THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF HEALTH POLICY AND ADMINISTRATION

HOW EFFECTIVE ARE THE INTERVENTIONS OF THE CDC'S NATIONAL DIABETES
PREVENTION PROGRAM IN LOWERING HBA1C LEVELS AND WEIGHT LOSS
PERCENTAGES IN PRE-DIABETICS?

SHANNON PORTERFIELD
SPRING 2018

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Health Policy and Administration
with honors in Health Policy and Administration

Reviewed and approved* by the following:

Patrick Plummer
Associate Teaching Professor of Health Administration
Thesis Supervisor

Sung W. Choi
Assistant Professor of Health Administration
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

Type II diabetes affects 29 million Americans with 1.4 million newly diagnosed each year. The disease also accounts for $245 billion in health care expenses. However, it is a disease that can be stopped with preventative medicine. Although the presence of prevention programs for type II diabetes is increasing, the overall rates of the disease are not decreasing despite an increased presence of these programs alone. Research shows this is due to an inequality in the effectiveness of varying prevention programs. To determine the effectiveness of a single diabetes prevention program, this thesis seeks to answer how effective the CDC's National Diabetes Prevention Program is in decreasing HBA1C levels and weight loss percentages in pre-diabetics.

To do this, a meta-analysis and calculation of effect size statistics was conducted to determine whether the interventions were effective. The effect sizes were calculated using sample size, means, proportions and standard deviations using the standardized mean difference effect size, as outlined in a study by DelliFraine and Dansky's called *Home-Based Telehealth: A Review and Meta-Analysis*, which was published in 2008. Once the unbiased summaries of the studies were created, a random effects model was used to analyze the studies and interventions to determine if the interventions produced the desired results.

Using the p-value to calculate probability and determine whether there is evidence to reject the null hypothesis, the effects model showed that $p = 0.03$ confirming that the results were statistically significant. This proves that the interventions outlined in the CDC's National Diabetes Prevention Program are effective in lowering HBA1C levels and weight loss percentages in pre-diabetics.

Keywords: diabetes, diabetes prevention, type II, weight loss, blood sugar, HBA1C

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

In completing this thesis, there are many that I would like to thank. First and foremost, I would like to thank my supervisor Dr. Plummer and my honors advisor Dr. Choi for working tirelessly with me on this project. They dedicated significant amounts of their own time to revisions and answering questions that I had, and I would not have been able to complete this thesis without them. I would also like to thank my parents, who continuously gave me support and kept my morale high in times of need when I needed them most. Finally, I would like to thank my thesis readers, especially Dr. Clark as she not only helped me to develop this topic, but also dedicated her own time to helping me with the data collection aspect of this project. A big thank you to all that supported and assisted me on this project. Please know that your contributions are appreciated and that this project would not have been the same without you.

Chapter 1

Introduction

Through the provisions of the Affordable Care Act (2010), the access and quality of

prevention programs in the United States have both expanded and improved. As a result,

significant strides have been made in the remediation of chronic diseases, demonstrating the

potential of improving the health of a population (Richard, 2015; Waidmann, 2011). However,

despite this advancement in preventative medicine, there is still much progress that has yet to be

achieved. The frequencies of some chronic diseases, which are preventable through the use of

these programs, have not diminished (CDC, 2016).

Diabetes, in particular, is a chronic disease whose treatment progression has largely not

been thwarted by preventive medicine efforts (CDC, 2014). In every year since 2012, the

number of people affected with diabetes has increased by 1.4 million in America, accounting for

$245 billion of health care expenses in the United States and affecting more than 29.1 million

people (CDC, 2014; ADA, 2016). Type II diabetes is the type of diabetes that causes one's

blood sugar levels to rise higher than usual, which typically results from unhealthy lifestyle

habits (ADA, 2016). Type II diabetes is the most common type of diabetes, affecting

approximately 96 percent of those diagnosed or 27.85 million people (ADA, 2016). Rather than

decrease, type II diabetes has continued to contribute to 24.5 percent of total hospital

expenditures in the United States (CDC, 2014; CMS, 2015). With diabetes advancing at such an

alarming rate, it is only logical that the costs of the disease will continue to increase if something

is not done to curb this growth. Since diabetes is one of the most common preventative diseases

plaguing the United States, it is a good candidate to continue researching to discover how implementing a preventative care solution could help curb rising health care costs.

  To accomplish this, this thesis seeks to compile the research that has already been conducted on preventative care solutions to type II diabetes, both within academic journals and past clinical trials. These aspects can be found in the Literature Review and Methodology sections of this paper. This research and data will then be evaluated and used in a meta-analysis to determine which tactics prove to be the most effective and whether the evaluated tactics can aid in the prevention of developing type II diabetes.

