DIABETES PREVENTION AMONG THE PACIFIC ISLANDER POPULATION:
A REVIEW OF THE LITERATURE

by

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DEDICATION

This Master’s Report is dedicated to the Pacific Islander people of Guam, whose culture of love, warmth, and hospitality, is engrained in me. We are a resilient people and together we will conquer this disease.
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ABSTRACT

Rapid westernization and urbanization over the last 50 years has led to drastic lifestyle changes among Pacific Island (PI) countries (Colagiuri, 2006; Braun, Ichigo, Kaulula, Aitatoto, Tsark, & Spegal, 2003). These changes have led to an alarming increase in the incidence and prevalence of diabetes among the PI population (Colagiuri, 2006). Pacific Islanders are now four to seven times more likely than non-Hispanic whites to develop diabetes (Braun et al., 2003). Yet, there remains limited knowledge on effective diabetes prevention programs culturally tailored to the PI population. Thus, the primary purpose of this review of literature was to identify, summarize, and evaluate information on translational research done with the Diabetes Prevention Program in order to identify best practices. These best practices can be tailored to the PI population, in order to create a more effective translational diabetes prevention program.
CHAPTER 1: INTRODUCTION

Diabetes is a major public health concern, ranking in the top five Focus Areas for Healthy People 2010 (U.S. Department of Health and Human Services [USDHHS], 2000). In 2007, the disease affected an estimated 23.6 million people, or 7.8% of the United States population. It is currently the leading cause of kidney failure, adult onset blindness, and nontraumatic limb amputations. People with diabetes are at increased risk for hypertension, stroke, heart disease, and complications in pregnancy (Center for Disease Control [CDC], 2008).

In 2005, diabetes contributed to more than 230,000 deaths. In 2006, it was listed as the seventh leading cause of death, killing more than 70,000 people. In general, people with diabetes have double the risk of death when compared to a person of the same age without the disease. In 2007, the total cost for diabetes, both direct and indirect, was an estimated 174 billion dollars (CDC, 2008).

In Type 2 diabetes mellitus (T2DM), both genetics and environmental factors play a role in the development and progression of the disease (Ferguson, 2008). Studies have shown that when people at risk for T2DM engage in lifestyle modifications, including diet modification, weight loss, and increased physical activity, they can delay and even prevent disease onset. Despite this evidence, T2DM accounts for 90-95% of all diagnosed cases of diabetes (National Diabetes Statistics, 2007).

Problem Statement

Rapid westernization and urbanization over the last 50 years has led to drastic lifestyle changes among Pacific Island countries (Colagiuri, 2006; Braun, Ichiho, Kauluua, Aitatoto, Tsark, & Spegal, 2003). Pacific Islanders who traditionally led active lifestyles, consumed a low
fat and high fiber diet are increasingly leading sedentary lifestyles, consuming diets high in fat, calories, salt, and refined foods (Braun et al., 2003). These changes have led to an alarming increase in the incidence and prevalence of diabetes among the Pacific Islander population (Colagiuri, 2006).

After World War II, the United States Navy conducted a health survey in the Pacific and no cases of diabetes were found among the Pacific Islander population (CDC, 2008). Pacific Islanders are now four to seven times more likely than non-Hispanic whites to develop diabetes. Pacific Islanders are more likely than any other race or ethnic group to develop complications and die prematurely from the disease (Braun et al., 2003).

People of an ethnic minority are twice as likely as Non-Hispanic whites of the same age to develop T2DM (Whittemore et al., 2009). The children and adolescents of ethnic minority groups are also more frequently diagnosed with T2DM (CDC, 2008). While elimination of health disparities and diabetes prevention have been identified as national goals in Healthy People 2010 there remains limited knowledge on effective, culturally sensitive prevention programs for all ethnic groups, especially the Pacific Islander population.

Significance of the Problem

The Centers for Disease Control and Prevention Primary Prevention Working Group (2004) reports that in the next 50 years the number of people diagnosed with diabetes is going to increase 165%, with one of the greatest increases to be seen among Pacific Islanders. Currently, Pacific Islanders are already overrepresented in this disease and are at increased risk of developing diabetes (Look, Baumhofer, Ng-Osorio, Furubayashi, & Kimata, 2008). Colagiuri (2006) urges for attention to preventive care as the burden of diabetes and its consequences
increases among the ill-equipped Pacific Island countries. For once a person develops diabetes, it becomes a chronic condition that cannot be cured and is costly to control (Egede & Dagogo-Jack, 2005).

Background

The Pacific Islander Population

Look et al. (2008) found that education culturally tailored to the Pacific Islander (PI) population produced positive program outcomes in diabetes education. The researchers also found that the use of culturally knowledgeable personnel aids in ensuring the use of appropriate teaching styles and the development of a culturally sensitive curriculum (Look et al., 2008). Additionally, Braun et al. (2003) point out that Pacific Islanders are oral-aural cultures, who prefer face-to-face interactions, group learning, and hands on practice over written or electronic communication.

Pacific Islanders are a vulnerable population, adding to their disproportionate risk for T2DM development. Geographic isolation, health care provider shortage, poverty, and being an ethnic minority group are several factors contributing to the vulnerability of this population. The geographic isolation of many of the Pacific Islands often makes it difficult to access quality health care services. The Health Resources and Services Administration (HRSA) designated Guam as both a primary medical care and mental health professional shortage area (HRSA, 2010). Aday (2001) identified community and individual resources that increase the risk for vulnerability, this included being an ethnic minority and having a low income. The Pacific Islander population has a median income of $45,900, which is $4,100 less than the U.S. population. In 1999, 17.7% of the PI population lived below the poverty line, which is 5.3%
more than the U.S. population (U.S. Census Bureau, 2005). Ethnic minority groups and low-income families generally have poorer health and less access to health resources (Aday, 2001).

The Social Cognitive Theory

The Social Cognitive Theory (SCT) by psychologist Albert Bandura (2004) holds that health promotion and disease prevention are influenced by six core determinants. According to Bandura (2004), in order for a health promotion program to be successful it must address all six of an individual’s core determinants. Figure 1 shows the core determinants of the Social Cognitive Theory applied to T2DM.

FIGURE 1: Social Cognitive Theory.

The first determinant is knowledge; if people are aware of the health risks associated with a behavior then they will avoid that behavior. Conversely, if they are unaware of the harm they are causing their health through actions they are accustomed to and enjoy, then they will not try to change it, such as eating fried foods on a daily basis. Thus, knowledge is an impetus for change (Bandura, 2004). However, knowledge is only one of the core determinants and often cannot elicit change on its own. As Allen (2004) points out, information alone on the importance of physical activity often does not lead people to incorporate this behavior into their lives.

