet and exercise as the initial treatment.

Limitations

Some of the limitations identified in this project included timing, schedule conflict, food availability, affordability, poor habits challenges, and lack of motivation. The timing when this project was started was a challenge to many participants. Many stated that the start of the project close to major holidays created the lack of motivation to the adherence of DASH diet and exercise. The inability of the participants to access fresh fruits at grocery stores created a barrier to participation. The high prices of healthy foods created a barrier for some of the participants who were unable to afford the fruits. Some of the 15 participants who enrolled dropped because they did not think that they had the potential to change poor health habits. The student investigator used motivational interviewing but still some did not perceive that they had the potential to change. The lack of motivation for some of the participants to create a lifestyle change created a barrier to their involvement.

Internal Validity

The internal validity threat to this project might have been affected by the nature of the EBQI. Participants were able to self-monitor most of their BPs at home. This action may skew the results and present results which may be difficult to generalize to the overall population. The patient may check and record the best BP readings instead which may lead to false results. All

the participants were on antihypertensive medications which might have contributed to the lower BP readings. To limit the threat to internal validity, the student investigator used the same measuring tools and survey questions for the participants.

External Validity

The unexpected attrition rate of the participants created a small sample whose results may not be generalized. The external validity threat for this project was affected by the lack of different ethnic background participants who might have presented results which cannot be generalized. The poor timing of the project was another external validity threat. Most participants opted out because they did not want to make lifestyle changes during major holidays, Thanksgiving and Christmas.

Sustainability

Patient self-discipline and motivation is essential to the sustainability of this project. Many participants did not have the self-discipline of checking blood pressures twice per day. Others did not own BP monitoring machines and expressed that they did not desire to make a trip to the clinic or the pharmacy to check BPs. The lack of motivation by some of the participants resulted in dropping out of the project. Many discontinued the project because they did not feel motivated to engage in lifestyle modification changes at the time. Motivational interviewing is critical for patients who choose to undergo any lifestyle change. Family support can also be applied to promote lifestyle change for the whole household as opposed to one family member.

Minimizing Limitations

The student investigator provided motivational interviewing to participants every two weeks. The student investigator made scheduled phone calls to the participants to offer encouragement and motivation for the lifestyle changes. Some of the participants expressed that

the phone calls motivated them to continue with the lifestyle changes. Educating the patient that the DASH diet is specifically aimed at lowering BP and not a weight loss regimen increased participation by some of the participants who initially had weight loss goals. One participant expressed that when she did not see weight loss that she was disappointed about the project because she had the idea that she would lose weight. Even though this is true to some people, the DASH diet should not be viewed as a weight loss diet but rather a HTN regimen.

Interpretation

Expected and Actual Outcomes

The expected number of participants was 30. The student investigator was able to recruits 15 participants. The week before the project was initiated, 12 participants decided not to participate. Some of the participants failed to return phone calls. Others who provided feedback gave several reasons from the timing of the project, food availability and affordability, to inability to make lifestyle changes. Most participants expressed the need to start lifestyle modifications at the beginning of the year when many are willing to make lifestyle changes as opposed to November when most people are busy with holidays. Others expressed the need for providing home BP monitoring machines instead of using a clinic or pharmacy. The lack of adequate funding created the inability to purchase a BP machine for each participant.

Intervention Effectiveness

DASH diet and exercise are the recommended initial treatment by the ACC, AHA, and JNC. Initiating both diet and exercise lifestyle changes at the same time can be a challenge for many participants. For effective results, the EBP supports the implementation of the two at the same time. Some participants may be discouraged or find it difficult to make both diet and exercise modifications at the same time. Participants who had personal BP machines did not face

the challenge of driving to check BPs, and they were able to check BP at the comfort of their own home.

Intervention Revision

It is critical for an investigator to find the best timing to pilot a study. Starting a project when most people are able to participate may yield a reliable sample size which can be well generalized. Providing participants with BP machines and healthy foods can be efficient in recruiting a better sample.

Expected and Actual Impact to Heath

Utilizing DASH diet and exercise for HTN is the least expensive way to manage BP compared to purchase of antihypertensive medications with their adverse effects. Patients who just rely on antihypertensive medications are likely to be on more than one medication which increases the risk for adverse effects. Unmanaged HTN can contribute to poor productivity, increased health care cost, and poor economy. Teaching patients how to take control of their health may promote autonomy and decrease possibilities of other chronic illnesses.

There are potential organizations which provide funding for studies designed to promote lifestyle changes to prevent chronic illnesses. Funds with the potential of providing participants with DASH diet foods and personal BP machines may promote participation. The estimated cost of this study was $433.40, and the actual cost was $656.00. The student investigator received partial funding of $250.00 from the UMKC Women's GAF. The student self-funded the remaining amount.