Chapter 2

Literature Review

Research has shown that when health care prevention is the focus, the associated total health care costs decrease (National Prevention Council, 2011). From a national perspective, increasing the use of governmental preventative services could save an annual amount of $3.7 billion on medical costs (National Prevention Council, 2011). Specific to type II diabetes, annual health care costs for people diagnosed with diabetes is $8,000 higher per year than for someone who does not have diabetes (ADA, 2013; National Prevention Council, 2011). Additionally, one in five dollars spent on health care in the United States is devoted to providing care for those with diagnosed diabetes (National Prevention Council, 2011). Thus, as health care costs continue to escalate, an increased emphasis on preventative care could be a key player in reducing health care expenses, especially as it relates to type II diabetes (Waidmann, 2011; CDC, 2013).

According to Waidmann, the costs associated with diabetes are expected to nearly double by 2030 if no preventative steps are taken (2011). Therefore, diabetes is a disease that requires more attention. This is particularly apparent with the increasing number of Americans developing the disease and the effect that the disease is having on overall national health and health care costs. Some estimate that without action, one in three Americans will acquire diabetes by 2050 (ADA, 2013). Therefore, it is crucial that preventative medicine target type II

diabetes more aggressively to achieve the successes studies have shown to be possible through the correct implementations of diabetes prevention programs (Waidmann, 2011).

2.1 Preventative Medicine and Its Role in Society

Chronic disease prevention tactics are more prevalent in today's society than they have been in the past. Gyms as a venue to encourage healthy lifestyle habits through increasing physical exercise, vaccinations and organic foods are all examples of preventative medicine actions introduced into society. In the effort to create a more educated and aware society, advertisements and public education campaigns sponsored by insurance companies have been used to increase the health and number of informed citizens to lower overall health care costs (Woolf, 2001). Additionally, the creation of new screening techniques along with advertisements of various pharmaceutical products in mainstream society has led to patients inquiring about screening options when they visit their primary care physician's office (Woolf, 2001). These types of advances may be the key to engaging a larger percentage of the population affected with diabetes to seek self-management of their disease.

Although beneficial in curbing the costs associated with type II diabetes, utilization of these prevention programs lacks usage within the United States (Pennsylvania Department of Health, 2015). In 2013, only 41 percent of patients diagnosed with diabetes went to their primary care physician the recommended minimum of four times a year (Pennsylvania Department of Health, 2015). This underutilization compares to that of heart disease, where 53 percent of Americans affected are not taking the proper steps towards managing their disease (Sifferlin, 2012). Even though 14 million people are unaware that they are hypertensive, 6

million are aware of their disease and yet are still opting not to pursue treatment of any kind (Sifferlin, 2012). This lack of patient involvement is a similar situation as that of people diagnosed with type II diabetes, since only 55 percent of those individuals have participated in a self-management class to effectively manage their disease (Pennsylvania Department of Health, 2015). Of this population, only half has engaged in a class that lasted more than four hours (Pennsylvania Department of Health, 2015). This trend of underutilization of preventative services is what is ultimately leading to the excessive spending on health care associated with complications from diabetes.

To truly curb the costs of type II diabetes and associated complications, early detection of the disease is crucial. People diagnosed with diabetes on average incur roughly $8,000 worth of services annually directly tied to their complications from diabetes (ADA, 2013). Overall, health care expenses for patients with diabetes are twice as much as expendtures for patients without diabetes (ADA, 2013). Furthermore, diabetes is also responsible for causing many complications, such as cardiovascular, metabolic and ophthalmic conditions, all of which increase health care costs (ADA, 2013). When symptoms are discovered early in diagnosis, treatment can by administered that will reverse the effects of type II diabetes. Blood glucose levels can be returned to normal, resulting in elimination or delay of developing full onslaught of type II diabetes (ADA, 2014). Thus, the use of preventative services can be a key component in combatting type II diabetes.

2.2 Policy Impacts on Preventative Medicine

With the enactment of the Affordable Care Act (ACA) in 2010, the presence of preventative medicine in society grew as a result of the provisions that deal specifically with prevention introduced in the ACA. Specifically, the ACA introduced legislation that enabled preventive programs to be established and covered within existing health care coverage, all of which is in section 3021 of the Patient Protection and Affordable Care Act, (2010) or section 935 of the Public Health Service Act (2016).

There are three main elements to the 2010 Affordable Care Act: 1) implementing a strategy known as the National Prevention Strategy, 2) expanding preventative programs throughout the United States via the creation of community-based health teams, and 3) providing grants to enhance existing prevention programs. The National Prevention Strategy aims to increase the health of Americans at any and every age by focusing on those who have disproportionate access to health care (CDC, 2014; National Prevention Council, 2011). To do this, the National Prevention Strategy (2011) has four focus areas:

1. Create and sustain healthy and safe community environments that promote health and wellness.
2. Ensure that clinical and community preventative services are available.
3. Help people make healthy life decisions.
4. Eliminate health disparities to improve quality of life.

By focusing on these four priority areas, the National Prevention Strategy encourages tobacco-free living, healthy eating, preventing drug and alcohol abuse, active and violence-free lifestyles, reproductive health, and mental and emotional well-being (National Prevention Council, 2011).