The second core determinant is perceived self-efficacy, or the belief that one has control over his or her health habits. Bandura (2004) asserts that self-efficacy is the basis for human motivation and action, which plays a crucial role in an individual's attempt at change. If people lack self-efficacy or confidence in their ability to succeed, then they will not engage in health behaviors because they believe their efforts will be in vain.

The third determinant, outcome expectations, is the belief that people's actions are driven by the outcomes they are expected to produce. Expectations are broken down into three components, physical outcomes, social outcomes, and self-evaluative reactions. People engage in positive health behaviors if they believe it will produce positive physical effects. Conversely, they will refrain from negative health behaviors because of their physically undesirable effects. Social outcomes refer to the acceptance or rejection of behaviors by one's peers. If people know that their behavior will produce outcomes disapproved by their social circle, then they will avoid that behavior and vice versa. Self-evaluative outcomes refer to the personal acceptance or rejection of health behaviors. People will participate in actions that improve their self-satisfaction and refrain from behaviors that destroy their sense of self-worth (Bandura, 2004).
The fourth determinant is goals, which are personal achievements people set for themselves in order to guide health behaviors. Bandura (2004) believes that long-term goals ultimately lead to changes in health behavior, but short-term goals are the necessary starting point. Short-term goals are realistic endeavors that can provide more immediate results to encourage continued practice of the health behavior.

Facilitators, the fifth core determinant, are things or people that aid in the achievement of health promoting behaviors, such as health care workers, nutrition experts, or physical therapists. Conversely, impediments, the sixth core determinant, are obstacles people encounter when attempting to participate in health promoting behaviors. Obstacles can come in many forms, including money, stress, and time. Bandura (2004) believes a person’s self-efficacy plays a role in overcoming impediments. If people are confident and continue to participate in health promoting behaviors in the face of adversity, then they have high levels of self-efficacy.

Allen (2004) performed an integrative review of the literature to ascertain the ability of the SCT to predict exercise behaviors and identify interventions that improve exercise initiation and adherence in people with diabetes. The studies used various self-efficacy measuring instruments. Allen (2004) reported that 10 out of the 13 studies reviewed found a significant relationship between exercise and self-efficacy. In nine out of the 13 studies a significant relationship was established between self-efficacy and exercise adherence. However, there were conflicting results regarding outcome expectancies and exercise adherence; three of the studies reported a significant relationship, five studies had mixed results, two studies found an insignificant relationship, and two studies found no relationship. Four out of the five co-
relational studies found that self-efficacy was predictive of exercise initiation and all of the studies found that it was also predictive of exercise maintenance.

Allen (2004) concluded that the SCT should be used in order to understand behavior change and guide the creation of effective exercise program interventions. Allen (2004) also recognizes the need for further research on the effects of SCT on exercise in minority groups disproportionately affected by diabetes.

_The Diabetes Prevention Program_

The National Institutes of Health (NIH) Diabetes Prevention Program (DPP) was a groundbreaking research study whose goals were to determine if lifestyle modifications or the use of metformin are effective in arresting or impeding the onset of T2DM. Participants of the program had to be at risk for developing diabetes by being overweight and prediabetic (National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2008). Participants were recruited from 1996 to 1999 through informational mailings, advertisements, open screenings, and referrals from health care providers. To ensure that all ethnic groups were represented in the study, 45% of the 3,234 participants were from Native American, African American, Asian American, Alaskan, Hispanic or Latino, and Pacific Islander backgrounds (The Diabetes Prevention Program Research Group, 2000).

In order to be eligible for the program study participants had to be at least 25 years of age, have a body mass index (BMI) of 24 or greater (22 or greater in Asians), fasting blood glucose of 95 to 125 mg/dL and oral glucose tolerance test result of 140 to 199 mg/dL. Exclusion criteria included persons on glucose altering medications and persons with illness that significantly reduced life expectancy or limited their ability to participate in the program.
The study had three main intervention groups, the lifestyle modification, metformin, and placebo group. The lifestyle program, entitled “Lifestyle Balance” spanned a 24-week period and included 16 core sessions with a personal lifestyle coach. Individuals in this group were given comprehensive education on diet, exercise, and behavior modification. Goals of the program were a weight loss of 7% of body weight, which was to be achieved through decreased fat and caloric intake and participation in at least 30 minutes of exercise five times a week. Individuals in the metformin group were started on 850 mg of metformin twice a day and those in the placebo group were given placebo pills. Both those in the metformin and placebo group were given material on diet and exercise, but no motivational support was provided (The DPP Research Group, 1999).

Overall, the study found that participants who achieved weight loss through physical activity and improved diet decreased their risk of developing T2DM by 58%. Participants aged 60 years or older decreased their risk by as much as 71%. The risk reduction in the lifestyle intervention group was consistent among both sexes and all ethnic groups. Risk reduction also occurred in the metformin group, but it was not as significant as the lifestyle group. Participants in the metformin group decreased their risk by only 31%. Additionally, 11% of the placebo group developed diabetes with each year of the study, compared to 7.8% in the metformin group, and only 5% in the lifestyle group (The DPP Research Group, 2002).

Purpose

Research in diabetes management among the Pacific Islander population continues to emerge, contributing to improved diabetes management strategies. However, there remains limited knowledge on effective diabetes prevention programs culturally tailored to the Pacific
Islander population. The primary purpose of this systematic review of literature was to identify, summarize, and evaluate information on translational research done with the Diabetes Prevention Program in order to identify best practices. Future studies can combine those best practices with the SCT and tailor it to the Pacific Islander population, in order to create a more effective translational diabetes prevention program.
Definitions

Type 2 Diabetes Mellitus

Type 2 Diabetes Mellitus, formerly known as non-insulin dependent diabetes, type II diabetes, or adult-onset diabetes, is described as elevated fasting blood glucose levels secondary to insulin resistance and relative insulin deficiency (American Diabetes Association [ADA], 2009). T2DM is a chronic condition that progresses gradually over time often going undiagnosed and consequently untreated for many years. It is approximated that one third of all people with diabetes are undiagnosed. This prolonged untreated state increases the risk of macrovascular and microvascular complications such as hypertension, stroke, coronary artery disease, retinopathy, nephropathy, and neuropathy (ADA, 2009).

Type 2 diabetes can be diagnosed by any one of the following three methods: 1) a fasting blood glucose greater than or equal to 126 mg/dL, 2) a random blood glucose greater than or equal to 200 mg/dL with symptoms of hyperglycemia (i.e., polyuria, polydipsia, and unexplained weight loss), and 3) a glucose level greater than or equal to 200 mg/dL in a 2 hour, 75 gram glucose tolerance test (LaRocque, 2009). Fasting blood glucose is defined as no caloric intake over the last eight hours. Random blood glucose refers to a blood glucose level taken at any time of the day with no regard to the last caloric intake (ADA, 2009).