Conclusion

The lack of symptoms related to hypertension is a vital contributing factor to poor management. Early diagnosis and treatment are significant to the prevention of complications

leading to cardiovascular morbidity and mortalities. The introduction of the DASH diet and exercise as the initial treatment plan can lower the complications and maintain a healthy lifestyle. The promotion of the DASH diet and exercise compliance and adherence is essential to the management of hypertension. Future studies should focus on consistency on the foods and exercise plans that are effective in managing and controlling hypertension. Measuring tools utilized for assessing the results of the DASH diet and exercise should be useful and cost-effective.

Given the health benefits of DASH diet and exercise, stakeholders support to promote the availability of affordable foods and exercise programs should be well established. The health care providers should be committed to creating time to educate the patients, especially those at risk on the early recognition and management of hypertension. The health care system should focus on preventive treatments as opposed to the promotion of medication prescription by providing reimbursement to the providers who are committed on taking the time to reinforce lifestyle modifications that have the potential to reduce healthcare cost.

Early diagnosis and treatment of HTN are significant to the prevention of complications leading to cardiovascular morbidity and mortalities. DASH diet and exercise have produced reliable results in HTN management.

Practical Usefulness

Major cardiovascular organizations have identified DASH diet and exercise as the initial treatment for HTN. The application of the DASH diet and exercise interventions to the management of HTN have shown successful BP reductions. DASH diet and exercise provide the most effective, reliable, and safe treatment for HTN. Compared to the cost of pharmacotherapy, hospitalization, and productivity, DASH diet and exercise have the least cost. The freedom of

self-care management of HTN using readily applicable interventions promotes patient autonomy. Patient motivation and support are essential to the adherence to the DASH diet and exercise. The measuring tools applied to this EBP project are cost-effective and easily accessible.

Future Studies

The project excluded participants with comorbidities that require close monitoring such as extremely high blood pressures. Future studies and implementation of evidence based interventions can evaluate the use of the DASH diet and exercise in patients with myocardial infarction, stroke, or congestive heart failure. There is a knowledge gap on the impact of the DASH diet and exercise availability and affordability. This project identified food affordability and availability as a barrier to success and sustainability. Future studies can focus on how accessibility and affordability of DASH diet foods and exercise can influence adherence and optimal hypertension control. Timing was another issue which was identified as a barrier for this project. Most participants stated that they could not continue with the project due to the timing of the project. The lifestyle modification which was the main factor for this project was seen as a challenge especially since the project was started right before the major holidays including Thanksgiving and Christmas. The project could have retained more participants if it would have been conducted at the beginning of the year when most people make lifestyle modification choices.

Dissemination

The student investigator presented a poster based on this project to a regional conference at the Advanced Practice Nurses of the Ozarks conference and Midwest Nursing research conferences. The submission of previously written materials by the student investigator to organizations supporting chronic diseases like HTN could be a path for future publication. The

student investigator plans to search for potential future oral presentations of the EBP project interventions and results to potential stakeholders. The student investigator plans to submit a manuscript to the American Association of Nurse Practitioners (AANP). The information from this project may be adapted by health providers and provided to potential patients on the use of the DASH diet and exercise on hypertension.

Hypertension is the leading cause of cardiovascular disease deaths (Rosas-Peralta, & Jiménez-Genchi, 2018). The modifiable factor of hypertension creates the possibility of eliminating its threat to reduce cardiovascular disease deaths (Rosas-Peralta, & Jiménez-Genchi, 2018). The current guidelines form the ACA and AHA have created new lower BP targets to eliminate the increasing number of deaths (Whelton et al., 2017). The new guidelines emphasize prevention, detection, evaluation, and management of hypertension to reduce the CVD risk factors (Rosas-Peralta, & Jiménez-Genchi, 2018). Reducing BP below a systolic BP of 130 mmHg and diastolic BP of 80 mmHg have been shown to reduce the cardiovascular disease risk factors (Whelton et al., 2017). There is an increased need for health care providers to create awareness of patients on the significance of BP control.

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Appendix A

Terms and definitions

Term	**Definition**
Blood pressure	This is the force of blood that is pushing against the arterial wall which carries blood from the heart to the other body parts.
DASH diet	Diet high in fruits and vegetables and low in fat.
Aerobic exercise	Various sustained activities including cardio, jogging, running, and swimming to name a few which are used to strengthen the heart and lungs by improving oxygen consumption by the body.
Motivation	Willingness for someone to do something.
Adherence	Commitment to someone, something or belief.
Myocardial infarction	Commonly known as a heart attack is a life-threatening condition that decreases or blocks blood supply to the heart muscle which leads to poor oxygen supply and tissue damage.
Theory	A theory is a set of concepts allowing a unified consideration to an otherwise diverse phenomenon.
Stroke	This is a medical emergency which is caused by decreased blood supply to the brain leading to death of brain cells due to lack of oxygen and nutrients.