To increase the presence of preventative care, the Affordable Care Act (2010) mandates that it will create community-based health teams to supplement the care received from primary care physicians for chronic care management and fund self-management activities. Furthermore, the ACA refers to the Public Health Service Act (2016), which was amended by the ACA. The Public Health Service Act (2016) includes the description of grants to be used for improving preventative programs. These grants are meant to fund prevention programs that can improve or maintain the quality of care to that of its pre-grant form while simultaneously keeping the costs of the program itself at a constant or lower rate (Patient Protection and Affordable Care Act, 2010; Public Health Service Act, 2016).

The Public Health Service Act (2016) outlines the process for determining eligible programs for these grants, along with the evaluation of the progress of the awarded programs. According to the Public Health Service Act, to receive a grant, an organization must submit an application that includes:

1. A plan for implementing the program for which the grant is intended to support, which includes costs, staffing requirements, and a timetable for implementation.

2. Estimations for progress to occur as a result of the program from a pre- and projected post-implementation perspective.

To ensure that the grant-funded program is meeting expectations and achieving progress as outlined in their original application, the programs are to be evaluated using the following criteria as is stated in the Public Health Service Act (2016):

1. How successful the organization is in implementing its outlined program.

2. The perception of success that surrounds the organization and its implementation of the program.

3. Whether the organization achieved successful outcomes of lower patient costs along with improved patient health outcomes.

Although these policies had increased the prevalence of preventative programs centered on lowering costs, before the creation of these procedures, select diabetes prevention programs were already garnering success, demonstrating the positive impacts that an effective prevention program can provide.

2.3 The Impact of Preventative Medicine on Type II Diabetes

Studies have shown how effective preventative medicine is in preventing type II diabetes when initiated in the early stages of the disease. Researchers, such as Van Busum and Windrum, have conducted meaningful research on workplace wellness programs, didactic education, and self-management education.

Workplace Wellness Programs. The Affordable Care Act (2010), as part of its provisions to expand the presence of preventative health care programs, also addresses the expansion and improvement of workplace wellness programs. Through providing technical assistance, consultation and other resources and tools, the Affordable Care Act plans to evaluate workplace wellness programs using three major elements. The first is by measuring the means used to attract participation in workplace wellness programs. The second element is to develop standard measures to assess policy and environmental changes needed to improve the overall health of employees. Lastly, the Affordable Care Act will evaluate the success of these programs based on how effective they are in benefitting the health of engaged employees regarding productivity, work absenteeism, and medical cost expenditures of the employees.

        In his report, Van Busum (2014) distinguished the factors that make an effective workplace wellness program by outlining specific techniques and recommendations. Headed by the RAND Corporation, his report outlines five simple steps to achieve this goal. The first step is to determine what the wellness program needs to accomplish to best benefit the business/company and its employees (Van Busum, 2014). These objectives can range from lowering costs, improving productivity, or even appealing to potential employees through a benefits program (Van Busum, 2014). However, determining which one of these objectives best fits a business/company is reliant upon the needs of the employees (Van Busum, 2014). This is the second step Van Busum suggests analyzing. In order to make the program as effective as possible for the employees, it must first be determined what major health areas and issues need to be addressed (Van Busum, 2014). Once this has been established, an implementation plan can be generated. As one of the largest setbacks in the development of any program is the participation rate, Van Busum also mentions ways to increase involvement. Research has shown that incentives are always a good way to spark direct participation, and Van Busum (2014) claims that one way to increase the options available to employees is to team up with community centers such as local YMCAs. Furthermore, if leaders in higher positions within the business/company actively engage in the program, employees will be encouraged to follow, likely leading to the employees viewing the program more favorably (Van Busum, 2014). However, to guarantee participation in the program, the key is to ensure that the program remains relevant to the needs of the employees. The final step then becomes determining a way to measure success. The strongest programs evolve when progress made is recorded and changes are made to continuously improve the program based on garnered results (Van Busum, 2014).

While Van Busum's report outlined factors that make up successful workplace wellness programs and gave general ideas on how to engage employees in them, Fronstin (2015) examines the differences between the types of people who are more likely to participate in wellness programs before and after the addition of financial incentives. The data and results for Fronstin's (2015) study were from a large employer headquartered in the Midwestern United States, whose employees reside throughout the country. Researchers found that the main differences between the pre-incentives group of participants and the post-incentives group of participants were that the latter group was older, male and less healthy — they had higher rates of diabetes, high blood pressure and high cholesterol — and they earned higher incomes (Fronstin, 2015). In other words, those who are more in need of participating in these programs require larger financial incentives to participate (Fronstin, 2015). Thus, this study shows that wellness programs can be useful tools, but sometimes, to affect those most in need, extra incentives or reward systems are necessary to achieve success and reach more people (Fronstin, 2015).

With an increase in businesses implementing these programs to create a healthier workforce and to save on health care costs and decrease unproductive time, it is crucial that these reports be studied and applied throughout the nation in the hopes of developing successful workplace wellness programs.

Didactic Versus Self-Management Educational Programs. One of the most crucial aspects of managing chronic diseases, such as type II diabetes, is ensuring that patients with chronic illness know how to live with their condition (Windrum, 2016). A major component of achieving this is educating patients about their disease and how to cope with it (Windrum, 2016). In the past, the education style used in studies of this nature was a mix of approaches or a

complete omission of educational information (Windrum, 2016). Windrum's study is the first to compare two distinct educational styles: patient-centered learning also known as self-management education, which is an active participation approach to educating patients, and didactic learning, which is a generalized lecture-based approach to educating patients (Windrum, 2016).

