Impact of a Brief Prediabetes Education on Physical Activity, Eating Habit and Self-Efficacy in a Rural Primary Care Setting

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Chapter 1 Introduction

Background & Significance

Diabetes is a metabolic disorder characterized by high blood glucose levels resulting from an imbalance of insulin production, insulin action, or both and if left untreated may result in serious life-altering complications such as heart disease, stroke, blindness, kidney failure, amputations, and nerve damage (Centers for Disease Control and Prevention [CDC], 2014). Diabetes-related treatment efforts have consumed tremendous healthcare resources and to date, concerted efforts to ameliorate this epidemic health issue have been of minimal success.

Prediabetes and Awareness

Prediabetes is defined as a state of impaired fasting glucose (IFG), impaired glucose tolerance (IGT) or both. More specifically, the IFG is a fasting glucose level between 100 and 125mg/dL and the IGT is an oral glucose tolerance test glucose level between 140 and 199mg/dL in prediabetic state (ADA, 2015; Hendelsman et al., 2011). Without any interventions, 15-30 percent of people with prediabetes will develop type 2 diabetes mellitus (T2DM) within five years (CDC, 2014).

Although awareness of prediabetes has slightly improved from 2005 to 2010, the nationwide unawareness of the disease remains as high as 90% (Li, Geiss, Burrows, Rolka, & Albright, 2013). Low awareness of prediabetes is prevalent especially among the young and poorly educated, but higher awareness exists among the overweight with a greater than a high school education, and among those with a family history of diabetes, health insurance and a usual source of medical care. Identifying people with prediabetes and increasing awareness of their risk factors on developing T2DM are a critical first step (Li, Geiss, Burrows, Rolka, & Albright, 2013).

Lifestyle Intervention and Outcomes

General knowledge about diabetes and its risk factors, management and prevention are significant variables to adopt health-promoting behaviors (Chen & Lin, 2010). Even though it is a daunting task during short office visits, healthcare providers must attempt to educate and convince patients to change their lifestyle (Geiss et al., 2010). The literature has explored several lifestyle interventions in the treatment of prediabetes. These include healthy eating, moderate physical activity (PA), and weight loss (Thomas et al., 2010).

The Diabetes Prevention Program (DPP) Research Group (2002) conducted a large randomized control trial (RCT) to evaluate the effectiveness of lifestyle intervention (LI) programs including a low-calorie, low-fat diet and 150 minute per week moderate PA to prevent or delay diabetes among adults with prediabetes. Compared to the control and metformin groups, the LI group achieved greater weight loss and greater increase in PA. The diabetes incidence rate was 58% lower (95% CI, 48-66%) than the control, and the estimated cumulative incidence of diabetes at three years was the lowest (14.4%) in the lifestyle intervention group. Both metformin and LI effectively delayed or prevented diabetes, and in particular, LI was more effective, with one case of prevention per seven persons treated for three years, substantially reducing the individual and public health burden of diabetes.

The Diabetes Prevention Study (DPS) in Finland (Eriksson et al., 1999) assessed the efficacy of an intensive diet and exercise program in preventing or delaying T2DM, and evaluated the effects of the study intervention on cardiovascular risk factors in persons with IGT. The intervention group lost more weight than the control group, and their plasma glucose concentrations were significantly lower as well. Additionally, serum triglycerides, systolic blood

pressure and diastolic blood pressure measurements were lower compared to the control group. The lifestyle intervention not only improved blood glucose level, but also affected heart health.

The landmark studies such as DPP and DPS have been translated into different practice settings, communities, and underserved minorities. The translational studies successfully produced significant weight loss, which reduces diabetes and cardiovascular risks (Almeida, Shetterly, Smith-Ray, & Estabrooks, 2010; Jakicic et al., 2013; Jiang et al., 2013; Katula et al., 2011; Katula et al., 2013; Look AHEAD Research Group, 2007; Ma et al., 2013; Matvienko & Hoehns, 2009; Parikh et al., 2010); however, long-term cost-effectiveness of lifestyle intervention programs remains questionable due to weight regain after the first year of lifestyle modification (Kahn & Davidson, 2014).

While medications for diabetes can only affect glucose levels, the LI with education and support may contribute more to improved overall health by directly impacting the diabetes risk factors such as weight, eating habit (EH), physical activity (PA) and blood pressure, thus preventing or delaying progression to T2DM (Diabetes Prevention Program Research Group, 2002; Eriksson et al., 1999). However, more evidence is necessary to evaluate the long-term effect of the LI programs.

Environmental Factors

Urbanization contributes to easy access in foods that are high in fat, sugar and calorie worldwide; however, the U.S. shows the opposite that is higher diabetes prevalence rate in rural communities. Also, people living in low-income or minority neighborhoods are more likely to suffer from diabetes or related complications. Limited access to nutritious food due to financial insecurity is related to diabetes risk and higher diabetes prevalence rate. People with sedentary lifestyles have an increased risk for diabetes. When the surrounding environment is safe and

promotes outdoor recreations, people are more likely to increase PA and less likely to be sedentary therefore reducing the risk of developing T2DM (Hill et al., 2013).

Internal Evidence

In a local healthcare clinic in Graham County, AZ, a lack of diabetes prevention program is identified. The barriers are a lack of time to educate patients during short office visits, the limited availability of local health resources, residents' unawareness of their diabetes risk, and other co-morbidities. The clinic serves a high volume of patients who are overweight and/or obese that is a risk factor for diabetes.

Problem Statement

Diabetes is an epidemic health issue that affects quality of life and exhausts valuable healthcare resources worldwide. It also disproportionately affects more ethnic minorities and rural communities. There is a great need to shift the healthcare community's focus from diagnosis and treatment of the diabetes epidemic to outright prevention of the disease. The world wide and national efforts to reverse the current trend of diabetes have not been very successful.

PICOT Question

In adults with prediabetes residing in a rural community (P), how would a lifestyle intervention program (I) compared to no lifestyle intervention (C) affect blood glucose level (O) in 3 months (T)?

Search Strategy

An exhaustive search included a database search and hand ancestry methods to obtain the most current and high level of evidence and to evaluate and synthesize the studies. The electronic databases consisted of Academic Search Premiers, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Library, PubMed, and PsycINFO. The population was

limited to adults only with prediabetes, and the intervention had to include any form of lifestyle changes such as healthy eating and/or PA. The outcomes were change in fasting glucose, oral glucose tolerance or HbA1c, or diabetes incidence. Studies with pregnant women, no randomization, or the number of subjects less than 50 were excluded. Preferred studies were original research or meta-analysis/systemic review. The database search was limited to English language, human subjects and published date from 2010 to 2015.

Academic Search Premiers

The search terms included were "prediabetes", "lifestyle intervention", "blood glucose", "incidence" with a Boolean term AND, and synonyms like "prediabetic", "lifestyle modification", "lifestyle change", "behavioral modification", "fasting glucose", "hemoglobin A1c", "oral glucose tolerance", and "diabetes" with a Boolean term OR, which yielding 57 articles.

CINAHL

For CINAHL database, the search was as follows Search (S) 1 "prediabetes OR prediabetic state OR impaired fasting glucose OR impaired glucose tolerance" n=3,388; S2 "lifestyle intervention OR lifestyle modification OR healthy eating OR diet OR exercise OR physical activity" n=189,809; S3 "diabetes incidence rate OR diabetes prevention" n=8,492; S4 "rural community OR rural health OR rural setting OR rural" n=39,636. Those four searches were combined with a Boolean term AND in multiple different ways and produced a total of 246 studies. Thirty articles were retained for further review.

Cochrane Library

The Cochrane Library search was performed using the following keywords: prediabetic state, lifestyle intervention, lifestyle change, diabetes prevention study, and rural population. The

search produced two Cochrane Reviews, 12 other reviews, and four trials. After careful evaluation, only two reviews were selected for the relevance to the research question.

PsycINFO

For PsycINFO database, the search terms included “prediabetes”, “lifestyle intervention”, “behavioral modification” and a Boolean term AND, which resulting 20 scholarly journals and four dissertations and theses.

PubMed

Searching PubMed database with Medical Subject Headings (MeSH) terms led to the followings “prediabetic state” n=3,858; “life style” n=65,714; “primary prevention” n=113,798; “rural community” n=40,572. The MeSH terms then combined with a Boolean term AND which yielded 53 studies.

Final Yields

After an exhaustive literature search on prediabetes and lifestyle intervention, the final 10 studies were included: two systematic reviews (SR), five RCTs, two quasi-experiments, and one cohort study. The studies were published within five years (See Table 1).

Evidence Synthesis

Eight studies utilized lifestyle modification with healthy eating or PA, or both as the intervention. Lifestyle intervention was delivered in individual-based or group-based. One study implemented both methods (See Table 2). People conducting the intervention were diverse consisting of nurses, community health workers, or trained researchers.