Appendix B

Inquiry: In adult population ages 18 to 65 years with hypertension, does the Dietary Approach to Stop Hypertension (DASH) diet and physical exercise (150 minutes per week), compared to patients who have hypertension and have no diet or exercise modifications lower blood pressurere during a four-month period at a Midwest Primary Care Clinic?

Author	**Research design**	**Level of Evidence**	**Sample/ setting**	**Independent and dependent study variables**		**Outcome measurement tools**	**Statistics analysis**	**Study Results**	**Strengths/limitations**
	Effects of DASH and Exercise on Hypertension								
(Paula et al., 2015).	RCT	II	N=40/ Omron Healthcare, Inc, Lake Forest, IL	DASH diet and Exercise/ Low BP and low BG		Clinic and ambulatory BPs. 24 HRS Nutrient record by Pts.	statistical software (SPSS, Chicago, IL)	55% of patients in the Intervention group had BP <135/85 mm Hg as compared with 15% in the control group	Strengths-Use of computerized selection/ Limitations- Small sample and short f/u period (4weeks)
(Saneei, Salehi-Abargouei, Esmaillzade& Azadbakht, 2014).	Systemic review and meta-analysis of RCTs/11	I	N=17 studies with 2,561 participants	DASH diet/ decrease in blood pressure.		Mean and standard deviation, Cochran's Q test	STATA version 11.2	Results showed that there beneficial effect of the DASH diet on both systolic and diastolic BP.	Strengths: The higher level of this systemic review results are highly reliable. Limitations: applied DASH eating pattern was not homogeneous in different studies, and some characteristics of this diet were not

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
									the same in all included clinical trials.
(Ziv et al., 2013)	RCT	II	N=113/ Spacelabs Healthcare, Issaquah, WA.	Use of multifactorial (DASH, exercise and behavioral) intervention to lower blood pressure.		24-hr ambulatory BP measurements and home BPs.	Independent t-test for numerical data. Numeric data results are presented as mean s.d.	Pts who participated in a multifactorial intervention and significant drop in blood pressure than patients on DASH diet only.	Strength: The 6-month maintenance period promotes the reliability of the study. Limitations: the study included participants on antihypertensives only.
(Edwards, Wilson, Sadja, Ziegler, & Mills, 2011).	RCT	II	N=52	Exercise only and DASH with exercise/ Low blood pressure and autonomic nervous system (ANS)		Plasma nonadrenal line and heart rate at rest.	One-way ANOVA- Assess difference between the groups. PASW Statistics 17.0- to	Participants in the exercise group only did not have a significant change in BP, but the group that participated	Strength- created knowledge on the need to focus on the multifactorial concept in the management of hypertension. Limitation- Small sample

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
							assess all the analysis	in DASH diet and exercise combined had a significant reduction in BP.	with mildly elevated blood pressure. Also used a noninvasive monitoring of ANS which is nonspecific and could provide unreliable results.
(Blumental et al., 2010)	RCT	II	N =144/tertiary care medical center	DASH diet alone vs DASH with weight mgt vs Usual diet/ Low BP		Clinic and ambulatory BPs	general linear model function in SAS statistical software	DASH diet w/ wgt mgt =16.1/9.9 DASH diet alone= 11.2/7.5 Usual diet controls=and 3.4/3.8 mm	The computer randomized selection ensured lack of bias. The sample was small limiting the accuracy of results. Used highly motivated participants.
(Nowson,Wattanapenpaiboon, & Pachett, 2009)	RCT	II	N=111/ Setting not provided.	Low sodium DASH diet/lower blood pressure.		Dietary adherence or compliance of participants was assessed using measurements of 24-hour urinary.	Social Sciences (SPSS version 14.0, 2006, SPSS Inc, Chicago, IL)	(n = 17) had a significant fall of SBP (6.5 ± 2.5 mm Hg, P = .02) and of DBP (4.6 ± 1.4 mm Hg, P = .005). There was a significant reduction of BP in participants	Strengths: use of reliable measuring tools: 24-hour urine excretion. Limitations: self-reported food consumption without means of measurement.