Signs and symptoms of T2DM include polydipsia, polyuria, polyphagia, weight loss, blurred vision, fatigue, and slow healing wounds. However, many patients can also present asymptotically (LaRocque, 2009). Risk factors for T2DM include a first degree relative with diabetes, age 45 and greater, sedentary lifestyle, hypertension, abnormal lipid levels, history of gestational diabetes or delivery of a baby weighing greater than nine pounds, being diagnosed
with polycystic ovary syndrome, vascular disease, signs of insulin resistance such as severe obesity, impaired glucose tolerance or impaired fasting glucose, and being a member of a high risk ethnic group such as African Americans, Latinos, Native Americans, Asian Americans, and Pacific Islanders (ADA, 2009).

**Insulin Resistance and Insulin Deficiency**

Insulin resistance is a pathophysiological condition in where liver, muscle, and fat cells fail to properly uptake glucose when stimulated by insulin. The dysfunction leads to excess glucose in the bloodstream, laying the foundation for overt diabetes (Pi-Sunyer, 2007). Obesity and a sedentary lifestyle have been shown to contribute to insulin resistance (NDIC, 2008).

In response to elevated blood glucose levels the beta cells of the pancreas are forced to increase insulin production. Eventually, the beta cells are exhausted and unable to keep up with insulin demand, causing beta cell dysfunction or insulin deficiency (Pi-Sunyer, 2007).

**Prediabetes**

Prediabetes is a state in which blood glucose levels are above normal, but not high enough to diagnose a person with diabetes. In 2007, roughly 27 million people in the U.S. had prediabetes (CDC, 2008). People with prediabetes are at increased risk for developing T2DM (Pi-Sunyer, 2007). Prediabetes is characterized by the presence of impaired fasting glucose or impaired glucose tolerance. Impaired fasting glucose is defined as a fasting blood glucose level between 100 to 125 mg/dL. Impaired glucose tolerance is when blood glucose levels fall between 140 and 199 mg/dL after completing a 2-hour oral glucose tolerance test (CDC, 2008). Approximately one third of people diagnosed with impaired glucose tolerance will progress to diabetes within two years if no efforts towards prevention are made (Pi-Sunyer, 2007). Studies
show that when people diagnosed with prediabetes engage in lifestyle modifications, including weight loss and increased physical activity, onset of diabetes can be delayed or prevented (CDC, 2008).

Pacific Islanders

According to the U.S. Census Bureau (2005), Pacific Islanders make up 0.3% of the United States population. In the year 2000, a total of 861,000 people claimed Pacific Islander descent. The title Pacific Islander refers to a broad group of people with a Polynesian, Melanesian, or Micronesian background. A Pacific Islander can trace their ancestry to any of the following Pacific Islands: Hawaii, Guam, Samoa, Fiji, Tonga, Tahiti, the Mariana Islands, the Marshall Islands, or Chuuk (Harris & Jones, 2005). The Native Hawaiians, Samoans, and Guamanians alone make up 74% of the total Pacific Islander population, making them the three highest represented Pacific Islander populations in the U.S. (Harris & Jones, 2005).

Translational Research

Translational research is described as the movement of knowledge from the bench to the bedside (Rubio et al., 2010). The NIH (2007) categorizes translational research into two types. The first type of translational research (T1) is when knowledge generated in the laboratory or in preclinical studies is tested in humans. The second type of translational research (T2) is when successful clinical trials or human studies are implemented in the general public (NIH, 2007). Type 2 translational research addresses the feasibility and cost-effectiveness of a prevention or treatment strategy (Rubio et al., 2010). The goal of T2 is to improve health and create best practices to be used in daily clinical practice (Woolf, 2008). The translation of the Diabetes Prevention Program into the community setting is a type of T2 research.
Significance to Advanced Practice Nursing

The impact of diabetes is far reaching, not only affecting the patient, but the family, the community, and the nation as a whole. Its contribution to depression, disability, chronic comorbidities, and governmental costs for health care has led to an aggressive push towards addressing this public health concern. The USDHHS has shifted its focus from identifying and treating disease, to promoting health and preventing disease. The goal of the USDHHS is to help Americans live healthier lives despite their age, race, or socioeconomic status (Johnson, 2006). With the shift towards health promotion and disease prevention, advanced practice nurses (APN) are in an ideal position to participate in and spearhead diabetes prevention research, dissemination, and translation into practice. The knowledge gained from this review of literature will assist advanced practice nurses in developing culturally sensitive and effective diabetes prevention programs that can be geared towards the Pacific Islander population.
CHAPTER 2: REVIEW OF THE LITERATURE

Literature Search Methods

An extensive search of the literature was conducted using the MEDLINE (PubMed) and CINAHL (EBSCO) databases. Keywords used were diabetes prevention, diabetes prevention program, translation, and translational research. Combinations of keywords were also used including diabetes prevention and translational research, diabetes prevention and translation, diabetes prevention program and translation, diabetes prevention program and translational research. The initial search yielded 695 articles. The search included all studies published up until January 2010 and was limited to English, full text, and human subjects. Inclusion criteria included a community-based intervention and the use of the DPP “Lifestyle Balance” intervention as the program foundation. A review of abstracts narrowed down the number of pertinent articles to eleven.