Measured outcomes were weight, BMI, FBG, OGTT, cholesterol, or diabetes incidence rate. Eight studies evaluated weight and reported statistically significant weight loss with either

individual or group-based lifestyle interventions. Five studies evaluated diabetes incidence outcomes. Of those, three showed significant changes in the incidence rate (See Table 2).

Overweight or obesity and sedentary lifestyle are one of the risk factors for developing diabetes. The lifestyle intervention with healthy eating and PA helps to reduce diabetes risks. The variable factors including variable intensities, delivery methods, practice settings and follow-up periods of the intervention also affect the degree of the weight loss and fasting blood glucose. Although the lifestyle intervention to reduce diabetes incidence rate is inconclusive, it has been shown to be effective with the risk reduction behaviors in prediabetic population. Implementation of healthy eating and exercise among prediabetic population will improve their overall health.

Purpose Statement

The purpose of the project is to identify patients with the high risk for prediabetes and implement lifestyle change intervention in a rural primary care setting. The project will benefit patients with high risk for prediabetes by increasing awareness and knowledge of prediabetes and by improving their physical activity (PA), eating habit (EH) and self-efficacy (SE).

Chapter 2 Applied Clinical Project: Methods & Results

This chapter provides details on the evidence-based practice (EBP) model, conceptual model, project methods, results, discussion and conclusion. The project methods illustrate ethics, setting, organizational culture, participants, procedure, outcomes measures, data collection, data analysis, and proposed budget.

Evidence Based Practice Model

The Model for Evidence-Based Practice (EBP) Change will systematically guide this evidence-based practice change. The model includes the following six steps: *Step 1 Assess the need for change in practice; Step 2 Locate the best evidence; Step 3 Critically analyze the evidence; Step 4 Design practice change; Step 5 Implement and evaluate change in practice; and Step 6 Integrate and maintain change in practice.*

In Step 1, internal data were collected to assess the need for change in practice. The key stakeholders included physicians, certified diabetic educators, medical assistants and prediabetic patients. The need to educate patients with high risk for prediabetes to prevent prediabetes and T2DM was identified. In step 2, the best evidence was located by conducting an exhaustive literature search in electronic databases. The types of evidence included practice guidelines, systematic reviews, meta-analysis and RCTs. In step 3, the evidence was critically analyzed and synthesized, and supported increasing prediabetes awareness and educating healthy lifestyle change among patients with high risk for prediabetes to prevent T2DM in prediabetic population. In step 4, a pilot program to identify patients with prediabetes or high risk for it was designed to increase prediabetes awareness and improve PA and EH. The step 4 includes identifying needed resources, desired outcomes, outcome measuring tools, and evaluation plan. In step 5, the pilot program will be implemented in the clinic and data will be collected and analyzed. Evaluate the

pilot program to decide if adaptation is warranted. Feedback of the participants and stakeholders is an important step to make adjustments. In step 6, the results of the project will be presented to the stakeholders and the practice change will occur if the pilot program supports positive effects on diabetes prevention.

Conceptual Model

The Health Belief Model (HBM) was selected as the most effective conceptual model to promote healthy lifestyle changes for this EBP project. The HBM conceptual model incorporates six sequential components: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and SE (National Cancer Institute, 2005). The focus of HBM, motivation, is widely applicable to many health situations, and the final element of the model, SE, can play a critical role in promoting and achieving health behavior and lifestyle changes among pre-diabetic populations.

While the evidence emphasizes the importance of lifestyle changes in preventing or delaying diabetes among prediabetic adults, the HBM model strongly suggests that people with prediabetes might not change their lifestyle to lose weight and increase PA because they do not know their perceived susceptibility (e.g., slightly higher FBG levels than those considered normal). Logically, perception must arise before motivation and SE. People with prediabetes must perceive and understand that slightly high FBG can lead to diabetes and macrovascular and microvascular diseases (perceived severity).

If knowledge, understanding and perceived benefits of healthy lifestyle changes can be articulated, and, if barriers to success can be identified in advance, such awareness may aid both individuals and groups in a reduction of risk for developing diabetes. Weekly meetings for education, healthy eating and PA log books, social media support, and follow-up phone calls

may cue continued action helping people to implement and comply. People with low confidence might benefit by setting short-term goals and participating in groups for peer-support (self-efficacy) (See Figure 1).

Project Methods

Ethics and Recruitment

The Arizona State University (ASU) institutional review board (IRB) reviewed and determined that this EBP project is adequate to protect the human subjects' right (Appendix A). Recruitment flyers were placed in the exam rooms of the champion clinicians. Any information that is obtained in connection with this project and that can be identified with the participants will remain confidential and will be disclosed only with their permission or as required by law. The participants' name will not be entered on the questionnaires or survey tools, which will be coded by a number, not name, on the top of the forms. A master list of subject's names and study IDs will be created. The master list will be destroyed after data is matched. No unauthorized persons will have access to this data. All demographic forms, questionnaires, and surveys will be stored separately from the consent forms within the same locked drawer for one year with this author and faculty advisor having access. The participants' name and designated phone number will be stored separately in a locked safe and used for the sole purpose of reminder calls. The data will be disposed of by shredding immediately after the last phone call is placed. All other forms associated with this project will be disposed of by shredding after 6 months.

After receiving IRB approval from ASU, the patients were recruited to participate in the project from October 26th, 2015 to October 30th, 2015 by convenience sampling of available patients in the primary care office for routine visits. The recruitment flyers were placed in the

exam rooms of the Champion. The purpose and goal of the project were explained to eligible candidates. Also, the participation was voluntary and the subjects can withdraw from the project anytime if they desire.

Setting

The project was conducted at a rural outpatient family healthcare clinic, Gila Valley Clinic, located in Safford, Arizona (AZ). The clinic was established in the community in 1994. The staff consists of nine providers (five medical doctors, three nurse practitioners, and one physician assistant), ten medical assistants, and ten administrative staff. The practice takes about sixty percent of AHCCCS and Medicare patient groups. Also, they provide sliding scale payment option for people with financial difficulties. Approximately eight five percent of patient population is mostly Whites and Hispanics.

Organizational Culture

The Gila Valley Clinic (GVC) staff overall work together well to provide the best healthcare to the community and actively involve in the community improvement activities. Their mission is to provide quality full spectrum medical care to their patients. One of the providers is identified as a Champion for the project because she expressed interests in diabetes health in the Eastern Arizona and volunteered to help with this DNP project. Also, the MA's of the Champion verbalized the negative impacts of diabetes in the town and wanted to spread the words to patients about the project. Open communication was encouraged to minimize possible barriers.

Participants

Twenty-four participants were recruited from the clinic. Eligibility criteria were as follows: adults who are 18 years of age or older; English speaking; cognitively intact; and risk

for prediabetes. These risk factors include 45 years of age or older, being overweight or obese, a family history of diabetes, ethnic background other than Caucasian, gestational diabetes, having given birth to a baby weighing nine pounds or more, or being physically active less than three times a week (CDC, 2014; CDC 2015). Exclusion criteria applied to those who have diagnosed with Type 1 diabetes or Type 2 diabetes, pregnant women, or unable to consent. All participants were explained with the goal of the DNP project and the benefits of participation. All questions were answered and written informed consent was obtained from all participants.

Procedure (Intervention)

Once the patients agreed to participate in the project and sign the informed consent, their demographic information was gathered including; age, gender, ethnicity, marital status, education status, current health condition, prediabetes awareness, height in inches, and weight in pounds. Their height and weight were extracted from their medical records. The *CDC Prediabetes Screening Test* by National diabetes Prevention Program was used to obtain their risk scores (CDC, 2015). The scores were divided into two groups, low risk or high risk for prediabetes. If their score was 3 to 8 points, they were placed in the low risk for prediabetes group. If their score was 9 or more points, they were placed in the high risk for prediabetes group. Regardless of their risk scores, all participants received the same survey questions and intervention. Each participants completed pre-intervention survey questions on PA, EH and SE level. Then, they received written and verbal prediabetes information including the definition, complications, risk factors, and simple lifestyle interventions with healthy eating and PA. Weekly, they received a brief phone call for four weeks for follow-up. The final fourth week, each participant completed post-intervention survey questions via phone calls. The pre and post intervention survey questions were identical to measure any changes on PA, EH and SE levels.