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
								who included low sodium diet in DASH.	
Burke, Beilin, Cutt, MansouWilson,& Mori, 2005).	RCT	II	N=118 Research studies unit.	Lifestyle modifications. Maintenance of optimal BPs and decrease in cardiovascular risks.		Antihypertensive drug requirements, ABP, weight, waist girth at four months and 1-year follow-up	General linear models with adjustment for baseline values. Categorical variables were examined using [chi]^2 test $P < 0.05$ was considered significant.	(64%) of the usual-care group and 74 (70%) of the programme group achieved changes in drug dosage after four months.	Strengths: The utilization of patients on antihypertensives to assess the impact of DASH, exercise and behavioral interventions Limitations: The study provided DASH diet foods which may not be ideal.

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
	DASH and Exercise Adherence								
(Shahrani, Daryabeigi, Shahriari,& Khosravi, 2016).	RCT	II	N=64/ Isfahan Hypertension Center	Continuous Care Model/Lifestyle modification adherence		Self-reporting of adherence.	Chi-square, Mann-Whitney, independent and paired t-test, and covariance analysis SPSS software version 20.	The mean score of the test group was greater than the control group.	Strength- The random assignment ensured the lack of bias in the study Limitations- the presence of unmodifiable factors that affected adherence to culture, a way of thinking and learning level.

Author	**Research design**	**Level of Evidence**	**Sample/ setting**	**Independent and dependent study variables**		**Outcome measurement tools**	**Statistics analysis**	**Study Results**	**Strengths/limitations**
(Kwan et al., 2013)	Systemic review	III	N=9 studies/studies from 1992 to 2012	Close monitoring/Adherence to DASH diet		Objective urinary excretion and subjective blood pressure records.	Not provided	The participants who had close follow up and supplied with DASH diet foods had better compliance scores compared to the group that received advice only.	Strength- the intensive study of different tools to measure compliance with DASH diet. Limitation- small sample of previous studies may not provide reliable data.
(Epstein et al., 2012)	RCT	II	N=144/Clinic	Blood pressure reduction/ DASH diet adherence		Clinic blood pressure monitoring, Ambulatory blood pressures.	General linear model, linear regression, and analysis of covariance.	DASH diet plus weight mgt:16 mmHg reduction in SBP; DASH alone: 11.2 mmHg reduction in Usual diet control: 3.4 mmHg reduction in SBP	Strengths: the study compares DASH diet to other usual diets. Limitations: The sample included a highly competitive group which may not be ideal for all patients with hypertension.
(Elmer et al., 2006)	RCT	II	N=810/4 clinical centers and a coordinating center	Lifestyle modifications (established recommendations, DASH plus established, and		Lifestyle variables and blood pressure status. Follow-up for blood pressure	General linear model: measured BP values and	decreased in all three treatment groups noted: 32% in the advice	Strengths: The sample was large enough to represent the general population.

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
				advice only)/ Lower blood pressure		measurement at 18 months	SAS analyzed All data	group, 24% in the established group, and 22% in the established plus DASH group	Limitations: The sample included volunteers who could impact the results and may not b the case in the real world.
(Appel et al., 2003).	RCT	II	N=810/ Four clinical centers	Established intervention plus DASH, established only Vs Advice only.		Blood pressure measurements	Linear regression model to measure BP and SAS software for all analysis.	Prevalence of HTN was 26% in the advice only, 175 in the established and 12% in the established plasma DASH	Strength- it was a large sample which can apply to the general population. Longterm study. Limitation- exclusion of patients on antihypertensive may not be ideal for the general population.
	Early Hypertension Management with DASH and Exercise								
Juraschek, Miller, Weaver, & Appel, 2017).)	RCT	II	N=412 Ambulatory care clinic.	Use of DASH diet for Obese patients to decrease vascular resistance and lower blood pressure		Changes in SBP with use of Low sodium-DASH diet.	mean ± SD and proportions. Crossover design and parallel design.	low sodium-DASH diet lowered SBP by −5.30 mm Hg (95% CI: −7.66 to −2.94 mm Hg)	Strengths: application of a large study whose results can apply to the general populations. Limitations: Study of normotensive pts.