Translation of the Diabetes Prevention Program

The Diabetes Prevention Program (DPP) was a benchmark study that proved that lifestyle modifications including dietary changes, increased physical activity, and weight loss decreased the likelihood of developing T2DM. While the DPP has been proven to be highly effective, Whittemore et al. (2009) pointed out that not only must a prevention program be effective, but it must also reach a diverse group of subjects, be appealing to health care providers, be practical in implementation, and maintainable. Since the publication of the DPP findings, several translational research studies have been conducted to assess the feasibility of implementing such a program into the community setting. Table 1 provides an overview of the various studies, including study design, sample, intervention, and results.
<table>
<thead>
<tr>
<th>Author</th>
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<th>Sample</th>
<th>Intervention</th>
<th>Results</th>
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<tr>
<td>Diabetes Prevention Research Group (2002)</td>
<td>Randomized control trial; Three intervention groups- lifestyle modification, metformin, and placebo; Goals of program- 7% weight loss and 150 minutes of exercise a week.</td>
<td>n=1,079 Gender- 68% female; Mean age- 50.6 years; Ethnicity- Caucasian 55%; African American 20%; Hispanic 16%; American Indian 5%; Asian/Pacific Islander 4%.</td>
<td>Lifestyle program spanned a 24-week period and included 16 core sessions with a personal lifestyle coach; Participants were given comprehensive education on diet, exercise, and behavior modification; Metformin group was started on 850 mg of metformin twice a day; Placebo group was given placebo pills; Both metformin and placebo groups were given material on diet and exercise, but no motivational support was provided.</td>
<td>Lifestyle group decreased incidence of T2DM by 58%; At 24 weeks 50% achieved 7% weight loss goal and 74% achieved physical activity goal; Metformin group decreased incidence of T2DM by 31%; 11% of placebo group developed T2DM each year of the study, compared to 7.8% and 5% in the metformin and lifestyle group.</td>
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<td>Whittemore et al. (2009)</td>
<td>Two phase, mixed method, trial pilot study, cluster randomization; Two groups- standard care and lifestyle change program.</td>
<td>n=58; Control=27; Gender- 89% female; Mean Age- 43.2; Ethnicity-White 41%; African American 22%; Hispanic 37%; Experimental=31; Gender 90%; Mean Age- 48.2; Ethnicity-White 48%; African American 45%; Hispanic 7%.</td>
<td>Translated DPP at primary care practice sites with NPs as main interventionist; Control group received information on diabetes during 30 minute visit with NP and 45-minute visit with nutritionist; Experimental group received the same care as control group in addition to motivational and behavioral support with six face-to-face sessions and five telephone sessions over six months.</td>
<td>Experimental group- at 24 weeks 25% had achieved a 5% weight loss and 46% achieved the physical activity goal; Control group- at 24 weeks 11% had achieved a 5% weight loss and 40% achieved the physical activity goal.</td>
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<td>Kramer et al. (2009)</td>
<td>Two phase, nonrandomized one-group prospective design.</td>
<td>Phase I: n=51; Gender-82% female; Mean age- 52.9; Ethnicity- White 73%; Nonwhite 27% (No further breakdown of ethnicities); Phase II: n=42; Gender- 79% female; Mean age- 57.2; Ethnicity- White 100%; Nonwhite 0%.</td>
<td>12 weekly one hour group sessions over 12 to 15 weeks; Instructors were exercise specialists, RNs and dieticians; Phase 1 was at four primary care practices, two urban and two rural locations; Phase 2 was at two suburban practices; Phase 2 participants had monthly support meetings for up to nine months after program completion.</td>
<td>Phase 1 participants loss 2.2% of baseline weight; Phase 2 participants loss 4.9% of baseline weight; For both phases, 5% weight loss was seen in 52.2% of participants and 7% weight loss was seen in 23.8% of participants.</td>
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<td>Pagoto et al. (2008)</td>
<td>Observational study</td>
<td>n=118; Gender- 72% female; Mean age- 48.7; Ethnicity- Caucasian 91%; African American 2%; Hispanic 6%; American Indian 0%; Asian/Pacific Islander 1%.</td>
<td>Translated the DPP into a 16 weeks weight loss clinic delivered as a group intervention; Also utilized six small group sessions focused on developing individualized exercise plans; Multidisciplinary team utilized-nutritionist, exercise physiologist, and behavioral health physician.</td>
<td>At 16 weeks, 49% of participants had loss ≥ 5% of their baseline weight; 30% of participants reached the 7% weight loss goal.</td>
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<td>Boltri et al. (2008)</td>
<td>Observational study</td>
<td>n=26; Gender- 58% female; Mean age- 52.1 females; 52.4 males; Ethnicity- African American 100%</td>
<td>Translated the DPP at a faith based setting in African American population; Sixteen sessions, lasting an hour to 1.5 hours over a four-month period; Volunteer healthcare professionals conducted the sessions.</td>
<td>Weight loss was 3.6% from baseline; At 12-months post-intervention participant weight loss had reverted to a 0.5% weight loss from baseline.</td>
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<td>Seidel et al. (2008)</td>
<td>Nonrandomized one-group prospective design</td>
<td>n=88 Gender- 84.1% female; Mean age- 54; Ethnicity- Caucasian 72.7% (No further breakdown of ethnicities).</td>
<td>Translated DPP in a medically underserved area; Group intervention with 12 weekly 90-minute sessions over 12-14 week period; Registered dietician and exercise specialist conducted classes.</td>
<td>At 12 weeks, 46.4%, of participants lost 5% of body weight and 26.1% lost 7% of their body weight; At 24 weeks, 88% had maintained the 5% weight loss and 67% maintained the 7% weight loss.</td>
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<td>McTigue et al. (2009)</td>
<td>Controlled cohort design</td>
<td>n=81 Gender- 84% female; Mean age- 49.9; Ethnicity- No breakdown of ethnicities.</td>
<td>Translated DPP at primary care practice; Group intervention with 12 weekly sessions conducted by nurse educator; Core sessions were $100 and six monthly support sessions could be added for an additional $50.</td>
<td>26% met the 7% weight loss goal.</td>
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<td>Cramer et al. (2007)</td>
<td>Randomized controlled trial</td>
<td>n=67 No information provided on gender, age, or ethnicity</td>
<td>Implemented a modified version of the DPP; Participants were randomly assigned to experimental group or control group; Experimental group received seven monthly individual sessions with a nurse case manager</td>
<td>Average weight loss for the experimental group was 2.69%; Physical activity increased from a mean of 34 minutes/week to 90 minutes/week.</td>
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<tr>
<td>Ackermann et al. (2008)</td>
<td>Cluster-randomized pilot study</td>
<td>n=92</td>
<td>Implemented modified version of DPP at a community YMCA; Participants were assigned to program site where they received screening; Both groups were given education on diabetes risk and prevention through diet modification, increased physical activity, and weight loss; Intervention arm received 16 group sessions lasting 60-90 minutes over a 16-20 week period YMCA employees instructed the classes</td>
<td>At 6 months experimental group had a 6% mean weight loss; At 6 months control group had a 2% mean weight loss At 12 months experimental group maintained a 6.0% mean weight loss At 12 to 14 months control group dropped to 1.8% mean weight loss</td>
</tr>
<tr>
<td>Amundson et al. (2009)</td>
<td>Nonrandomized one-group prospective design</td>
<td>n=293</td>
<td>Implemented modified DPP at four health care facilities with an optional fee for service; Participants were required to complete a readiness to change questionnaire and sign a commitment contract; 16 weekly one-hour group sessions followed by monthly support sessions for the next six months; A dietician and exercise specialist led the classes.</td>
<td>70% met the goal of at least 150 minutes of physical activity a week; 45% achieved 7% weight loss goal; 67% achieved at least 5% weight loss from baseline.</td>
</tr>
<tr>
<td>Matvienko, O., &amp; Hoehns, J. (2009)</td>
<td>Nonrandomized one-group prospective design</td>
<td>n=31</td>
<td>Implemented modified version of DPP instructed by exercise graduate students; Program had weekly or biweekly individual meetings with personal coach over 6 month period; Participants received weekly personal physical activity training; Also a maintenance phase which included monthly visits and at least once a month telephone calls.</td>
<td>25% reached the 7% weight loss goal and 39% lost at least 5% of baseline weight; After maintenance phase 32% met 7% weight loss goal and 24% lost at least 5%; At six months 53.6% of participants reported at least 150 minutes per week of physical activity, at 12 months it increased to 61.5%.</td>
</tr>
</tbody>
</table>
TABLE 1: Translation of the Diabetes Prevention Program - Continued