As part of this study, 203 patients were divided evenly between the two learning methods (Windrum, 2016). Results were measured via their blood sugar levels to see whether they increased or decreased after receiving care from one of the specified approaches (Windrum, 2016). Hence, the successes and failures of the different educational approaches would be through these changes in blood glucose levels (Windrum, 2016). At the end of the study, the patient-centered approach proved to be the most successful, with the didactic approach worsening the condition of the patients involved (Windrum, 2016). This educational approach, although providing the same information as the patient-centered approach, relied heavily on the patient self-managing their disease without any personalized support (Windrum, 2016). However, the effectiveness of the competing learning methods differed depending on the severity of one's condition (Windrum, 2016). According to Windrum (2016), the patient-centered educational approach was much more successful with patients initially at the healthy range for their blood glucose level and patients with very high blood glucose levels. This educational approach was only an option for patients whose blood glucose levels were high but still close to the healthy range, as, for this group, both methods proved to be effective (Windrum, 2016). Thus, for the majority of patients with type II diabetes, it was concluded that self-management education is the educational approach they should employ, as it is the most successful way to curb the disease (Windrum, 2016).

Self-Management Programs. Diabetes self-management education is the active process of creating the knowledge, skills, and abilities necessary to effectively self-manage type II diabetes (Funnell, 2010). By establishing these fundamental components, diabetes self-management education aims to provide patients with the knowledge needed to make informed decisions regarding their diabetes, teach self-care behaviors, and improve the quality of life and clinical outcomes through problem-solving and collaboration among health care team members (Funnell, 2010).

Diabetes self-management education is a relatively new tool used in the management of diabetes. It did not begin to be an acknowledged form of diabetes management until the twentieth century, before which the focus was solely on hospital acute care (Alpert, 2016). However, now that the focus is changing, multiple studies show that more attention needs to be paid to the development of self-management education, as not all programs are created equally (Alpert, 2016).

To produce the most successful self-management programs, researchers such as Funnell and Vos, have developed several evaluation tools. One study evaluated self-management programs through the patient's knowledge of diabetes self-management, their confidence in doing so, and how prepared they feel to implement the necessary behavioral changes (Mbugbaw, 2017). One study that followed this foundational approach was a comparison study of an American Diabetes Association certified diabetes self-management prevention program with an unstructured nurse practitioner educational program (Wooley, 2016). The programs focused primarily on tactics to cope with diabetes, meal planning, medication administration and associated complications (Wooley, 2016). After one year in the self-management programs, the costs related to diabetes and its complications, such as heart disease, were lowered, proving that

the programs were having a positive impact. Therefore, as long as the foundation of the program is structured properly, the administering environment does not have a bearing on the results.

Another proven evaluation tool of diabetes self-management programs is the National Standards for Diabetes Self-Management Education (Funnell, 2010). These National Standards show that the most effective programs have a multidisciplinary team with a comprehensive plan of care (Funnell, 2010), which means that the care provided by the team is diverse and that the patient with diabetes is considered to be a vital member of the team (Funnell, 2010). Therefore, when patients have a say in the development of their education, they garner better results (Funnell, 2010). Following this line of thinking, Vos (2016) presented a five-step proactive coping plan for patients to individualize their experience. This five-step plan allowed the patients to establish their goals and evaluate ways for the patient to meet these targets even with potential barriers stopping them (Vos, 2016). Therefore, self-management education gives the patients the skills to enhance their education by teaching them to alter their treatment when real-life obstacles get in the way rather than force them to quit because they are unequipped to deal with adversity as it relates to their disease (Vos, 2016).

2.4 Effectiveness of Successful Prevention Programs

Considering that not all diabetes prevention programs are interchangeable, it is crucial to determine what conditions create successful prevention programs. Many of the studies conducted show overlap of desirable qualities. Across the research presented, many studies indicate that successful diabetes prevention programs begin with clear goals, frequent meetings with health care supporters, catering to different populations, and an expert on diabetes

management overseeing the program (Alpert, 2015; Funnell, 2010; Powers, 2017; Kwan, 2017).

Furthermore, many agree that focusing on specific topics, such as healthy eating, exercise and

healthy coping, are also key elements of successful programs (Powers, 2017; Vos, 2016).

One aspect that is often not considered in making prevention programs is the inclusion of

family members (Powers, 2017). Family members do not always understand the severity of the

disease or the stress and difficulty associated with trying to manage it (Kwan, 2017). When

family members understand these factors, it can create a more active and supportive environment

for the patient to make progress in their self-care, ultimately leading to better results for the

patient (Powers, 2017; Kwan, 2017). Therefore, the disease not only needs to be explained to the

patient but to their family members as well (Kwan, 2017).

Successful programs are also flexible when they introduce new information to patients.