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
(Jarl, Tolentino, James, Clark, & Ryan, (2014)	RCT	III	N=45 Primary care clinic.	Management of hypertension with lifestyle modifications.		Rapid Eating Patient Assessment and Partners in Health (PIH) questionnaires.	SPSS for Windows, version 10 (SPSS Inc., Chicago, IL).	Participants had average of 3.6lbs weight loss.	Strengths: Utilizations of standard guidelines. Limitations: Small sample. No specific blood pressure readings.
(Neter, Stam, Kok, Grobbee, & Geleijnse, 2003)	RCT systemic metanalysis	I	N=4874/ Electronic literature search	Increased physical activity/Reduced blood pressure.		SAS PROC MIXED- account both within- and between-study variation	SBP: −6.48 to −3.75] vs −2.01 mm Hg DBP (−5.31 mm Hg	Increased physical activity is associated with decrease in both SBP and DBP.	Strengths: The level of study provides reliable evidence. Evidence shows that weight reduction through exercise is a core measure in BP control. Limitations: RCTs lasted for limited time which may not be reliable to longterm control of hypertension.
	DASH diet and Exercise Maintenance								

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
(Hinderlitet al., 2014).	RCT	II	N=144/ Ambulatory clinic	Persistent of DASH diet alone, and DASH with weight management (WM) on blood pressure compared with usual diet.		Ambulatory blood pressure. Self- report dietary intake by participants.	Intent-to-treat analysis models with SAS PROC MIXED General linear model.	Participants' average body weight at 1 year was 86.7kg in DASH-WM, 91.9kg in DASH-A, and 91.8kg	Strengths: The long-term follow up results provides reliable data. Limitations: Missing data of 20 participants after 1 year.
(Wing, Venditti, Jakicic, Polley, & Lang, 1998).	RCT	II	N=154/ Study did not provide setting.	Long-term maintenance of lifestyle modification on weight changes and risks of cardiac heart disease.		Weight changes at baseline and every six months up to 2 years.	SAS and S-plus. One-way analysis of variance was used to compare difference in 6, 12, or 24 months minus baseline on weight changes.	Results for diet alone compare to diet and exercise did not differ significantly. Only the diet-plus-exercise group maintained a significant decrease in body weight (-2.5 kg) from baseline to 2 years.	Strengths: The length of the study provided reliable data. Limitations: The supervised exercise activities by a therapist in week 1-10 showed a longer maintenance period but may not be ideal for the general populations.
			DASH Diet and Exercise Cost-effectiveness						
(Monsivais et al.,2015)	Cross-sectional study	IV	N= 24,293 Data from Norfolk,	Effects of DASH diet/ improved population health		Self-reported questionnaires.	The FFQ data were processed	Results showed that DASH diet	Strengths: The data on the cost of DASH diet

Author	Research design	Level of Evidence	Sample/ setting	Independent and dependent study variables		Outcome measurement tools	Statistics analysis	Study Results	Strengths/limitations
			United Kingdom (EPIC-Norfolk)	and reduced diet-related greenhouse gases.		The cost of dietary foods was evaluated using regressional analysis.	by using the FFQ EPIC Tool for Analysis (17), software based on the earlier analysis system (16).	foods were more costly than the usual unhealthy foods.	highlights the need to identify components of healthy diets that can be obtained at low cost Limitations: the self-reported data might contribute to bias and unreliable data.
(Forster, Veerma, Barendregt, & Vos, 2011).	Systemic review	II	N=1685/ Australian Institute of Health and Welfare, and Department of Health and Ageing.	DASH diet and low-fat diet/ Cost savings related to body weight treatment.		Disability-adjusted life years (DALYs) averted, incremental cost-effectiveness ratios (ICERs) and proportions of disease burden avoided.	Calculation of 95% uncertainty intervals for DALYs, net costs and the ICER using Monte Carlo simulation (2000 iterations) using the Excel add-in Ersatz	The DASH diet and low fat contributed to $68,000 cost savings per disability-adjusted life years	Strengths: Results can be applied to the cost-effectiveness of DASH and exercise on hypertension. Limitations: Self recorded data can be skewed.