Outcome Measures

Demographic data were collected at baseline. The PA was measured by a 2-item questionnaire, Brief Physical Activity Assessment. Each participant was asked the weekly frequency of each vigorous PA (score 0-4) and moderate PA (score 0-4). A score is given to each category. A score 0 to 3 meant insufficiently active and a score of 4 or more meant sufficiently active. The k coefficients showed significant inter-rater agreement at $k=0.53$, $p < .001$ (Marshall, Smith, Bauman, Kaur, & Bull, 2005). Eating habit was measured by an 8-item food frequency questionnaire, Starting The Conversation. Each item was scored from 0 to 2, higher score indicating the least healthful habit. All eight-item scores were added to yield a summary score (0-16), lower score reflecting healthier eating and higher score meaning unhealthy EH. All items and the summary scores were well intercorrelated, $r = 0.39\text{-}0.59$, $p < .05$ (Paxton, Strycker, Toobert, Ammerman, & Glasgow, 2011). There was no preexisting prediabetes specific SE measurement tool. A six item, 5-point Likert scale (0-4) questionnaire (*Prediabetes Lifestyle Change Self-Efficacy*) was used to measure the confidence level of participants, which was modified from *Self-Efficacy for Diabetes* (Lorig, Ritter, Villa, & Armas, 2009) to reflect the information on prediabetes and lifestyle change given during the intervention session (See Appendix B-G).

Data Collection and Analysis Plan

Demographic data were collected on the day of visit to the clinic. The PA, EH and SE data were collected via the phone call during the fourth week follow up. Participant data were statistically analyzed using SPSS Statistics 23.0. The frequency and descriptive analysis were done on the demographic data. A paired samples t-test was appropriate to measure any

differences of PA, EH and SE between pre and post intervention. Statistical significance was set at $p < .05$.

Proposed Budget

The main cost of the implementation of the project was the printed educational material and time spent by the person providing education who can be a nurse practitioner (NP) or medical assistant (MA) and the follow up phone call time. The estimated costs for NP and MA range $11.96 ~ $13.54 and $3.86 ~ $4.36, respectively (See Appendix H). There was no monetary compensation for the participants. People with diabetes are twice more likely to spend in medical expenses than those without diabetes. Also, they tend to lose more workdays and die prematurely compared to those without it (CDC, 2014). Therefore, it is much more beneficial to prevent diabetes with the brief intervention.

Project Results

Participant Characteristics

A total of 24 participants completed the pre-intervention assessment. Of those, 16 finished the post-intervention assessment. The mean age of participants was 56.6 ± 13.0 years, had a height of 65.0 ± 3.3 inches, and had a weight of 201.4 ± 38.2 pounds. The mean score of the *CDC Prediabetes Screening Test* was 12.3 ± 4.7 points, which interpreted a score of 9 or more points indicates high risk for having prediabetes. The majority of the participants were female (81.3%), and more than half identified as Caucasian (62.5%). Most participants reported married (81.3%), and over half (56.3%) described their health condition as good. The three quarters (75%) noted they have heard of the term prediabetes (See Table 3).

Outcome Variables

A paired samples t-test was performed to compare the changes in PA, EH and SE from pre-intervention to post-intervention within the participants. The paired t-test revealed that mean PA differed before the intervention (*M* = 2.88, *SD* = 2.53) and after the intervention (*M* = 5.31, *SD* = 2.77) at the significance level of .05 (t = -3.31, df = 15, n = 16, p = .005, 95% CI for mean difference -4.01 to -.87, r = .37). On average PA was increased after the short lifestyle modification education. The paired t-test showed that mean EH decreased before the intervention (*M* = 6.94, *SD* = 2.52) and after the intervention (*M* = 5.00, *SD* = 2.48) at the significance level of .05 (t = 3.08, df = 15, n = 16, p = .008, 95% CI for mean difference .60 to 3.28, r = .49). On average EH was improved after the short lifestyle modification education. The paired t-test indicated that mean SE increased before the intervention (*M* = 16.69, *SD* = 4.19) and after the intervention (*M* = 19.88, *SD* = 3.28) at the significance level of .05 (t = -3.49, df = 15, n = 16, p = .003, 95% CI for mean difference -5.14 to -1.24, r = .54). On average SE was improved after the short lifestyle modification education (See Table 4).

Discussion

The lifestyle modification is a proven method to prevent or delay the diabetes development (Diabetes Prevention Program Research Group, 2002). However, translating it into a primary care setting can be challenging due to time constraints. The Diabetes Prevention Program (DPP) lifestyle intervention is composed of a 16-week intensive lifestyle-modification intervention. The shortest translational study was 3 month long (Whittemore, 2011). This DNP project was only 4 weeks long and the actual intervention took only 3-5 minutes during the interview session. Many clinicians are challenged with short visit times with their patients; therefore, keeping the intervention short is an important factor to consider.

The participants were recruited at a primary care clinic. The Champion clinician encouraged the participants to get involved in the project, so it was likely that they wanted to please their clinician by participating even though they were not interested in it. The incompletion rate at the fourth week was as high as 33%.

The phone call follow-up was challenging because some of the participants were not answering the calls. Multiple calls per participant were necessary to complete the follow up surveys each week. According to the U.S. Department of Health and Human Services [HHS] (2014), many studies have shown that health text messaging can help improve health knowledge, behaviors and outcomes. With increasing use of smartphones, health text messaging can make the follow up process easier and less time consuming for future study.

Compared to the DPP study, this project had a less intensive intervention (Diabetes Prevention Program Research Group, 2002). The intervention was provided one time during one office visit and no other visits were required. Nevertheless, it showed improvements in PA, EH and SE level with the short intervention.

The Finnish Diabetes Prevention Study (DPS) illustrated that the lifestyle intervention group demonstrated changes in dietary and exercise habits by eating less fat and more vegetables and increasing exercise (Eriksson et al., 1999). In this DNP project, the participants had statistically significant improvements in their PA and EH. Therefore, discussing prediabetes risk and lifestyle modification during the office visit is an important first step towards to preventing T2DM.

This current project showed an improved SE level between pre and post intervention. This finding is consistent with the results of the study by Chen and Lin (2010). Their analysis revealed a significant positive correlation between SE and health-promoting lifestyle.

Limitations

There were multiple limitations for this DNP project. The sample size was small, and the attrition rate was high at 33%. The phone call follow-ups were burdensome because of the participants' low rate of answers, so it required multiple attempts on calls each week. In addition, a 4-week of follow up on lifestyle change was very short to make strong conclusions. Also, it was conducted at one practice site that limits generalizability. Furthermore, the subjects who participated in the project could be already motivated to change their lifestyle for better health before enrolled in.

Conclusions

The results reject the null hypotheses that there would be no differences in PA, EH or SE level from pre-intervention to 4 weeks post-intervention. Providing lengthy classes for lifestyle changes can be challenging in a primary care setting due to time constraints, space and staffing. The findings of this DNP project illustrate that the lifestyle change education can be brief and effective to increase PA, eat healthier and improve SE level. Larger sample study over a longer period time is necessary to exam the long-term effect of lifestyle change.

There is a great need to shift the healthcare community's focus from diagnosis and treatment of the diabetes epidemic to outright prevention of the disease. Early identification of people who are at risk for prediabetes is the first step in preventing T2DM. Also, providing them with a simple guideline on lifestyle change can help change the trend of diabetes before it begins. The practice site values the time of both their staff and patients. Thus, it is likely to adopt the practice change if the lifestyle change education is brief and succinct for the both parties. Future research is needed on innovative methods to implement lifestyle changes in a primary care setting.

Chapter 3 Organizational/Health Policy Impact & Sustainability

With the increasing number of T2DM, early identification of prediabetes is an important step followed by lifestyle change intervention (American College of Endocrinology & American Association of Clinical Endocrinologists, 2008). The project findings suggest that the lifestyle change education is achievable in a primary care setting. This chapter will address impact of the project on practice, financial implications, impact of current policy, the role as innovative leader, sustainability plan, implications for further study, and identified gaps.

Impact on Practice

It requires interprofessional collaboration to have a successful DNP project (Conrad, 2014). This author only could recruit the Champion clinician for the project. The main reason of non-participation of other providers was the time restraint and resistance to change of their routine. For other clinicians, meeting the high volume of patients was their priority. With the clear evidence of early identification of prediabetes and lifestyle change education and the positive impact on lifestyle, the Champion continues with the brief lifestyle change education. This author remains hopeful to change the practice in the setting gradually with the assistance of the Champion clinician. A few medical assistants (MAs) expressed the importance of early lifestyle education with their high-risk patients and stated that they were interested in doing the education if the time is allowed. Instead of pushing for change with the resistance, the gradual change approach would benefit the site and staff.

Cost and Benefit Analysis

The project budget was $50 to cover supplies and educational materials. A total of $26.60 was spent, and no monetary compensation was provided for the participants or provider. The space was limited in the setting; hence, the phone call follow-up was chosen. Also, the

participants did not have to pay another co-pay with the calls and no loss of workdays. If a physician, NPs and MAs provided the education and follow-ups, it would cost $23.10 - $26.18, $11.96 - $13.54, and $3.86 - $4.36, respectively (See Appendix H). It is cost beneficial when MAs provide the education and follow up with the patients.