As Powers (2017) explains, there are four ideal times when self-management education needs to

be introduced to the patient and implemented. These times would be after an initial diagnosis of

type II diabetes, during an annual physical, when complications begin to arise, and when there is

a change in care (Powers, 2017). However, patients do tend to get very overwhelmed with all

the information given upon initial diagnosis of type II diabetes (Kwan, 2017). Therefore, part of

being effective is knowing when and how to introduce information to patients. A more

successful approach is to provide information in a flexible manner as each group going through

the program will advance at a different pace. By enacting a flexible plan, it can allow the team

to progress on its own time without losing focus of the overall group (Kwan, 2017).

2.5 Conclusion to Literature Review

There are many different types of prevention programs, and they are not equally valid. The goal does not need to be the creation of more programs but the assurance that existing programs are successful and garnering desired results. With the help of the Affordable Care Act, this goal is becoming more of a reality. The Affordable Care Act is providing an allotted number of grants to improve existing prevention programs. One program that has recently received one of these grants is the CDC's National Diabetes Prevention Program, which is the exact program that will be evaluated through this research. This program has been initiated in various venues throughout the United States and documented in trials on ClinicalTrials.gov. Thus, by evaluating the different techniques that are set forth by the CDC's National Diabetes Prevention Program for pre-diabetics through measuring patient changes in HBA1C levels and weight loss percentages, it can be determined how successful the expansion of the program across the United States will be.

Chapter 3

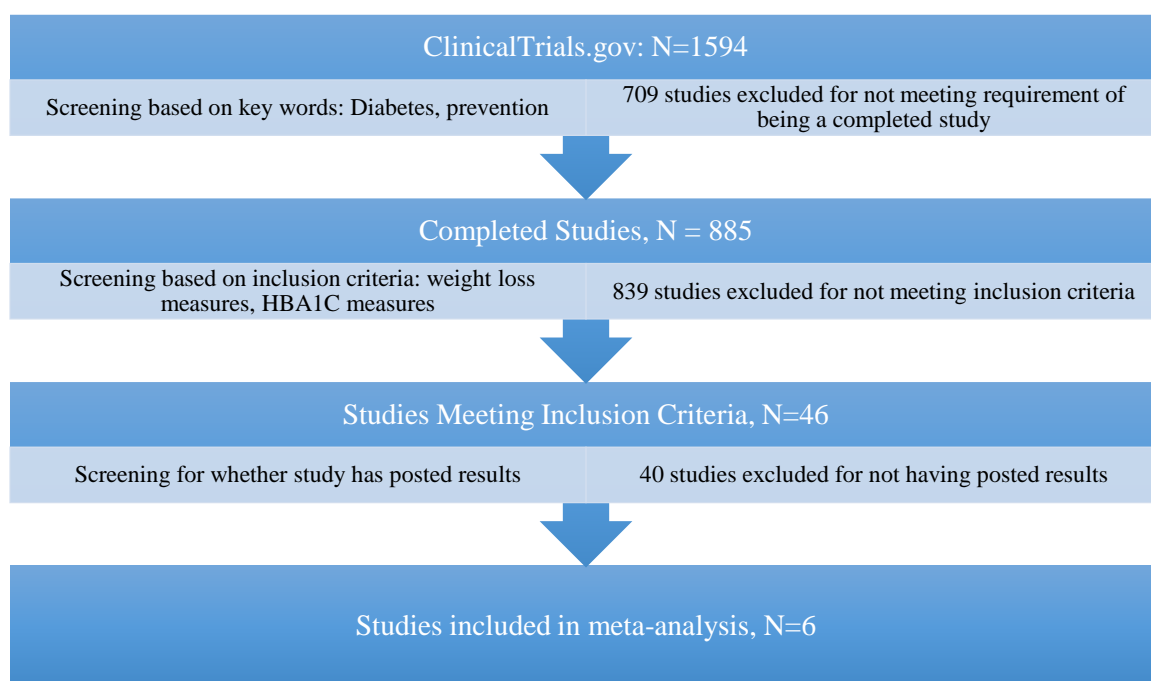## Methodology

3.1 Research Design and Sample

The purpose of this methodology is to determine whether there is a specific type of prevention program or specific aspects of prevention programs that are more effective in curbing type II diabetes than other alternatives. To do this, this study will consider prior research conducted on the topic and perform a meta-analysis to determine whether the advised tactics are truly effective. The research design is a meta-analysis of specific interventions in the CDC National Diabetes Prevention Program as they impact weight loss and HBA1C levels. Specifically, it statistically analyzed studies that were implemented since the creation of the Affordable Care Act (2010). The data was collected from studies of the CDC National Diabetes Prevention Programs reported in ClinicalTrials.gov. The sample populations were of pre-diabetics who participated in government clinical trials for diabetes prevention either in an intervention group or in a control group.