<table>
<thead>
<tr>
<th>Author</th>
<th>Design</th>
<th>Sample</th>
<th>Intervention</th>
<th>Results</th>
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<tbody>
<tr>
<td>Merriam et al. (2009)</td>
<td>Nonrandomized one-group prospective design; Used the Social Learning theory to guide program.</td>
<td>n=312</td>
<td>Translated the DPP into a Latino, underserved, low-income population; Intervention group received 13 group sessions and three home visits; Instructors were Spanish-speaking community members with a background in nutrition.</td>
<td>Study results continue to be analyzed at this time.</td>
</tr>
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</table>

Whittemore et al. (2009) performed a pilot study to test the ability to translate the DPP into a primary care setting with nurse practitioners as the main provider of care. The specific aims of the study were to: 1) modify the DPP for implementation in the primary care setting with input from NPs, 2) analyze the reach, implementation, and efficacy of a 6-month diabetes prevention program provided by NPs in a primary care setting to adults at risk for T2DM development, and 3) examine the impact of a 5% weight loss on clinical, behavioral, and psychosocial factors.

The study used a mixed method design, which consisted of two phases. Phase I focused on collaborating with NPs to develop a modified DPP that could be more easily translated into the practice setting. Phase II was the cluster randomized pilot study. The study took place at four NP clinics with a convenience sample of 58 participants. Two sites were randomly assigned to the lifestyle change program and two were assigned to the enhanced standard care program (Whittemore et al., 2009).

The enhanced standard care program (control group) consisted of 27 participants. The lifestyle change program (experimental group) consisted of 31 participants. The enhanced standard care group received culturally appropriate information on diabetes prevention, a 20 to
30 minute visit with the NP that focused on diabetes prevention and lifestyle changes, and a 45-minute session with a nutritionist (Whittemore et al., 2009).

In addition to the educational material and individual sessions the enhanced standard care group received, the lifestyle change group received behavioral support and motivational interviewing. Motivational and behavioral support took place over a six-month period with six face-to-face sessions and five telephone sessions (Whittemore et al., 2009).

The sample was diverse comprising people from different ethnic groups, including Whites, Blacks, and Hispanics. Ninety-two percent of the participants were female. Most participants were obese and coming from a moderately low-income household. By the end of the study, seven people had withdrawn, making a 12% attrition rate. Face to face sessions had a 96% attendance rate, while phone sessions were less successful, with only a 37% completion rate (Whittemore et al., 2009).

At the end of the six-month intervention period, 25% of the lifestyle change participants had achieved a 5% weight loss, while only 11% of the enhanced standard care group reached the same goal. The lifestyle change participants significantly improved their exercise habits, going from 29% participating in at least 150 minutes of exercise per week at baseline, to 46% at the end of six months. A majority of the standard care group maintained their previous exercise habits. There was only a 1% increase in the amount of people exercising 150 minutes per week, going from 39% at baseline to 40% at the end of the study period. Whittemore et al. (2009) concluded that NPs were capable of implementing a diabetes prevention program in the primary care setting with minimal extra training.
Kramer et al. (2009) set out to create a modified version of the DPP that could be more easily translated in various real world settings. The program was entitled Group Lifestyle Balance (GLB). It consisted of 12 weekly one-hour group sessions over 12 to 15 weeks. Group instructors were health care professionals, which included registered nurses, registered dieticians, and exercise specialists. Prior to the program, they were required to complete a training workshop provided by the Diabetes Prevention Support Center at the University of Pittsburgh Diabetes Institute.

The program focused on healthy food choices in general, as opposed to specifically following the food guide pyramid as in the DPP. Participants were given a pedometer early in the program and were required to keep a food intake, physical activity, and weight log. Instructors reviewed the logs weekly and used them to provide patients with feedback on their progress (Kramer et al., 2009).

Phase I took place at four primary care practices, two urban and two rural locations. Participants recruited were between 25 to 74 years of age. Letters to possible participants in this age group were sent to 2167 people, with 388 attending the screening. Given the study criteria, a total of 51 participants were eligible for the study. Participants had to have a BMI ≥ 25 kg/m², be diagnosed with metabolic syndrome, and be free of diabetes in order to participate in the study. Biological data collected included a medical and family history, blood pressure, waist circumference, weight, height, and lipid and glucose levels. Clinical measurements were collected at baseline and upon completion of the program (Kramer et al., 2009).

Phase 2 was the evaluation of the GLB program at a different setting, two suburban practices in Pittsburgh. Criteria was broadened to include people 18 years of age or older and
those with prediabetes. Participants in this phase were recruited through physician referrals, newspaper announcements and flyers. Seventy people were recruited, 56 met criteria, and 42 decided to enroll in the program. In Phase 2 biological data was collected at baseline, upon completion of the program, and then again at 6 and 12 months post-intervention. Phase 2 participants were also given the opportunity to attend monthly support meetings for up to nine months after the program was completed (Kramer et al., 2009).

Attendance rates for Phase 1 were low, with only 61% attending at least half of the sessions. Phase 2 saw better attendance rates with 95% of participants attending at least half of the sessions. Increased physical activity and weight loss correlated with higher attendance rates. Upon completion of the program, participants in Phase 1 had a mean weight loss of 2.2% from baseline and participants in Phase 2 had mean weight loss of 4.9%. For both phases, 5% weight loss was seen in 52.2% of participants and 7% weight loss was seen in 23.8% of participants. The researchers concluded that the weight loss was significant and was comparable to the weight loss trends of the DPP (Kramer et al., 2009).

Pagoto, Kantor, Bodenlos, Gitkind, and Ma (2008) translated the DPP into a weight loss clinic at the University of Massachusetts Memorial Medical Center using the diffusion of innovations theory as a framework. In order to decrease costs and increase feasibility, the DPP was modified in the following ways: 1) it was shortened to 16 weeks, 2) delivered as a group intervention, 3) a multidisciplinary team was utilized including a nutritionist, exercise physiologist, and a behavioral health physician, 4) and twice weekly exercise classes were replaced with six small group sessions focused on developing individualized exercise plans (Pagoto et al., 2008).
There was also a six-month maintenance phase, which was supposed to be carried out through follow-up phone calls, however this proved to be problematic for program providers. As a result, monthly group support meetings were used instead. A cost analysis was performed and an out of pocket cost of $800 per person was established. Participants were recruited through their primary care physicians and advertisements in the local newspaper (Pagoto et al., 2008).