Impact of Policy

In 2010, the Congress passed the Patient Protection and Affordable Car Act (ACA). The goal is to expand health insurance accessibility and make it more affordable resulting in more people to be covered. It is good news for people with chronic conditions such as diabetes because it is against the law to deny their coverage due to their pre-existing conditions (Longest, 2016). Additionally, the preventive health services that are evidence-based must be provided. Currently, T2DM screening for asymptomatic adults with high blood pressure is covered (Mason, 2011). This leaves out the estimated 86 million prediabetic Americans with other risk factors such as obesity or a family history (CDC, 2014). However, on March 23rd, the HHS (2016) announced that they are considering the expansion of the Diabetes Prevention Program (DPP) to the Medicare beneficiaries with prediabetes because the positive health impacts with financial benefits are too significant to ignore. With the recent consideration, there is a need to increase the number of qualified educators or community workers who can teach the healthy lifestyle education to the beneficiaries.

Innovative Leader

According to Chism (2010), a DNP graduate exhibits excellent leadership and collaboration that increase patient satisfaction and decrease conflict. One of the most important leadership attributes is effective communication skill. At the initial of the project planning, the Champion clinician verbalized a concern for limited time and space at the clinic for group

intervention sessions. This DNP student used the democratic style of leadership to resolve the conflict. The democratic leader considers all viewpoints and utilizes good communication skills to collaborate, resolve conflict and influence others (Chism, 2010). The project was modified to the individual session with follow-up calls by the MAs to address the Champion clinician's concern. Then, the MAs raised a concern for implementing the project due to their limited patient care time. The student provided other options for implementation methods and all agreed the student to implement the intervention. Once they observed the actual process being quick and easy during the implementation period, a few MAs verbalized their interest on the education part. It was a learning process. If the student held a meeting with both the clinician and staff at the same time, their both concerns could have been addressed at once. This DNP project provided valuable lessons for the future EBP process to be successful.

Sustainability

Many factors play a role for sustainability of a project. One essential element is readiness for change (Alt-White & Pranulis, 2011). Even though the Champion clinician and a few MAs were part of this DNP project, the organization as a whole was not ready to change their practice due to their limited patient care time. The operation cost of the project was minimal (Appendix H); yet, insufficient employee and managerial time constrained the system-wide use of the project (Alt-White & Pranulis, 2011). Although the project did not convince the organization as a whole to change the practice, the Champion clinician continues to educate the patients. Additionally, the recent announcement of DPP expansion to Medicare beneficiaries with prediabetes may influence the organization's practice change in the future (HHS, 2016).

Implications for Further Application and Research

HealthyPeople 2020 identified diabetes health as a part of their nationwide initiative to focus efforts on improving national health. The objective related to prediabetes is to increase prevention behaviors for prediabetic people with high risk for diabetes (HHS, 2014).

Assessing the prediabetes risk scores with a standardized questionnaire such as the *CDC Prediabetes Screening Test*, other than blood work, can help identify people who are at risk for prediabetes in clinics before developing it. This DNP project showed that one time brief lifestyle change education could positively impact PA, EH and SE in people with high risk for prediabetes in a primary care clinic. Further study is needed to develop other innovative ways such as using patient portal, mobile applications and electronic messages to implement lifestyle change education without affecting patient care time in primary care settings.

Gaps

During the project, a gap was identified that people who are at high risk for developing prediabetes heard the term prediabetes, but they were not formally educated on their risk factors or healthy lifestyle education. Primary prevention is an essential key to prevent prediabetes that can lead to T2DM. The focus should be on the risk reduction behaviors like weight loss, increased PA and healthy eating and less on the laboratory values. The successful DPP research with prediabetic people is abundant (Almeida, Shetterly, Smith-Ray, & Estabrooks, 2010; DPP Research Group, 2002; Eriksson et al., 1999; Jiang et al., 2013; Katula et al., 2013); however, the insurance only covers the program for the people with T2DM. Researchers and healthcare providers need to work together to lessen the gap from research results to practice and policy.

Conclusion

This EBP project demonstrated how to translate evidence into a real practice setting by utilizing EBP Change model and conceptual framework. The internal data were assessed for the

need for practice change. Then, the exhaustive search for the best evidence was completed followed by evidence synthesis. Next, the project was developed with the approval of IRB. The findings illustrated that the lifestyle change education can be brief and effective to increase PA, eat healthier and improve SE level. Larger sample study over a longer period time is necessary to exam the long-term effect of lifestyle change. The project abstract got accepted for the 4th Annual Interprofessional Rural Health Professions Conference and the 2016 National Nurse Practitioner Symposium for the result dissemination.

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Table 1 *Evaluation Table*

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
Almeida, F. A., Shetterly, S., Smith-Ray, R. L., Estabrooks, P. A. (2010). Reach and effectiveness of a weight loss intervention in patients with prediabetes in Colorado. Preventing Chronic Disease, 7(5), 1-5. Retrieved from www.cdc.gov/pcd/issues/2010/sep/9_0204.htm Country: Denver, U.S. FA: Department of Preventive Medicine at KPCO C/B: none	Patient-centered approach	Design: Matched cohort longitudinal study Purpose: To investigate the effectiveness of a theory-based, brief, small-group wt loss intervention for diabetes prevention and to determine the potential reach of the intervention	N=1520, (760 matched pairs) Demographics: mean age 63, 53% F, LI: 188.3 lbs, BMI 29.8 Setting: Kaiser Permanente Colorado, an integrated health care organization	IV=a single 90 minute small group session that targeted personal action planning for healthful eating, PA, and wt management DV=wt change in medical records	Weight, BMI	Mixed models analyses to adjust for matching variables and covariates and to account for individual random effects over time. Nonparametric X^2 test of independence to test for group differences between groups.	Wt in LI decreased sig more than that for CG (mean wt loss -3 lbs [95%CI -3.6 to -2.4] for control, -1.4 lbs [95%CI -2.0 to -0.8], ($p<.001$). LI were 1.5 X (95% CI, 1.2-2.0) more likely to lose at least 5% of their wt than CL.	Level 4 Strength: Theory based study Weakness: not randomized, wt measurement not done by trained research staff, generalizability is unclear. CO: A single-session, theory based wt loss program can be modestly effective, but many not have sufficient reach to be effective as a population approach. CS: Supports short and one time LI education for sig wt loss to reduce DM risk factors
Balagopal, P. (2012). A community-based participatory	TTM	Design: Cohort study Method: CBPR method by using trained CHW,	N= 1638 male 766, female 872, high SES 873, low SES 764	IV: ten face to face encounters for lifestyle intervention (advice on	Dietary recall ADA 7-item DM risk test	SPSS 19 Multivariate regression	% change in BMI= -0.46 ($p<.001$) % change in	Level 3 Strength: large sample size, door-to-door

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
diabetes prevention and management intervention in rural India using community health workers. The Diabetes Educator, 38(6), 822-834. DOI: 10.1177/0145721712459890. FA: American Association of Physicians of Indian Origin in collaboration with Texas A&M University and Maharaja Sayajirao University of Baroda C/B: none Country: India		interventions given to all participants Purpose: to test the effectiveness of a 6-month community-based diabetes prevention and management program in rural Gujarat, India No monetary compensation IRB approval by Texas A&M University	D: mean age 41.9+/-15.9, high SES had a below-poverty level of 24% and illiteracy of 9.7%, and low SES had 51% and 50.5% respectively Setting: rural community in Gujarat, India IC: all adults, age 18 and older, from a rural community, 25 km from Vadodara, Gujarat EC: migrant workers	healthy diet and regular physical activity) DV: BMI, waist, PA, fruit/veg intake, knowledge of DM and CVD risk factors, SBP, DBP, and FBG	11-item AHA risk calculator PA modified version from IDPP study Fasting capillary blood glucose Averaged 3 BP measurements Ht/Wt/WC/HC		WC= -1.25 (p=.001) Change in SBP= -7.37 mmHg (p<.001) Change in DBP= -3.24 mmHg (p<.001) Change in FBG= -1.28 mg/dL (p<.001) Change in DM knowledge score= 0.78 (p<.001) Change in CVD knowledge score= 1.64 (p<.001) Change in fruit intake =.04 (p<.001) Change in veg intake = 0.19 (p<.001) % change in	visits, culturally sensitive LI, high community support WE: no randomization or control group, door-to-door visits, vulnerable population CO: Community-based DM prevention program reduced FBG and increased DM knowledge in both high and low SES in rural community. CS: CBPR is useful method and CHW plays a critical role in implementation.