3.2 Data Sources and Collection

The data was retrieved from clinical trials that were reported since 2000, using the CDC National Diabetes Prevention Program for intervention techniques, as reported in ClinicalTrials.gov. By searching ClinicalTrials.gov, I collected data from trials that focus on

diabetes prevention programs that use the intervention techniques listed in the CDC's National Diabetes Prevention Program. The search terms *diabetes prevention*, *diabetes,* or *diabetes prevention program* were used to locate the studies on diabetes prevention programs and their effects on HBA1C – blood sugar glucose levels - and weight loss percentages. The sources were limited based on whether they included results with changes to HBA1C levels and weight loss percentages as intervention variables. The full process can be seen in Table 1. Once the studies were identified and reviewed to ensure they meet the inclusion criteria, I compared the data tables that are provided and conducted a meta-analysis that compares the clinical trial findings for weight loss using standardized measures and effect sizes.

Table 1. Flow Diagram of Included Studies

ClinicalTrials.gov: N=1594	
Screening based on key words: Diabetes, prevention	709 studies excluded for not meeting requirement of being a completed study

Completed Studies, N = 885	
Screening based on inclusion criteria: weight loss measures, HBA1C measures	839 studies excluded for not meeting inclusion criteria

Studies Meeting Inclusion Criteria, N=46	
Screening for whether study has posted results	40 studies excluded for not having posted results

Studies included in meta-analysis, N=6

3.3 Data Analysis

The meta-analysis allowed for a rigorous analysis of multiple small studies to determine if the interventions were effective across a diverse population. Information such as participants' age, gender and length of study were recorded and stored in a database. The program outcomes and technique tactics (group meetings, individual meetings, etc.) used by the intervention and control groups were also recorded. Sample size, means, proportions and standard deviations were recorded and used to calculate the effect size statistics using the standardized mean difference effect size, as outlined in DelliFraine and Dansky's study *Home-Based Telehealth: A Review and Meta-Analysis* (2008). The difference was calculated as the mean of the treatment group minus the mean of the control group divided by a standard deviation for the data. This is officially recognized as the Cohen's d effect size model. To correct for bias on sample sizes fewer than 20, the Hedges correction technique was used to calculate an unbiased effect size statistic. Once the unbiased summaries of the studies were created, a random effects model was used to analyze the studies and interventions to determine if the interventions produced the desired results.

Chapter 4

Data Results

Upon evaluating the studies on ClinicalTrials.gov, there were forty-six studies that met the criteria of evaluating HBA1C levels or weight loss percentages and used the CDC's National Diabetes Program within its methods. However, of these studies, only six had posted results available, whether they be on ClinicalTrails.gov or through academic journals. A full breadth of these six studies can be seen in Table 2.

Table 2. Description of Studies

Study Name	Inclusion Conditions	Interventions (Control vs. Active group)	Outcome Measure
Study 1	Pre-diabetic	Active group: Group & Individual lifestyle counseling Control group: Individual counseling only	Weight Loss Percentage
Study 2	Pre-diabetic	Active group: 12 one-hour weekly sessions of DPP curriculum in the workplace Control group: no program	Weight Loss (# of pounds), average group glucose level
Study 3	Pre-diabetic	Active group: lifestyle modification group sessions Control group: No program involvement	Weight loss (# of pounds), fasting glucose level

Study 4	Pre-diabetic	Active group: Quarterly group lifestyle sessions plus additional 2 classes annually with 15-minute annual check-up Control group: Quarterly group lifestyle sessions, 850 mg metformin	Incidence rate percentage, BMI, metformin percentage
Study 5	Pre-diabetic	Active group: weekly meetings for 3 weeks, biweekly for 3 months, monthly for 18 months, then once every two months Control group: meetings 6 times in 4 years	Diabetes Incidence rate as non-percentage
Study 6	Pre-diabetic	Active group: enhanced standard care and six appointments with nurse practitioner Control group: one appointment with nurse practitioner and one appointment with nutritionist	Percentage of group that met weight loss goal

Of these six studies, only three could be included in the meta-analysis due to the results measuring different variables. For instance, while some of the studies measured weight loss, other studies measured diabetes incidence rates or glucose levels. The studies that measured glucose could not be compared with those that measured weight loss, and therefore they could not be used in the same meta-analysis together. Even among the studies that measured weight loss, it was measured in different ways. Some measured weight loss in percentages while others measured it in BMI or change in pounds. This also limited what studies could be included in the

meta-analysis. For this reason, only the three studies that measured the changes in weight loss

pounds were used to complete the meta-analysis.

For the studies used in the meta-analysis, their means and standard deviations were

recorded and used to calculate the effect size. Table 3 shows the values of the studies' individual

standard deviations, means, and number of participants.

Table 3. Means & Standard Deviations

Study Name	Mean (Treatment)	Standard Deviation Treatment	Mean (Control)	Standard Deviation (Control)	N Treatment	N Control
Study 1	-6	4.14209051	-2	4.08864194	39	38
Study 2	-2.3	3.92028015	0.73	1.39970842	41	24
Study 3	-3.8	5.2	-1.4	4	85	81

By using these statistics, it was determined that the results were statistically significant,

with a M value equal to 0.906351167 and a Z value equal to 1.928264933. This left p = 0.03

with a 97.32 confidence interval. Thus, the CDC's National Diabetes Prevention Program is

effective in decreasing weight loss percentages and HBA1C levels. The results can be seen in

tabular format in Table 4 and Table 5.