The program underwent its first data analysis 18 months after the onset of the program. A total of 118 patients had completed the program thus far. The characteristics of the study participants varied somewhat from the original DPP participants. Twenty-one percent had T2DM and a significantly higher body mass at 43.3, compared to 33.9 in the DPP (Pagoto et al., 2008).

There was a 17% attrition rate. For those who dropped out before the final weigh in, their most recent weight was carried forward. After 16 weeks, 49% of participants had loss $\geq 5\%$ of their baseline weight. The average weight loss was 5.57 kg. While weight loss in the program was successful, it was significantly less than that of the DPP, with only 30% of participants reaching the 7% weight loss goal, compared to 49% of DPP participants (Pagoto et al., 2008).

Participants on average attended 13 out of 16 sessions and were provided with materials from missed sessions. If they desired to do so, they were also allowed to sit in on missed sessions with another group. However, these make-up sessions were not counted towards attendance for regularly scheduled meetings (Pagoto et al., 2008).

Upon completion of the program, 72 of the 118 participants completed a satisfaction survey, with 56% of participants agreeing or strongly agreeing to being satisfied with their weight loss. With the positive feedback in addition to the positive weight loss results the program was maintained at the institution (Pagoto et al., 2008).
This was an observational study, not a randomized control trial, thus efficacy cannot accurately be determined. Ninety percent of the sample was of Caucasian ethnicity limiting the ability to generalize the findings. Additionally, no biological data was obtained during the study, such as lipid levels, blood glucose levels, and blood pressure readings, making evaluation of the programs effect on diabetes and cardiovascular disease not possible (Pagoto et al., 2008).

Boltri et al. (2008) translated the DPP at a faith based setting in a primarily African American population. The researchers worked with a contact person from the church to determine the best days and times to discuss the program and hold screenings. On two consecutive Sunday services the modified DPP program was explained to all church attendants. Attendants 18 years and older were given a risk assessment survey developed by the Center for Disease Control and Prevention. Those who scored as high risk for T2DM had blood glucose testing performed. Fifty people completed the assessment and 26 were found to be at risk for diabetes. There were eight people with prediabetes and all were enrolled into the program.

The program consisted of 16 sessions, lasting an hour to 1.5 hours over a four-month period. No support methods were provided to participants once they completed the program. It was modified to a group format that included prayer. Volunteer health care professionals who had completed a training session on the goals of the DPP, materials of the DPP, and how to conduct the sessions led the classes. Baseline data collected included height, weight, blood pressure, and fasting fingerstick glucose levels (Boltri et al., 2008).

Fifty-eight percent of the sample was female, 81% were 45 years or older, the mean weight was 201.1 lbs for females and 206.1 lbs for males. Twenty-five percent of the participants attended at least eight of the 16 sessions. Weight loss was 3.6% from baseline and fingerstick
glucose levels decreased 3.8% from baseline. However at the 12-month post-intervention assessment, participant weight loss had reverted to a mere 0.5% weight loss from baseline (Boltri et al., 2008).

Boltri et al. (2008) cited the lack of a control group, the small sample size, and the use of fingerstick glucose, instead of plasma glucose as limitations of the study. However, the researchers concluded that overall, it is feasible to translate the DPP into the community setting such as in a faith-based institution, in order to prevent diabetes.

Matvienko and Hoehns (2009) implemented a modified version of the DPP, entitled “Fitness Plus”. Participants were recruited through physician referrals, flyers, and newsletter advertisements. Inclusion criteria included being between age 25 to 65 and being at high risk for diabetes or diagnosed with diabetes in the last five years. Exclusion criteria included anyone with less than three risk factors for T2DM, receiving insulin, diagnosed with diabetes more than five years ago, or unable to perform moderate intensity physical activity. Forty people were recruited, 31 met the eligibility criteria and all enrolled in the program. The sample was composed of primarily non-Hispanic white females. There was one African American participant and one Asian American participant. Fourteen of the participants had been diagnosed with diabetes.

The Fitness Plus program closely matched its interventions to those used in the DPP lifestyle group. Exercise science graduate students trained in the DPP protocol instructed the classes. In the first six months participants had weekly or biweekly individual meetings with their coach that focused on diet, physical activity, motivational and problem solving strategies. In addition to instructional classes, participants received once weekly personal physical activity training. The next six months was the maintenance phase, which included once a month visits
and at least once a month telephone calls to offer support and answer questions (Matvienko & Hoehns, 2009).

Data was collected at baseline, six, and 12 months. Participants were asked to obtain laboratory tests from their PCP including lipid levels, fasting blood glucose, and a hemoglobin A1c. Investigators collected height, weight, and blood pressure measurements. The attrition rate for the program was low, with 94% of participants completing the core phase and 84% completing the six-month maintenance phase. However, one participant was excluded from data analysis due to an inability to complete the program secondary to medical problems (Matvienko & Hoehns, 2009).

Upon completion of the core phase, 25% of participants had reached the 7% weight loss goal and 39% had lost at least 5% of their baseline weight. After completion of the maintenance phase, 32% had met the 7% weight loss goal and 24% had lost at least 5% of their baseline weight. At baseline and six months 53.6% of participants reported completing at least 150 minutes of moderate intensity physical activity, at 12 months the number increased to 61.5%. Significant reductions were seen in weight, BMI, and blood pressure measurements from baseline to six months (Matvienko & Hoehns, 2009).

Seidel, Powell, Zgibor, Siminerio, and Piatt (2008) implemented a Group Lifestyle Balance (GLB) program based on the DPP. The researchers used a nonrandomized prospective, one group design in order to test the feasibility of translating the DPP in a medically underserved area in Pittsburgh, Pennsylvania. The study took place in two phases.

The first phase involved recruitment and screening. Recruitment methods included flyers and advertisements in the local newspaper and on a local cable network. Persons ineligible to
participate in the program were those who have had bariatric surgery, were on any weight loss medication, unable to provide informed consent, unable to walk at least a quarter of a mile without stopping, pregnant, diagnosed with diabetes, or on any prescribed antidiabetic medication. Those who were able to participate in the program had to have at least three components of metabolic syndrome, a BMI $\geq 25$ kg/m$^2$, and clearance from their physician (Seidel et al., 2008).

Screenings were held at local churches, community centers, and worksites free of charge. A total of 573 people were screened, with 183 being eligible for the program. Eighty-eight enrolled, with the remainder declining for reasons including work and/or family conflict, or wanting only to be screened. Biological data obtained from participants included height, weight, waist circumference, blood pressure, fasting blood samples of glucose, triglycerides and HDL cholesterol. These measures were taken at baseline then again at three and six months after the start of the program (Seidel et al., 2008).