A: Asian, AI: American Indian, ALT: alanine aminotransferase, AN: Alaska Native, AST: aspartate aminotransferase, BMI: body mass index, BP=blood pressure, CBPR: community-based participatory research, CG=control group, CHW: community health workers, CI: confidence interval, **CO**- conclusions; **CS**- clinical significance; CV: cardiovascular, DEP: DM education program, DM: diabetes, DPP: Diabetes Prevention Program, **DV**- dependent variable; **DV2**- dependent variable 2; d/t=due to, **EC**- exclusion criteria; F= female, **FA**-Funding Agency; FBG=fasting blood glucose, FPG: fasting plasma glucose, f/u=follow-up, GGT: gamma-glutamyltransferase, HbA1c: glycosylated hemoglobin, HC-hip circumference; Ht-height; HCP: health care programs, HD=healthy diet, HDL: high density lipoprotein, HOMA-IS: homeostasis model assessment of insulin resistance, HS: high school, IDPP- Indian Diabetes Prevention Program; IHS: Indian Health Services, **IV**-independent variable; KPCO: Kaiser Permanente Colorado, LDL: low density lipoprotein, LG: lifestyle group, LI: lifestyle intervention, M: male, MA: meta-analysis, MAQ: modifiable activity questionnaire, MG: metformin group, N: total number of participants, n: number of sub-category participants, nc=number of participants in control group, ni=number of participants in intervention group, NA: not applicable, NCOI: no conflict of interest, NIDDKD: National Institute of Diabetes and Digestive and Kidney Diseases, NIH: National Institutes of Health, OGTT: oral glucose-tolerance test, P: purpose, PA=physical activity, PC: primary care, PH: public health, PI: Pacific Islander, PG: placebo group, RCT: randomized clinical trial, RR: risk reduction, SES- socioeconomic status; SR: systemic review, TG: triglycerides, **TTM**-Transtheoretical model; TX: treatment, U.S.A.: United States of American, W: white, **WE**- weaknesses wk: week, wt: weight, yrs: years **D**-demographics; **IC**- inclusion criteria; **V2**- independent variable 2; **IV3**-independent variable 3; **MA**- meta-analysis; **N**- sample size; **NIH**-National Institute of Health; PA-physical activity;

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
							PA= 11.6 (p<.001)	
Cardona-Morrell et al. (2010). Reduction of diabetes risk in routine clinical practice: Are physical activity and nutrition interventions feasible and are the outcomes from reference trials replicable? A systematic review and meta-analysis FA: not stated C/B: none	NA	Design: SR/MA Method: Multiple databases were systematically reviewed and a MA was done of RCTs that evaluated LI in adults at risk for DM Purpose: to determine whether lifestyle interventions delivered to high-risk adult patients in routine clinical care settings are feasible and effective in achieving reductions in risk factors for DM.	N=363 papers potentially eligible N=41 papers examed for full eligibility N=12 included in final review & bias assessment N=4 for MA 7 RCTs, 3 before-after designs without a CG and 2 before-after designs with a CG Limits: English, published 1990-Aug 2009 IC: translational research studies,	IV: LI (nutrition and/or PA) with or without med DV1: weight loss or WC DV2: metabolic outcomes indicative of DM risk reduction DV3: self-reported or objectively measured behavioral outcomes Secondary outcome: prevention of DM (incidence % or delay in onset) MA main	Denominator for effect sizes= #of subjects in whom the outcome had been assessed Study results were categorized as +/-/inconclusive Study quality score Changes in means, and tests of heterogeneity between trials were calculated with random effects models SD of mean differences in	Critically reviewed. MA with NCSS software version 7.1.1.9 Forest plots	Mean wt reduction was 1.82kg greater in tx than CG (95% CI: -2.7 to -.99kg), pooled mean waist measurement reduction in tx exceeded CG by 4.6 cm (95% CI: -5.8 to -3.4 cm), FPG reduction was 0.19 greater in tx (95% CI: -.44 to +.06), OGTT 0.04 (95% CI: -.49 to +.42)	Level 1 Strength: SR/MA reviewing LI for feasibility and replication Weakness: Only 12 studies included. Many studies' f/u period was short and only modest sample sizes CO: Modification of the original research to real life practice made LI feasible, affordable or replicable in

A: Asian, AI: American Indian, ALT: alanine aminotransferase, AN: Alaska Native, AST: aspartate aminotransferase, BMI: body mass index, BP=blood pressure, CBPR: community-based participatory research, CG=control group, CHW: community health workers, CI: confidence interval, **CO**- conclusions; **CS**- clinical significance; CV: cardiovascular, DEP: DM education program, DM: diabetes, DPP: Diabetes Prevention Program, **DV**- dependent variable; **DV2**- dependent variable 2; d/t=due to, **EC**- exclusion criteria; F= female, **FA**-Funding Agency; FBG=fasting blood glucose, FPG: fasting plasma glucose, f/u=follow-up, GGT: gamma-glutamyltransferase, HbA1c: glycosylated hemoglobin, HC-hip circumference; Ht-height; HCP: health care programs, HD=healthy diet, HDL: high density lipoprotein, HOMA-IS: homeostasis model assessment of insulin resistance, HS: high school, IDPP- Indian Diabetes Prevention Program; IHS: Indian Health Services, **IV**-independent variable; KPCO: Kaiser Permanente Colorado, LDL: low density lipoprotein, LG: lifestyle group, LI: lifestyle intervention, M: male, MA: meta-analysis, MAQ: modifiable activity questionnaire, MG: metformin group, N: total number of participants, n: number of sub-category participants, nc=number of participants in control group, ni=number of participants in intervention group, NA: not applicable, NCOI: no conflict of interest, NIDDKD: National Institute of Diabetes and Digestive and Kidney Diseases, NIH: National Institutes of Health, OGTT: oral glucose-tolerance test, P: purpose, PA=physical activity, PC: primary care, PH: public health, PI: Pacific Islander, PG: placebo group, RCT: randomized clinical trial, RR: risk reduction, SES- socioeconomic status; SR: systemic review, TG: triglycerides, **TTM**-Transtheoretical model; TX: treatment, U.S.A.: United States of American, W: white, **WE**- weaknesses wk: week, wt: weight, yrs: years **D**-demographics; **IC**- inclusion criteria; **V2**- independent variable 2; **IV3**-independent variable 3; **MA**- meta-analysis; **N**- sample size; **NIH**-National Institute of Health; PA-physical activity;

Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
			routine clinical practice setting, intervention as single or combined (nutrition or PA) programs with or without med EC: program delivering DM education material only, med-only studies	outcomes: changes in wt, FPG, WC, 2hour OGTT	outcome measures were calculated from # of subjects and standard errors or from 95% CI			clinical settings Transferability is still questionable d/t diminished outcome effect over time. CS: No specific recommendation on the most effective features of the LI. The direction of the effects on wt, FPG, WC, OGTT is encouraging. The feasibility of the translational studies is still worth promoting LI in clinical settings. Need more studies with large samples and longer study period.
Jiang, L.,	TTM	Design: Quasi-	N=2553,	IV=HD and	Annual OGTT,	On average, tx	Crude DM	Level 3

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
Manson, S. M., Beals, J., Henderson, W. G., Huang, H., Acton, K. J., & Roubideaus, Y. (2013). Translating the diabetes prevention program into American Indian and Alaska Native communities: Results from the special diabetes program for Indians diabetes prevention demonstration project. Diabetes Care, 36(7), 2027-2034. doi: 10.2337/dc12-1250 Country: U.S.A.		experiment Method: all participants were assigned to intervention P: to evaluate a translational implementation of DPP in a diverse set of AI/AN communities.	1891(74%) postcurriculum completion, 1503(59%) 1st annual assessment, 1079(42%) 2nd annual assessment, 834(33%) 3rd annual assessment Demographics: ¾ female, 46.6yrs, BMI 35.8 at baseline Setting: 6 IHS hospitals/clinics, 30 tribal or IHS-contracted HCP administered by tribes.	increased PA with cultural adaptation (talking circles, indigenous foods, drumming into intervention sessions) DV1=DM incidence DV2=wt loss, BP, lipid profile, PA	semiannual FBG, body wt, ht, BMI, BP, HDL cholesterol, LDL cholesterol, triglyceride, average min of PA per wk. Used standardized lab protocol for any measurements in the study, so it is reliable and valid tests.	group lost 9.6lbs after completion (4.4% wt loss), 22.5% of participants who completed the postcurriculum assessment achieved the 7% wt loss goal by the end of the classes, 17.5% met this goal 3 yrs after the intervention began. 181 min PA/wk after LI. FBG decreased by 4mg/dL.	incidence 4%/yr. Cumulative DM incidence among participants who attended all 16 classes was significantly lower than those who attended less than 15 (p<.0001). Crude incidence of DM was ~3.5% each yr. 22.5% participants achieved 7% wt loss by the end of classes, 17.5% met this goal 3 yrs after the LI began. PA goal increased to 56%. FBG decreased by ~4mg/dL. SBP, DBP, LDL, triglyceride decreased	Strength: Large sample, reports DM incidence WE: only AI/AN as participants, high rates of f/u loss, not as rigorously controlled, no placebo group to compare CO: The study supports the feasibility of translating the LI across a wide range of Native communities. It will need other retention strategies. CS: Supports DPP translational study are