Although not included in the meta-analysis and effect size model calculations, the studies

also proved a positive relationship between the effectiveness of the CDC's National Diabetes

Prevention Program and changes in HBA1C levels and incidence rates of diabetes. This can be

seen in the three studies that were not able to be included in the effect size calculations. A

description of these studies can be found in Appendix A, Table 6. Although their data was

unable to be compared statistically, their results further prove the significance of this study and

how the use of self-management programs in any setting can have positive impacts on curbing

type II diabetes.

Table 4. Variables for Effect Size Model

Study Name	W study	Pooled Standard	D study	Wd study
Study 1	0.0590425	4.11545299	0.97194647	0.05738615
Study 2	0.11542159	2.94333867	1.02940474	0.11881554
Study 3	0.0464684	4.6389654	0.51735674	0.02404074

Table 5. Effect Size Results

Variable	Value
Sum W	0.22093249
Sum diWi	0.20024242
M	0.90635117
Z	1.92826493
P	0.03
V	0.47004356

4.1 Limitations

One of the largest limitations of this thesis was the small number of studies that were able

to be included for the meta-analysis and effect size model. This was the result of many of the

studies not having their final results posted on ClinicalTrials.gov. The studies used were of

varying years since the year 2000, proving that many of the studies have been completed but were never posted upon completion. This alludes to a much larger issue as many organizations are provided funding to perform research on the assumption that they will make the results of that research available for other scholars. However, this is not what is occurring, and in this specific case, it directly affected the outcome of this thesis, at no fault of my own.

Because there are fewer studies used in the effect size model calculations, there is potential for the results to be skewed more heavily than they would have had there been more studies. I do not believe that this should alter the results of the study, mainly that the self-management prevention programs are effective in curbing type II diabetes, as none of the studies had negative results. Although I do not believe that the results would change, I do believe that the effectiveness could change. It is important for all to understand this when considering the results of this thesis.

Chapter 5

Conclusion

Type II diabetes affects many Americans and requires the use of proper implementation of prevention programs to decrease its rates. At current state, there is a lack of effective prevention programs, but with the implementation of the Affordable Care Act in 2010, policy initiatives were created to improve the enacted programs. The answer is self-management education. For diabetes specifically, the CDC's National Diabetes Prevention Program is the leading diabetes prevention program spanning the nation.

As this thesis determined, there is a statistical significance between the interventions of the CDC's National Diabetes Prevention Programs and rates of weight loss percentages and decreasing HBA1C levels. This is true no matter what setting the program is administered in, whether it be in the workplace or in local community centers. Thus, self-management education is the answer to curbing type II diabetes rates in the American population.

Although this thesis does have its limitations, the end results should not be questioned. All studies led to positive outcomes, ensuring that self-management education is an effective intervention. For future research on the topic, more effort should be taken to making results available on public databases. Many studies have been conducted since the year 2000, however, as can be seen by this thesis, few have results available online. Although this may seem insignificant, it can be debilitating to scholars who need the data for further research. For effective research to be done on this topic in the future, this data needs to become available and shared in the health care and medical communities.

Appendix A

Results of Non-Included Studies

Table 6. Results of Studies Not Included in Meta-Analysis

Study Name	Unit of Measurement	Mean (Treatment)	Mean (Control)	N Treatment	N Control
Study 4	BMI	33.7	34.0	916	936
Study 5	Incidence Rate as Percentage	17%	33%	6	3
Study 6	Percent of Group that Met Set Goal (5% decrease in weight)	25%	11%	24	27

BIBLIOGRAPHY

Alpert, P. (2016). Self-management techniques to improve chronic diseases. *Home Health Care Management & Practice*, *28*(3), 184-186. doi: 10.1177/1084822315605853

American Diabetes Association (2014). *Diagnosing diabetes and learning about prediabetes*. http://www.diabetes.org/diabetes-basics/diagnosis/?loc=db-slabnav

American Diabetes Association (2013). Economic costs of diabetes in the US in 2012. *Diabetes Care*, *36*(4), 1033–1046. http://dx.doi.org/10.2337/dc12-2625

American Diabetes Association (2016). *Statistics about diabetes*. http://www.diabetes.org/diabetes-basics/statistics/?loc=db-slabnav

Center of Disease Control. (2016, October 7). *Health expenditures*. https://www.cdc.gov/nchs/fastats/health-expenditures.htm

Center of Disease Control. (2014, January 17). *National prevention strategy: America's plan for better health and wellness.* https://www.cdc.gov/features/preventionstrategy/

Center of Disease Control. (2013, June 12). *Preventive health care*. https://www.cdc.gov/healthcommunication/toolstemplates/entertainmented/tips/preventivehealth.html

Center for Disease Control and Prevention. (2014). *National diabetes statistics report: estimates of diabetes and its burden in the United States*. Atlanta, GA: U.S. Department of Health and Human Services.

Center for Medicare & Medicaid Services (2015). *National health expenditures 2015 Highlights*. Baltimore: Center for Medicare & Medicaid Services.