Phase II was the implementation of the GLB. The program was a group-based system with 12 weekly 90-minute sessions over a 12-14 week period. A registered dietician and an exercise specialist conducted the classes. The instructors received a two-day training workshop from the University of Pittsburgh’s Diabetes Prevention Support Center on how to properly conduct the classes. In addition to the instructors, the program utilized two lay health coaches whose job was to schedule follow up visits and increase attendance rates by encouraging participation (Seidel et al., 2008).

Participants received a fat and calorie counter, pedometer, food and physical activity journals, and a free six-month membership to a local YMCA. Attendance rates were high with
69% of participants attending at least 75% of the classes. Participants were primarily female (84.1%), non-Hispanic white (72.7%), with an average age of 54. More than half of the participants had an annual household income below the 200% federal poverty level (Seidel et al., 2008).

At the three-month mark, 69 (78.4%) of the participants completed the biological data collection. Fifty (56.8%) completed the six-month data collection. At three months, 46.4%, 32 of the 69 measured participants had lost 5% of their body weight and 26.1% (18) had lost 7% of their body weight. At six months, 28 of the 32 had maintained the 5% weight loss and 12 of the 18 maintained the 7% weight loss. In addition to weight loss, there were also significant decreases in abdominal obesity and hypertension (Seidel et al., 2008).

Seidel et al. (2008) cited several weaknesses of the study including inaccurate self-reporting of diet and exercise, volunteer bias by having the screening only in the morning, low male representation (26%), and the use of carried forward imputations for those participants with incomplete follow up data.

Amundson et al. (2009) assessed the feasibility of implementing a modified DPP at four health care facilities in Minnesota. Two sites charged a fee for the service, but all sites were required to accept all qualifying participants regardless of their ability to pay. One site charged $50, with $25 returned upon completion of the core sessions and the other $25 returned upon completion of the follow-up sessions. The second site charged $150 and used the money for program expenses. Participants were recruited through physician referrals, work sites, service groups, churches, press releases, and news and television advertisements.
Participants were required to be at least 18 years of age, have a BMI ≥ 25 kg/m², have one or more diabetes risk factors, be able to participate in moderate physical activity, and be cleared by their physician to participate in the program. Participants were also required to complete a readiness to change questionnaire and sign a contract indicating their commitment towards making lifestyle changes to meet their health goals. Participants could not be pregnant, diagnosed with diabetes, have unstable cardiac disease, have cancer, end stage renal disease or be on dialysis (Amundson et al., 2009).

The modified program consisted of 16 weekly one-hour group sessions followed by monthly support sessions for the next six months. A dietician and exercise specialist who had completed a two-day training workshop led the classes. Data collection included height, weight, and blood pressure. Participants referring physicians were asked to provide blood glucose and lipid levels. Measurements were obtained again upon completion of the program and after the six-month support sessions (Amundson et al., 2009).

A total of 355 people were enrolled in the program, 293 (83%) of the participants completed the course. Failure to complete the course was defined as those who dropped out or missed more than three sessions in a row. Attendance rates were high, with 43% of participants attending all 16 sessions and 91% attending at least 12 sessions. Seventy percent of participants met the goal of at least 150 minutes of physical activity per week, 45% achieved the 7% weight loss goal and 67% achieved at least a 5% weight loss from baseline. There were also decreases seen in blood glucose levels, blood pressure, and lipid levels (Amundson et al., 2009).

McTigue, Conroy, Bigi, Murphy, and McNeil (2009) translated the DPP at a primary care practice. The modified version was called the Weight Loss through Living Well (WiLLoW)
program. It was a fee for service group based intervention with 12 weekly sessions. The core sessions were $100 and if desired one could continue to attend six monthly support sessions for an additional $50. The clinic’s nurse educator administered the classes (Amundson et al., 2009).

Participants were recruited through physician referrals at the clinic conducting the study. They had to be medically cleared by their physician and have a BMI \( \geq 25 \text{ kg/m}^2 \). The program was open to both people with and without diabetes. Biological data collection included height and weight. There were 166 people referred to the program, 81 of them joined. Twenty-six percent of those enrolled in the program met the 7% weight loss goal (McTigue et al., 2009).

Ackermann, Finch, Brizendine, Zhou, and Marrero (2008) performed a cluster-randomized pilot study to evaluate the ability of lay personal at a community YMCA to implement a modified version of the DPP. The study is also known as the DEPLOY project. In order to recruit participants, letters were sent to 7500 randomly selected households near two YMCA centers. The letters discussed diabetes risk factors and encouraged people with risk factors to attend the screening.

There were 535 people who attended the screenings, 131 were eligible for the program and 92 enrolled. Inclusion criteria included a random capillary blood glucose of 110 to 199 mg/dL and being high risk for diabetes as determined by a score of \( \geq 10 \) in the ADA diabetes risk assessment. Exclusion criteria included an inability to provide informed consent, a comorbidity (i.e. recent cardiovascular event) that limited life expectancy to < 3 years or prohibited participation in moderate physical activity (Ackermann et al., 2008).

There were two screening sites, which also acted as the study sites. Participants were assigned to the program site where they received their screening. Prior to the screenings, one site
was randomly assigned to be the intervention site and the other the control group. There were 46 participants in both the intervention and control group. Both groups were given education on diabetes risk and prevention through diet modification, increased physical activity, and weight loss. The intervention arm received 16 group sessions lasting 60-90 minutes over a 16-20 week period. YMCA employees instructed the classes after receiving a two and a half day training session. Intervention participants attended 57% of classes. Thirty-five of the intervention participants completed 75% of the classes (Ackermann et al., 2008).

Data collected from both groups included height, weight, height, blood pressure, hemoglobin A1c levels, and total and HDL cholesterol. Measurements were taken at baseline, four to six months, and then again at 12-14 months. Eighty-five percent of the intervention group and 83% of the control group completed the first follow-up. At six months the researchers found a significant decrease in body weight in the intervention group with a mean weight loss of 6%. The control group achieved a mean weight loss of 2% at four to six months. At the 12 to 14 month assessment the intervention group had maintained a 6.0% mean weight loss, while the control group dropped to 1.8% mean weight loss. A significant decrease in total cholesterol was also observed in the intervention group at both follow-up assessments (Ackermann et al., 2008).