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
FA: IHS C/B: none							significantly. HDL significantly increased	effective to delay DM.
Kang, J. Y. (2010). Effect of a continuous diabetes lifestyle intervention program on male workers in Korea. Diabetes Research and Clinical Practice, 90, 26-33. DOI: 10.1016/j.diabres.2010.06.006 Country: South Korea FA: the Korea Hydro & Nuclear Power project C/B: none	TTM	Design: RCT Method: Subjects were randomly assigned to either the CG, 1 yr, or 2 yr intervention group Purpose: to compare the effects of 2 year LI to no intervention or 1 year of intervention on DM risk factors in male workers with IFG or DM	N= 123 industrial male workers (CG 75, 1 yr 23, 2 yr 25) D: No differences among groups in terms of age and proportion of IFG and DM. Annual income was higher in 1 yr group. EC: subjects taking meds for glucose, lipid, HTN, manifesting CV disease and chronic ETOH and/or drug abuse	IV: LI consisting 2 parts (#1 part-5X of 20-30 min of face to face counseling, #2 part-email nutrition education Q3 wks, a total of 10X) DV1: anthropometric measurements DV2: FPG, HbA1c, total cholesterol HDL, LDL, HOMA-IR DV3: dietary intake	Ht, Wt, WC, BP, FPG, HbA1c, total cholesterol HDL, LDL, HOMA-IR Computerized food frequency questionnaire	SPSS program (SPSS 15.0 KO for Windows) Chi-square-homogeneity of the proportion of IFG and DM, and annual income Paired t-test-differences between baseline and after intervention values ANOVA with Tukey's post hoc to compare groups.	1 yr: SBP, FPG, HOMA-IR and HDL sig decreased ($p<.05$) 2 yr: Wt, BMI, WC, SBP, DBP, FPG, HbA1c decreased ($p<.05$) Total energy intake in 1 yr group after intervention ($p<.05$) Total energy, carb, protein and sodium level decreased in 2 yr group ($p<.05$). Changes in WC, SBP, total cholesterol in 2 yr group were	Level 2 Strength: RCT, using email nutrition education for f/u WE: small sample size, exercise level was not considered; some baseline data was higher in 2 yr group than the others. Used ADA guideline for IFG resulting difficulty comparing other studies with WHO guidelines.

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
							greater than in CG or 1 yr group (p<.05)	CO: Male Korean industrial workers with IFG or DM, continuous LI over 2 yrs improved DM risk factors CS: Email for f/u can be useful and resource saving.
Katula, J. A., Vitolins, M. Z., Rosenberger, E. L., Blackwell, C. S., Morgan, T. M., Lawlor, M. S., & Goff, D. C. (2011). One-year results of a community-based translation of the diabetes prevention program: Healthy living	TTM	Design: RCT Method: Subjects randomly assigned to LI group or usual care group. Purpose: To translate the methods of the DPP into the community via key modifications to enhance feasibility and dissemination	N=301 (G=150, I=151) Criteria: BMI 25-40 with FG 95-125mg/dL No differences between the groups at baseline (42.5% M, mean age 57.9 yrs, 26% race/ethnicity other than W,	IV=LI DV= FBG, insulin and anthropometry	Wt, BMI, waist, glucose, insulin, HOMA-IR, % wt loss All biochemical measurements were performed in lab by technicians masked to the intervention assignment. FPG coefficients of variation were 6.45%. Insulin:	T-test, Fisher exact for baseline comparisons General linear models for repeated-measures ANCOVA to compare the main effect of the intervention on the 6, 12 month values	LI: body wt 87.44 +/- 1.28 (p<.001), waist 99.22+/-0.90 (p<.001) FBG 101.11+/-0.84 (p<.001). LI decreased in insulin and HOMA-IR 2.48+/-0.13 (p<.001)	Level 2 Strength: LI delivered by CHW in community-based setting, minimizing resources and maximizing community involvement WE: the study conducted in

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
partnerships to prevent diabetes (HELP PD) project. *Diabetes Care, 34*, 1451-1457. doi: 10.2337/dc10-2115/-/DC1 Country: U.S.A. Funding: NIDDKD C/B: none			80% beyond HS) Setting: community setting Attrition: 6		the overall within-assay variability was 3.9%.	measured during the 1 yr f/u.	Wt: -5.73+/-0.42 BMI: -1.90+/-0.14 Waist: -5.05+/-0.38 Glucose: -3.76+/-0.76 Insulin -3.75+/-0.58 HOMA-IR: -1.08+/-0.17 %wt loss: -6.11+/-0.44	only one community. Training program must be developed to prepare CHW. Reimbursement policy is needed. CO: Empowering community members through partnerships with existing DEPs may effectively translate DM prevention efforts and ultimately alter the course of obesity and DM epidemics. CS: low-cost, community based LI using CHW is

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Citation	Conceptual Framework	Design/Method	Sample/Setting	Major Variables & Definitions	Measurement	Data Analysis	Findings	Level/Quality of Evidence, Decision for Practice/Application to Practice
								encouraging for wt loss in DM prevention
Ma, J., Yank, V., Xiao, L., Lavori, P. W., Wilson, S. R., Rosas, L. G., & Stafford, R. S. (2013). Translating the diabetes prevention program lifestyle intervention for weight loss into primary care: A randomized trial. JAMA Internal Medicine, 173(2), 113-121. doi:10.1001/2013.jamainternmed.987 Country: U.S.A. Funding: multiple grants	TTM	D: RCT P: To evaluate the effectiveness of 2 adapted DPP lifestyle interventions among over wt or obese adults with prediabetes, metabolic syndrome, or both.	N=241 (CG 81, IG1=79, IG2=81) Demographics: Mean age 52.9 yrs, BMI 32.0, 47% F, 78% W, 17% A/PI, 4.1% H, majority had high educational attainment, family annual income Setting: a single primary care clinic within the Silicon Valley (Los Altos, CA) that is part of a large multispecialty group practice in the San Francisco Bay	IV=LI (face to face or home based DVD to self-directed intervention) DV1=BMI DV2=anthropometric and BP measurements	BMI, wt change, waist circumference, DBP, TG, HDL, FBG All biochemical measurements were performed in central lab by technicians.	Intention-to-treat using tests of group by time interactions in repeated-measures mixed-effects linear for continuous outcomes or logistic models for categorical outcomes.	Mean BMI change from baseline was -2.2 in the coach-led ($p<.001$ vs. C, $p=.03$ vs. self-directed), -1.6 in self-directed ($p=.02$ vs. usual care). 37% lost 7% DPP-based st loss goal ($p=.003$) in coach-led, 35.9% ($p=.004$) in self-directed.	Level 2 Strength: used different delivery methods for LI (face to face or self-directed) WE: primarily high socioeconomic status participants, so difficult to generalize the findings. Difficult to evaluate the long term effects and comparative cost-effectiveness of the 2 interventions.

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Bias: NCOI			Area.					CO: Proven effective in a PC setting, the 2 DPP-based LI are readily scalable and exportable with potential for substantial clinical and PH impact.
Parikh, P., Simon, E. P., Fei, K., Looker, H., Goytia, C., & Horowitz, C. R. (2010). Results of a pilot diabetes prevention intervention in East Harlem, New York City: Project HEED. American Journal of Public Health 100, S232-S239. doi: 10.2105/AJPH.2	Self-efficacy theory	Design: RCT Method: Randomly assigned to LI or delayed intervention in 1 yr. Purpose: to develop and pilot a simple, peer-led intervention to promote wt loss, which can prevent DM and eliminate racial/ethnic disparities in incident DM among over wt adults with prediabetes.	N=99(age: 48, F=85%) CG=49(age: 50, F=84% IG=50, F=86%) Demographics: Mean age of 48 yrs (range25-84yrs), predominantly female (85%), Hispanic (89%), Spanish speaking (77%), unemployed (70%), uninsured (49%), low	IV=peer-led LI DV=wt loss	Wt, Waist circumference, BP, LDL cholesterol, FBG, OGTT, HbA1c, PA, food intake	Bivariate comparisons with t tests, X^2 tests, analysis of variance for demographic characteristics Paired t-test for wt and behaviors between baseline and 12 months Focus group interviews to study experiences	Wt -7.2 (7.3), waist -1.3 (2.6), FPG 10 (13), OGTT 3 (34), HgA1c -0.3 (0.2). LI group lost significantly more wt than CG; lost average 7.2 lbs (p=.01). Waist circumference decreased significantly. LI reported eating more green salad (p=.05), drinking	Level 2 Strength: community based and peer-led intervention. Weakness: small sample size to generalize the findings. Possible contamination of intervention to the control group. Vulnerable group

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009.170910 Country: U.S.A. Funding: National Center on Minority Health and Health Disparity Bias: NCOI			income (62% were below the poverty level), undereducated (58% had not graduated from high school). Setting: community sites in East Harlem in NYC Attrition: 83 participants returned at 3 mo, 79 at 6 mo, 72 at 12 mo. 4 became ineligible d/t pregnancy. 23 lost to f/u at 12 mo. Reasons: relocation, family responsibilities, and doctors telling them that their BG didn't need attention.				fewer sugary beverages ($p<.01$). The incidence rate of DM was the same in both groups.	CO: A community-driven approach to DM prevention in high-risk community of color may be quite feasible and effective. This type of program may help to narrow racial and ethnic disparities CS: Support LI program using CHW in vulnerable population/community.