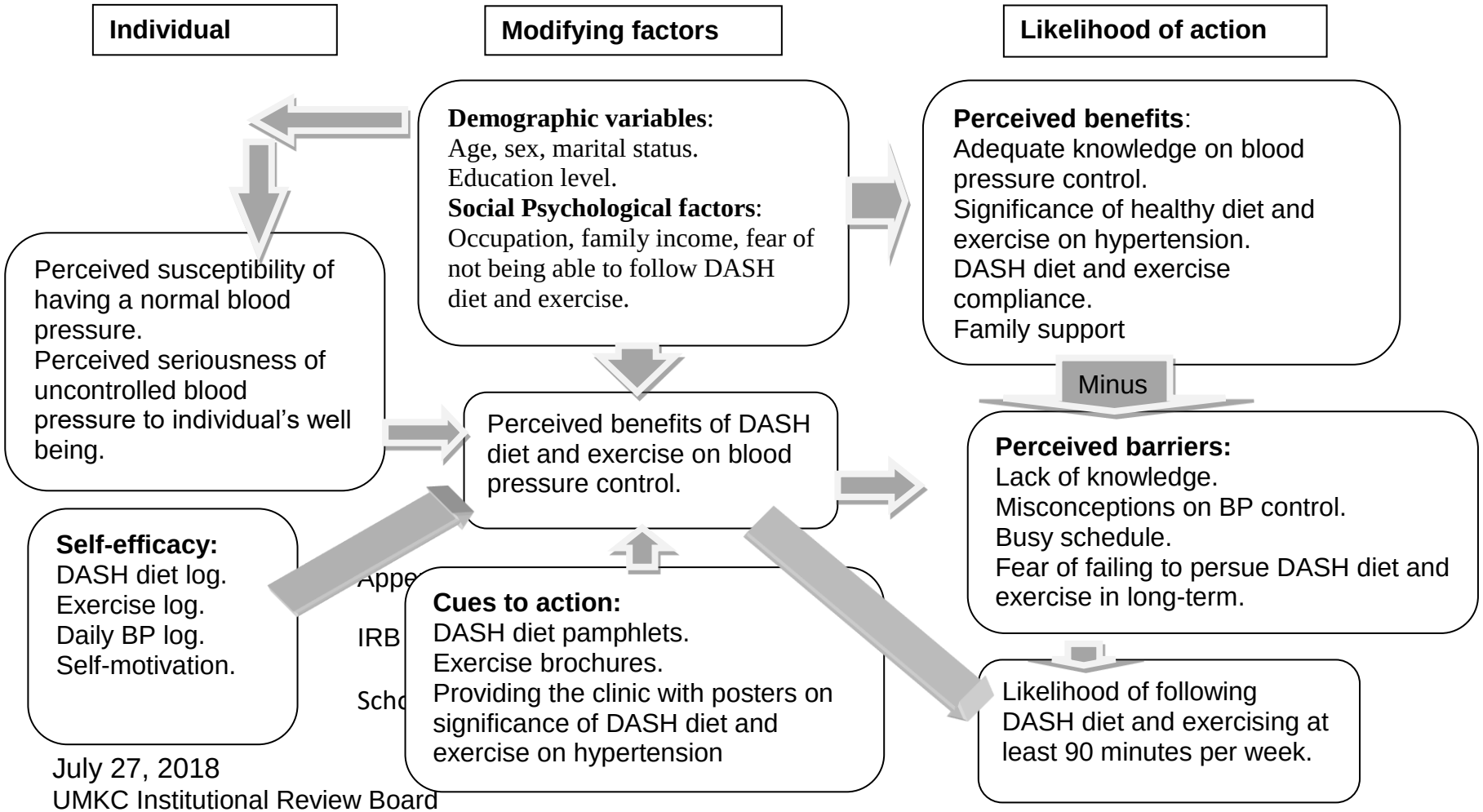
Author	**Research design**	**Level of Evidence**	**Sample/ setting**	**Independent and dependent study variables**		**Outcome measurement tools**	**Statistics analysis**	**Study Results**	**Strengths/limitations**
(Polar, & Sturm, 2009	Quasi-experimental	III	Data compiled from the National Health and Nutrition Examination Survey (1999–2004)	Reduces salt intake/ reduced cost-effectiveness of blood pressure treatment.		hypertension prevalence, direct health care costs, and quality-adjusted life years for noninstitutionalized U.S. adults	STATA 9.2 and Microsoft Excel. Survey weights were used to calculate population averages	Reducing average population sodium intake to 2300 mg per day, the recommended maximum for adults, may reduce cases of hypertension by 11 million, save $18 billion health care dollars, and gain 312,000 QALYs.	Strength: The reported results of lifestyle modification to the healthcare cost are significant to the project. Limitations: Data from NHNES provided estimates of sodium consumption based on self-reported intake data

Appendix C

Rating System for the Hierarchy of Evidence For an Interventional Inquiry (Modification by Dr. Lindholm for course N5613)	
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs. *Evidence-based clinical practice guidelines based on systematic reviews of RCTs).**
Level II	Evidence obtained from well-designed RCT. *Quantitative systematic review of well-designed controlled trial without randomization.*
Level III	Evidence obtained from well-designed controlled trial without randomization *(quasi-experimental).* *Quantitative systematic review of case-control, cohort, or correlational studies.*
Level IV	Evidence from well-designed case-control or cohort study *(or cross-sectional study)*
Level V	Evidence from systematic review of *quantitative* descriptive *(no relationships to examine)* or qualitative studies.
Level VI	Evidence from a single *quantitative* descriptive *(no relationships to examine in the study) or* qualitative study
Level VII	Evidence from the opinion of authorities and/or reports of expert committees