Fronstin, P., & Roebuck, M. C. (2015). *Financial incentives and workplace wellness-program participation* (Report No. 412). Washington, DC: Employee Benefit Research Institute.

Funnell, M.M., Brown, T.L., Childs, B.P., Haas, L.B., Hosey, G.M., Jensen, B, …Weiss, M.A. (2010).

National standards for diabetes self-management education, *Diabetes Care*, *33*(1), S90-S96. doi:

10.2337/dc10

Kwan, B.M., Jortberg, B., Warman, M.K., Kane, I., Wearner, R., Koran, R. … Nease Jr, D.E. (2017).

Stakeholder engagement in diabetes self-management: patient preference for peer support and

other insights. *The Journal of Family Practice*, 1-6. doi: 10.1093/fampra/cmw127-S089

Mbuagbaw, L., Aronson, R., Walker, A., Brown, R. E., & Orzech, N. (2017). The LMC Skills,

Confidence and Preparedness Index (SCPI): Development and evaluation of a novel tool for

assessing self-management in patients with diabetes. *Health and Quality of Life Outcomes*,

15(27), 1-9. doi: 10.1186/s12955-017-0606-z

National Prevention Council (2011). *National Prevention Strategy*. Washington, DC: US Department of

Health and Human Services, Office of the Surgeon General.

Patient Protection and Affordable Care Act, 42 U.S.C. § 18001 et seq. (2010).

Pennsylvania Department of Health. (2015). Statistical news: 2013 diabetes prevalence among

Pennsylvania adults, *38*(1), 2-5.

Powers, M. A., Bardsley, J., Cypress, M., Duker, P., Funnell, M. M., Fischi, A. H., ..Vivian, E. (2017).

Diabetes self-management education and support in type 2 diabetes: a joint position statement of

the American Diabetes Association, the American Association of Diabetes Educators, and the

Academy of Nutrition and Dietetics. *Diabetes Educator*, 43(1), 40-53. doi:

10.1177/0145721716689694

Public Health Service Act, 9 U.S.C § 901 et seq. (2016).

Sifferlin, A. (2012, September 4). *Too many Americans have out-of-control high blood pressure*. TIME.

http://healthland.time.com/2012/09/04/too-many-americans-have-out-of-control-high-blood-

pressure/

Van Busum, K. R., Liu, H., & Mattke, S. (2014). *Five steps to a successful workplace wellness program: a RAND toolkit*. Santa Monica, CA: RAND Corporation.

Vos, R.C., Eikelenboom, N.W.D., Klomp, M., Stellato, R.K., and Rutten, G.E.H.M. (2016). Diabetes self-management education after pre-selection of patients: design of a randomized controlled trial. *Diabetology and Metabolic Syndrome*, 8(82). Doi:10.1186/s13098-016-0199-4

Waidmann, T. A., Ormond, B. A., & Boybjerg, R. R. (2011). *The role of prevention in bending the cost curve*. Washington, DC: Urban Institute Health Policy Center.

Windrum, P., García-Goñi, M., & Coad, H. (2016). The impact of patient-centered versus didactic education programs in chronic patients by severity: The case of type 2 Diabetes Mellitus. *Value in Health*, *19*(4), 353–362. doi:10.1016/j.jval.2016.01.014

Wooley, Dennis S., & Kinner, Tracy J. (2016). Comparing perceived self-management practices of adult type 2 diabetic patients after completion of a structured ADA certified diabetes self-management education program with unstructured individualized nurse practitioner diabetes self-management education. *Applied Nursing Research 32*, 171-176. http://dx.doi.org/10.1016/j.apnr.2016.07.012

Woolf, S. H., & Atkins, D. (2001). The evolving role of prevention in health care: contributions of the US Preventative Services Task Force. *American Journal of Preventative Medicine, 20*(3S), 13–20.

ACADEMIC VITA

Academic Vita of Shannon Porterfield
Sip5287@psu.edu
810 Sprint Lane Camp Hill, PA 17011

Education:
      Bachelor of Science in Health Policy and Administration, Pennsylvania
            State University, Spring 2018
      Honors in Health Policy and Administration
            Thesis Title: How Effective are the Interventions of the CDC's
                  National Diabetes Prevention Program in Lowering HBA1C
                  Levels and Weight Loss Percentages in Pre-Diabetics?
            Thesis Supervisor: Patrick Plummer

Experience:
      Internship with Penn State Hershey Medical Center, Summer 2017
            Supervisors: April Adley, Judy Dillon
      Internship with Gift of Life Donor Program, Fall 2015 – Summer 2016
            Supervisor: Dwendy Johnson

Awards:
      Dean's List
      Phi Kappa Phi
      Upsilon Phi Delta

Activities/Presentations:
      Presenter/Finalist, Paper Titled: "Technologies: Parvus Patch," 2015
            Whalen Symposium, Ithaca, New York
      Public Health Research Team Member, Ithaca College, 2015
            Supervisor: Kari Brossard Stoos
      Co-Undergraduate President: Health Administration Club, 2017 - 2018

Community Service Involvement:
      Volunteer at American Cancer Society's Hope Lodge, 2017
            Supervisor: Caroline Antonetty