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Sakane et al. (2011). Prevention of type 2 diabetes in a primary healthcare setting: Three-year results of lifestyle intervention in Japanese subjects with impaired glucose tolerance. BMC Public Health, 11, 40, doi: 10.1186/1471-2458-11-40 Country: Japan Funding: Ministry of Health, Welfare, and Labor of Japan Bias: none	TTM	D: RCT P: to test whether LI by a PC setting using existing resources, can reduce the incidence of T2DM in Japanese with IGT	N=304 Ni=152, nc=152 Demographics: mean BMI 24.5, mean age 51, 50% F. No differences between two groups. Setting: PC Attrition: 91 during 3 yrs	IV=LI by nurse in PC DV=DM incidence	Ht, wt, waist, BP, OGTT, total cholesterol, HDL, triglyceride, creatinine, uric acid, AST, ALT, GGT, HbA1c, FBG, insulin, dietary intake, PA	Two tailed unpaired t test or X^2 test, two tailed paired t test, survival curves, two sided log rank test	Wt 63.5+/-12.9 (p=.023) FPG 5.8+/-0.6 (p=.698) OGTT 8.0+/-2.1 (p=.083) The estimated cumulative incidence of DM was 8.2% in LI, 14.8% in CG. RR 53% with LI (p=.097). The LI effect was not apparent in the lowest BMI quartile. BMI>22.5 revealed a sig decrease in the cumulative incidence with LI (p=.027).	LOE: II Weakness: only Japanese middle aged subjects, Possible contamination of CG with LI information Strength: RCT Conclusion: Even if the statistical sig was weak, LI using existing HC resources is beneficial in DM prevention.
Thomas et al.	NA	SR	8 studies, with	NA	All 8 studies	Not reported	RR of 33% for	LOE=I,

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(2010). A systematic review of lifestyle modification and glucose intolerance in the prevention of type 2 diabetes. Current Diabetes Reviews, 6(6), 378-387.		P: to identify and evaluate studies that have investigated impact of LI on the prevention of the development of DM incidence in those with glucose intolerance	populations including any non-pregnant adult 18 and older with 100 or more participants, focusing on activity or dietary aspects, RCT. Excluded reviews, no assessment of incidence of DM, sub-study publications		were RCT, measured incidence of DM, LI as intervention strategy		the benefits of dietary modifications, 51% reduction with exercise interventions, 51% reduction with combination of LI, pooled reduction of the interventions of 49%.	Weakness: only 8 studies, Strength: highest level of evidence Conclusion: LI has shown to reduce the incidence of DM and risk of developing one. However, more study is needed to translate the findings into the PC settings with less labor-intensive interventions.

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Table 2 *Synthesis Table*

Studies	Almeida	Balagopal	Cardona-Morrell	Jiang	Kang	Katula	Ma	Parikh	Sakane	Thomas
Year	2010	2012	2010	2013	2010	2011	2013	2010	2011	2010
LOE	4	3	I	3	2	2	2	2	2	1
Design	CS	QE	MA, SR	QE	RCT	RCT	RCT	RCT	RCT	SR
Length		6mo		3yr	2yr	2yr	15mo	12mo	3yr	
Samples	1520	1638		2553	123	301	241	99	304	
LI	X	X		X	X	X	X	X	X	
Group	X			X		X	X	X	X	
Individual		X			X				X	
Wt Δ	X	X	X	X	X	X	X	X	X	
BMI		X			X	X			X	
FBG		X	X	X	X	X	X	No Δ	No Δ	
OGTT			X					No Δ	No Δ	
Cholesterol				X	X		X	No Δ	No Δ	
DMI			X	X				No Δ	No Δ*	X
Knowledge		X								
MTC										
PA			X	X				No Δ	X	
HE		X	X		X			X	X	

Table 3

Participant Characteristics (N=16)

Age, years	56.6 ± 13.0 (*M* ± *SD*)
Gender	
Male	3 (18.8%)
Female	13 (81.3%)
Ethnicity	
Caucasian	10 (62.5%)
Hispanic	6 (37.5%)
African American	0
Native American	0
Asian	0
Marital status	
Single	1 (6.3%)
Married	13 (81.3%)
Divorced/Separated	2 (12.5%)
Widowed	0
Education	
HS or GED	8 (50%)
Some college	2 (12.5%)
Bachelor	5 (31.3%)
Master or higher	1 (6.3%)

Current health condition	
Fair	2 (12.5%)
Good	9 (56.3%)
Very good	4 (25%)
Excellent	1 (6.3%)
Heard prediabetes/borderline diabetes	
Yes	12 (75%)
No	4 (25%)
Height, inches	65.0 ± 3.3 (*M* ± *SD*)
Weight, pounds	201.4 ± 38.2 (*M* ± *SD*)
Prediabetes screening score	12.3 ± 4.7 (*M* ± *SD*)

Table 4

Results of Paired t-test for PA,EH and SE (N=16)

	Pre-intervention	Post-intervention	95% CI			
Outcomes	*M (SD)*	*M (SD)*	LL	UL	*t*(15)	*p*
PA	2.88 (2.53)	5.31 (2.77)	-4.01	-.87	-3.31	.005*
EH	6.94 (2.52)	5.00 (2.48)	.60	3.28	3.08	.008*
SE	16.69 (4.19)	19.88 (3.28)	-5.14	-1.24	-3.49	.003*

Note. * indicates statistical significance.

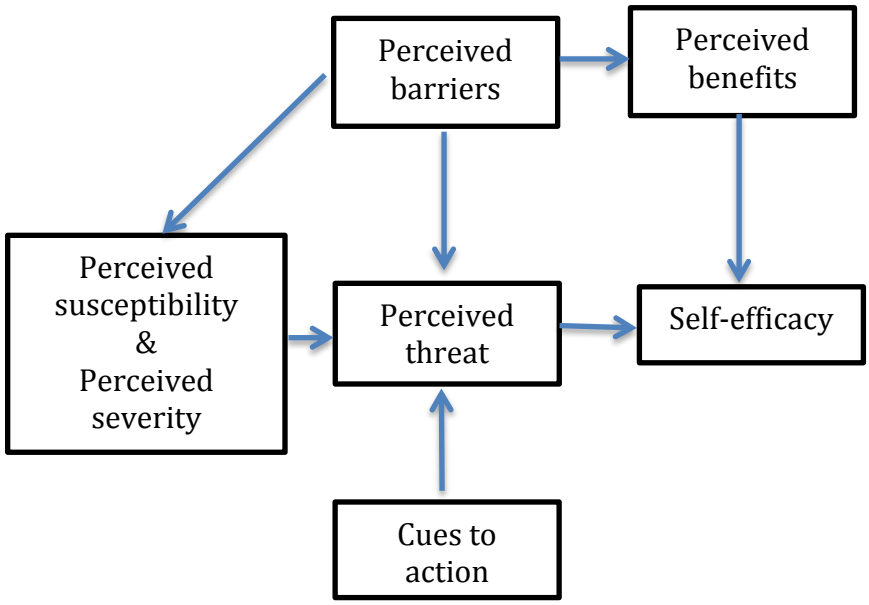

Figure 1. Health Belief Model. Adopted from Glanz, K., Rimer, B.K. & Lewis, F.M. (2002). Health Behavior and Health Education. Theory, Research and Practice. San Fransisco: Wiley & Sons.