Appendix D

The Health Belief Model



July 27, 2018
UMKC Institutional Review Board
Primary Project Site IRB
UMKC DNP Student
UMKC IRB, Primary Project Site IRB, and DNP Student

Appendix E

DNP Proposal Approval, IRB Approval

UMKC School of Nursing and Health Studies
DNP Proposal Faculty Approval

This letter serves to provide documentation regarding Eunice Mutisya's Doctor of Nursing Practice (DNP) Project proposal. Ms.Mutisya obtained approval for her project proposal, Hypertension Management with DASH Diet and Exercise, from the School of Nursing and Health Studies DNP faculty on July 27, 2018.
If we can provide further information, please feel free to contact us.
Sincerely,

Cheri Barber, DNP, RN, PPCNP-BC, FAANP
Clinical Assistant Professor
DNP Program Director
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NOT HUMAN SUBJECTS RESEARCH DETERMINATION

Principal Investigator: Dr. Lyla Lindholm
UMKC Health Sciences Building
Kansas City, MO 64108

Protocol Number: 18-215
Protocol Title: DASH Diet and Exercise for the Management of Hypertension
Type of Review: Not Human Subjects Determination

Date of Determination: 09/07/2018

Dear Dr. Lindholm,

The above referenced study, and your participation as a principal investigator, was reviewed and determined to be Not Human Subjects Research (NHSR). As such, your activity falls outside the parameters of IRB review. You may conduct your study, without additional obligation to the IRB, as described in your application.

The NHSR Determination is based upon the following Federally provided definitions:

"Research" is defined by these regulations as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge."

The regulations define a **"Human Subject"** as "a living individual about whom an investigator (whether professional or student) conducting research obtains: data through intervention or interaction with the individual, or identifiable private information."

All Human Subjects Research must be submitted to the IRB. If your study changes in such a way that it becomes Human Subjects Research, please contact the Research Compliance office immediately for the appropriate course of action.

Please contact the Research Compliance Office (email: umkcirb@umkc.edu; phone: (816)235-5927) if you have questions or require further information.

Thank you,

Rebekah Lee
UMKC IRB Administrative Office

Appendix F

Project Budget

Items	**Cost**	**Quantity**	**Total Amount**
Cost of paper for pamphlets	$0.70 each	30	$ 21.00
APNO conference plus travelling expenses	$275.00	1	$275.00
Poster Printing #1	$65.00	1	$65.00
MNRS Conference	$230.00	1	$230.00
Poster Printing #2	$65.00	1	$65.00
Total Cost			$ 656.00

Appendix F

Logic Model for DNP Project

Student: Eunice Mutisya

Inquiry, : In adults ages 18 to 65 years with hypertension does the Dietary Approach to Stop Hypertension (DASH) diet and physical exercise (150 minutes per week compared to patients who have hypertension and have no diet or exercise modifications lower blood pressure during a four-month period at a Midwest Primary Care Clinic?

Inputs	**Intervention(s)** *Activities*	**Outputs** *Participation*	**Outcomes -- Impact** Short	Medium	Long
Evidence, sub-topics 1. DASH and exercise 2. Adherence 3. HTN management 4. Maintenance 5. Cost-effectiveness **Major Facilitators or Contributors** 1. Clinician interests 2. Pt's readiness 3. Staff support. 4. Mentor support **Major Barriers or Challenges** 1. Funding 2. unfamiliar W patients. 3. Lack of staff support 4. Pts transportation.	**EBP intervention which is supported by the evidence in the Input column (brief phrase)** 1. Moderate density exercises. 2. DASH Dietary maintenance. 3. DASH diet food list. **Major steps of the intervention (brief phrases)** 1. Clinician and staff briefing. 2.Initial Base line BPs. 3. First group meeting. 4. DASH diet and exercise reading material. 5. 2- week diary logs for DASH, exercise and BPs recordings. 6. Weekly calls/ text/email F/U. 7. Home recorded BP measurements at 4 months.	**The participants (participants)** Pts dx with HTN aged 18 to 65 yrs. **Site:** TMC Family Clinic, Raytown, MO **Time Frame: 9**/2018- 03/2019 **Consent or assent Needed:** Pt's consent. **Others directly involved in consent or data collection (yes/no)** Jaqueline Still, FNP-APRN	**(Completed during DNP Project)** **Outcome(s) to be measured** **Primary**: BP changes at home and clinic. Adherence and maintenance of DASH diet and exercise **Secondary:** Use of antihypertensives **Measurement tool(s)** 1. BP logs. 2. DASH diet diary log 3. Exercise diary log **Statistical analysis used** 1. correlation 2. Descriptive	**(after student DNP)** **Outcomes to be measured** 1. BP 2. DASH diet intake. 3. Exercise	**(after student DNP)** **Outcomes that are potentials** 1. Prevent hypertension complications. 2. Reduce economic burden of HTN.

Appendix G

Project Plan

STEP 1

Identified potential subjects with systolic blood pressure greater than 130mmHg or diastolic blood pressures greater than 80 mmHg for the project from the clinic data.

STEP 2

Recruited 15potential subjects through the clinic staff, face to face conversations during clinic appointments, and phone.

STEP 3

Obtained 3 previous recorded BPs from EMR.

STEP 4

Calculated and recorded the average the 3 BPs as the base line data.

STEP 5

Schedule the first meeting on 09/03/18 with the selected subjects to inform the expectations of the project and specifics of DASH diet and exercise. Provided pamphlets with DASH diet foods and cardiovascular exercises. Subjects were sent home with blood pressure, diet and exercise logs to bring at the second meeting. Schedule the second meeting on 09/17/18.

STEP 6

On 9/17/2018, the student investigator obtained 2 BP readings from each patient after five minutes of rest. The average of the two BPs were be recorded. The student investigator calculated the weekly average blood pressure readings from home and at the clinic and enter the data. Student investigator to met one on one with participants and discuss concerns, offer support and motivation.

STEP 7

The student investigator met one on one with each subject and discussed any concerns or limitations of the interventions. The student investigator provided motivation to promote adherence.

STEP 8

On 10/01/2018, Obtained BP and record as second meeting. Met with the subjects and identified the needs that needed any needs that may need to be addressed and provided motivation. The following four meetings were held on 10/15/2018, 10/29/2018, 11/12/2018, and 11/ 26/2018 and involved the same process as the second and third. At the last meeting on 11/26/2018, the participants were requested to provide feedback back for the student investigator project using a survey monkey.

STEP 9

From 03/01/2019- 03/15/2019, the student investigator analyzed Using description and table to present central tendency.

STEP 10

03/16/2019 The student investigator created a report to compare each subject's blood pressure readings before and after the interventions.

Appendix H

Project Timeline

08/2017- 05/2018:

HTN management identified as a need for change.
EBP topic narrowed to the use of DASH diet and exercise for HTN.
crtically apraise, evalyate and synthesize evidence.
Identify potential project site.
Communicate with facilitator.
Develop measuring tools.

05/2018-12/2018:

Obtain IRB approval- 5/31/2018
Gain clinic staff and facilitator support -8/13/2018
Assess and eliminate barriers- 8/14/2018-8/25/2018
Identify potential participants -8/16/2018-09/18/2018
Recruit participants 9-/20/2018- 9/24/2018.
Obtain baseline data from EMR-9/27/2018-10/5/2018.
Pilot the EBP project- 10/25/2018
Obtain post intervention data- 03/4/2019

03/2019-04/2019:

Data analysis.
Report results.
Dissemination.

Appendix I

RedCap Questionnaire

1. What did you view was the most beneficial information from the program?
2. What did you view was the least beneficial information from the program?
3. How likely are you to recommend the program to a friend with hypertension?

Appendix J

Measurement Tools

Outcome	Instrument or Source	Validity	Reliability	Permission for Use
#1. DASH diet	Diary log	N/A	N/A	No
#2. Exercise	Diary log	N/A	N/A	No
#3. Blood pressure	Sphygmomanometer	N/A	N/A	No

Appendix K

Baseline/outcomes of n=12- Non completed Participants

	Baseline	Mean, Range, Mode
DASH Diet (days/week)	0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	
Exercise (mins/week)	60, 0, 0, 30, 20, 45, 0, 0, 0, 0, 0, 0	Range, 0-60. Mode, 0.
SBP*	138, 155, 147, 142, 139, 146, 135, 139, 141, 137, 134, 149	Mean, 141.83 Range, 135-155
DBP*	87, 97, 86, 92, 88, 94, 92, 85, 87, 84, 92, 82	Mean, 88.83 Range, 82-97

*Mean of 2 BPs

Appendix L

Baseline/ Outcomes of N=3: Completed Participants

	Pre	Post	Change
DASH Diet (days/week)	0, 0, 0	5, 3, 4	+5, +3, +4
Exercise (mins/week)	10, 0, 0	90, 120, 150	+80, +120, +150
SBP*	150, 147, 138	145, 138, 132	-5, -9, -6
DBP*	90, 89, 84	82, 80, 78	-8, -9, -4

*Mean of two BPs.