Appendix A

IRB Approval Letter

EXEMPTION GRANTED

Monica Rauton
CONHI - DNP
928/639-7242
monica.rauton@asu.edu

Dear Monica Rauton:

On 9/10/2015 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	The impact of prediabetes awareness and a brief education for prediabetic patients on eating habit, physical activity and self-efficacy in a primary care setting
Investigator:	Monica Rauton
IRB ID:	STUDY00003005
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• InformedConsent_RV3.pdf, Category: Consent Form; • Lee_Y_IRB_HRP_503a_SocialBehavioral_RV5.docx, Category: IRB Protocol; • Lee_Y_CITItraining2.pdf, Category: Non-ASU human subjects training (if taken within last 3 years to grandfather in); • FollowUpPhoneCallsWk1-3.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Pre and post survey for diet assessment, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Recruitment Flyer_RV.pdf, Category: Recruitment Materials; • Pre&PostSurvey_Brief Physical Activity

	Assessment.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Pre and post survey for self-efficacy questionnaire, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • brief preDM education, Category: Participant materials (specific directions for them); • PostInterventionSurveyWk4.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • PreSurvey_Demographic_RV.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 9/2/2015.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Yunmi Lee
Yunmi Lee

Appendix B

Informed consent

Prediabetes Awareness and Healthy Lifestyle

I am a graduate student under the direction of Monica Rauton in the College of Nursing and Health Innovation at Arizona State University. I am conducting a project to assess the impact of prediabetes awareness and a simple education on healthy lifestyle.

I am inviting you to participate in an evidence-based practice project, which will involve one 5-minute education session of your day, once a week follow-up phone calls for 4 weeks, and pre and post surveys. During this education session, you will learn about prediabetes, your risk factors, and lifestyle modifications.

Your participation in the project is voluntary. You can skip questions in the survey if you wish. If you choose not to participate or to withdraw from the project at any time, there will be no penalty. It will not affect the care you receive prior to, during, or after your participation in the project. Participation in this project will not affect your treatment in this clinic. You must be 18 years of age or older to participate in this project.

Responses to the questionnaires will be used to evaluate the impact of prediabetes awareness and education on healthy lifestyle. There are no foreseeable risks or discomforts to your participation in this project.

Your responses on the questionnaires and surveys will be anonymous and will be identified only by a number that will not be connected to your name or other personal identifying information. The results of this project may be used in reports, presentation, or publications, but your name will be not be known or used.

If you have any questions concerning this project, please contact the following team members: Yunmi Lee, RN, BSN, DNP student (602-476-9254 or yunmi.lee@asu.edu) or Monica Rauton, DNP, ANP-BC (928-301-7793 or monica.rauton@nahealth.com).

If you have any questions about your rights as a subject/participant in this project, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788. Please let me know if you wish to be part of the project.

By signing below you are agreeing to be part of the project.

Name: _____

Signature: _____ Date: ____/____/____

Appendix C

Demographic Information

1. Age: _____ years

2. Gender:
    1. ☐ male
    2. ☐ female

3. Ethnicity:
    1. ☐ Caucasian
    2. ☐ Hispanic
    3. ☐ African American
    4. ☐ Native Indian
    5. ☐ Asian
    6. ☐ Others: specify

4. Marital Status:
    1. ☐ Single
    2. ☐ Married
    3. ☐ Divorced/Separated
    4. ☐ Widowed

5. Education Status:
    1. ☐ No high school diploma or GED
    2. ☐ Have a high school diploma or GED
    3. ☐ Have a college degree
    4. ☐ Have a Bachelor degree
    5. ☐ Have a Master degree or higher

6. How would you describe your current health condition?
    1. ☐ Excellent
    2. ☐ Very good
    3. ☐ Good
    4. ☐ Fair
    5. ☐ Poor

7. Have you ever heard of prediabetes or borderline diabetes?
    1. ☐ Yes
    2. ☐ No

8. Height: _____ in

9. Weight: _____ lbs

ID#
Pre/Post-intervention

Appendix D

Lifestyle Change Intervention

PREDIABETES INFORMATION

What is PREDIABETES?

Prediabetes is a condition that can lead to type 2 diabetes. It means your blood glucose (sugar) levels are higher than normal but are not high enough to be called diabetes. Diabetes can cause other health problems such as heart disease, stroke, blindness, kidney failure, amputations, and nerve damage. There are no clear symptoms of prediabetes. You can have it and not know it.

Who is at RISK for PREDIABETES?

Your risk for prediabetes will go up if you:

- are age 45 or older
- have a parent, brother, or sister with diabetes
- are a woman who had diabetes during pregnancy
- are overweight
- are NOT physically active

We have a GOOD NEWS for you.

The good news is that you can prevent or delay type 2 diabetes with healthier lifestyle changes such as:

- **healthier eating**
- **physical activity**
- **weight loss**

How do I make HEALTHY CHANGES?

You do not have to make a big change. Try **small steps** to eat healthy, be active, and lose weight. Here are some tips for you.

Eat healthier

- Cut back on regular soda and juice. **Have water or calorie-free drinks.**
- **Eat smaller serving sizes** of your usual foods.
- **Choose baked, grilled, and steamed foods** instead of pan-fried or deep-fried.
- **Eat more vegetables, whole grains, and fruit.**
- **Cut back on starchy food** such as white rice, flour tortilla, pasta, potato, or bread.
- **Start each dinner with a salad** of leafy greens with low-fat dressing.
- **Choose fruit** instead of cake, pie or cookies.
- **Eat lean meats** such as the round or loin cuts, chicken without the skin, or fish.
- **Cut back on high fat and processed meats** like hot dogs, sausage, and bacon.

Be active

- Find physical activity you like to do such as gardening, walking the dog, or dancing.
- **Walk** briskly **30 minutes a day, 5 days a week**. Or split the 30 minutes into three 10-minute walks.

Lose weight

- Research suggests that if you are overweight, losing 7% of your weight may prevent your risk for diabetes. In fact, **losing even a few pounds will help you**.

Appendix E

Physical Activity Questionnaire

Brief Physical Activity Assessment

1. How many times a week, do you usually do 20 minutes of vigorous physical activity that makes you sweat or puff and pant? (For example, jogging, heavy lifting, digging, aerobics, or fast bicycling)

   ☐ >3 times/week ☐ 1-2 times/week ☐ none

2. How many times a week, do you usually do 30 minutes of moderate physical activity or walking that increases your heart rate or makes you breath harder than normal? (For example, mowing the lawn, carrying light loads, bicycling at a regular pace, or playing doubles tennis)

   ☐ >5 times/week ☐ 3-4 times/week ☐ 1-2 times/week ☐ none

ID#
Pre/Post-intervention

Appendix F

Eating Habit Questionnaire

Starting The Conversation

Over the past 4 weeks:

1. How many times a week did you eat fast food meals or snacks?

   ☐ Less than 1 time ☐ 1-3 times ☐ 4 or more times

2. How many servings of fruit did you eat each day?

   ☐ 5 or more ☐ 3-4 ☐ 2 or less

3. How many servings of vegetables did you eat each day?

   ☐ 5 or more ☐ 3-4 ☐ 2 or less

4. How many regular sodas or glasses of sweet tea did you drink each day?

   ☐ Less than 1 ☐ 1-2 ☐ 3 or more

5. How many times a week did you eat beans (like pinto or black beans), chicken, or fish?

   ☐ 3 or more times ☐ 1-2 times ☐ less than 1 time

6. How many times a week did you eat regular snack chips or cracker (not low-fat)?

   ☐ 1 time or less ☐ 2-3 times ☐ 4 or more times

7. How many times a week did you eat desserts and other sweets (not the low-fat kind)?

   ☐ 1 time or less ☐ 2-3 times ☐ 4 or more times

8. How much margarine, butter, or meat fat do you use to season vegetables or put on potatoes, bread, or corn?

   ☐ Very little ☐ some ☐ a lot

ID#
Pre/Postintervention

Appendix G

Prediabetes Lifestyle Change Self-Efficacy

Tell us how confident you are in doing certain activities. For each of the following questions, please choose the number that corresponds to your confidence that you can do the tasks regularly at the present time.
(0=not at all confident, 1=a little confident, 2=somewhat confident, 3=very confident, 4=totally confident).

1. How confident are you that you can cut back on regular soda or juice?	0	1	2	3	4
2. How confident are you that you can eat smaller serving size?	0	1	2	3	4
3. How confident are you that you can eat more vegetables and fruits?	0	1	2	3	4
4. How confident are you that you can walk 30 minutes a day, 5 days a week?	0	1	2	3	4
5. How confident are you that you can lose weight?	0	1	2	3	4
6. How confident are you that you can prevent or delay type 2 diabetes?	0	1	2	3	4

Appendix H

Budget

Item	Cost	Occurrence
Printed education material (colored)	$0.11	1
Education time (3-5 min) by MD	$4.62-$7.70	1
Education time (3-5 min) by NP	$2.37-$3.95	1
Education time (3-5min) by MA	$0.75-$1.25	1
Follow up time (3 min) by MD/week	$4.62	4
Follow up time (3 min) by NP/week	$2.37	4
Follow up time (3 min) by MA/week	$0.75	4
Total cost/participant with MD	$23.10-$26.18	
Total cost/participant with NP	$11.96-$13.54	
Total cost/participant with MA	$3.86-$4.36	