Cramer, Sibley, Bartlett, Kahn, and Loffredo (2007) performed a randomized controlled trial using a modified version of the DPP to promote a healthy diet, increased physical activity, and weight loss to decrease insulin resistance in a minority population with type 2 diabetes. While the DPP was not developed or tested for the use in patients with poorly controlled T2DM, the investigators felt that the programs proven efficacy at decreasing insulin resistance would also positively impact this patient population (Cramer et al., 2007).
The goals of the program were to reduce hemoglobin A1c (HbA1c) levels by 1 percentage point through the original DPP goals of 7% weight loss and 150 minutes of moderate intensity physical activity a week. Participants were recruited from family practice clinics serving primarily minority groups in inner city Buffalo, New York. Participants were required to have a diagnosis of diabetes, an HbA1c level ≥ 8% in the last six months, and the ability to perform self-care. Exclusion criteria included pregnancy, a mental health or seizure disorder, a cardiovascular event in the last three months, an inability to attend routine clinic visits, and the lack of access to a telephone (Cramer et al., 2007).

A total of 67 people were recruited. Participants were randomly assigned to the intervention group or control group. The intervention group received seven individual sessions with a nurse case manager who discussed diet, exercise, and motivational techniques. Upon completion of the program, researchers reported a 34-minute increase in mean physical activity for the intervention group and a 19-minute mean decrease in the control group. Average weight loss for the intervention group was 2.69%, with none of the participants meeting the 7% weight loss goal. The intervention groups HbA1c level saw a mean decrease of 1.87 points, while the control group saw a 0.54 increase (Cramer et al., 2007).

While the program produced positive results, it cannot be generalized or reproduced due to the lack of information on participant ethnicity, age, length of sessions, and the amount of participants in the intervention or control group. In addition, it is unclear how many of these patients were on medications for their diabetes and what those medications were (Cramer et al., 2007).
Merriam et al. (2009) translated the DPP into a primarily Latino, underserved, low-income population in Lawrence, Massachusetts. The researchers collaborated with a local family health center in order to recruit patients. Chart reviews at the health center identified possible study candidates. Recruitment letters were initially sent, followed by pre-screening telephone calls, and then in person screening appointments were made for those meeting preliminary eligibility. In addition to chart reviews, participants were recruited through public service announcements on television, local radio programs, newspaper advertisements, flyers, and letters sent to local physicians in the community to make them aware of the program.

In order to decrease the costs associated with screening and recruitment the researchers utilized the Stern formula to assess an individual’s relative risk of developing diabetes. Participants had to be age 25 or greater, overweight, and have a 30% or greater chance of developing T2DM per the Stern equation. Exclusion criteria included a diagnosis of severe psychiatric illness, inability to participate moderate physical activity, inability to provide informed consent, no telephone, a fasting glucose $\geq 126$ mg/dL, or a previous diagnosis of diabetes (Merriam et al., 2009).

Participants were randomly assigned to the lifestyle intervention and usual care group. Spanish-speaking community members with post high school education and a background in nutrition instructed the classes. Instructors received extensive training on the intervention protocol and the social learning theory used to guide the program (Merriam et al., 2009).

The lifestyle group received 13 group sessions and three home visits, which used the social learning theory to promote healthy behaviors. The DPP nutrition material was altered to focus on primarily traditional Latino foods. Additionally, the educational materials were changed
to meet the low literacy levels of the participants. The program incorporated video “novellas” as a teaching tool, a popular form of entertainment among the Latino population. Participants were provided with a pedometer, instructed on its use, and given a goal of at least 4000 steps per day. Participants significant others, family members, or friends living in the same household were encouraged to attend group sessions, in order to provide the individual with support (Merriam et al., 2009).

Participants completed a demographics questionnaire and biological data obtained included height, weight, waist circumference, blood pressure, and a fasting venous blood sample for lipids, glucose, and HbA1c levels. Weight was reassessed at six months and at the one-year mark all measures were reassessed. Participants were given a $25 dollar incentive for completing the baseline and six-month assessments and $50 dollars for completing the one-year assessment (Merriam et al., 2009).

The study recruited a total of 312 eligible participants, with a low attrition rate of 7% at the end of the one-year study period. Participants were primarily female, obese, and married. Unfortunately, the study results are still being analyzed at this time, therefore it remains to be seen if the program was successful at reducing the risk of T2DM development. However, the program proved to be able to recruit and retain a large amount of study participants (Merriam et al., 2009).

Summary of Findings

The DPP was translated into various community settings with several alterations made to the original program often due to the availability of resources. Variations between the programs included program length, cost, type of instructor, group or individualized sessions, and
recruitment and retention methods. As a result, there were considerable differences in program outcomes including percentage of weight loss achieved and the amount of participation in physical activity.

Upon critically reading and analyzing each study, nine common themes were identified. The data were summarized and synthesized utilizing a narrative review research design. Narrative reviews provide the groundwork for the creation of clinical practice guidelines and identify areas for future research (Polt, Beck, & Hungler, 2001). They allow researchers to identify and avoid difficulties that previous researchers have encountered (Green, Johnson, & Adams, 2001).

**Program Instructors and Training**

The DPP employed registered dieticians as the primary lifestyle coach (The DPP Research Group, 2002). The instructors used in the studies differed from nurse practitioners, registered nurses, nurse case managers, a nurse educator, exercise specialists, nutritionists, registered dieticians, graduate students, to laypersons. Training of these instructors also varied. Seidel et al. (2008), Ackermann et al. (2008), Amundson et al. (2009) and Kramer et al. (2009) had class instructors undergo a two-day training workshop with DPP professionals. Matvienko et al. (2009) utilized the DPP Lifestyle Manual of Operations to train exercise graduate students conducting the classes.

Whittemore et al. (2009) utilized NPs as the main interventionist. NPs received training in the DPP protocol and motivational interviewing. Upon completion of the program, NPs reported confidence in employing the educational and behavioral material adapted from the DPP. They cited motivational interviewing as the most challenging aspect of the program. As a result,
Whittemore et al. (2009) recognized this as an area for further training in future programs. Programs that utilized an instructor who had received some formal training in the DPP material or had a background in nutrition or exercise produced significant outcomes.

*Program Costs*

The Diabetes Prevention Program Research Group (2003) used the cost effectiveness analysis method to assess the cost and effectiveness of lifestyle modification interventions in people identified at risk for T2DM. They found that the interventions cost $15,700 from a payer perspective and $24,400 from a societal perspective per case of diabetes prevented. Additionally, they found that the interventions cost $31,500 from a payer perspective and $51,600 from a societal perspective per quality-adjusted life years gained. The researchers concluded that the lifestyle modifications were cost-effective and affordable in standard clinical practice, particularly if implemented in a group format.

Nearly all programs cited cost as a reason for altering the DPP guidelines. While most programs provided the service to patients free of cost, some did charge a fee for service. One program site in the study by Amundson et al. (2009) charged a $50 fee up front, but returned half of the money upon completion of the core phase and the other half upon completion of the maintenance phase. This may have attributed to the program’s high retention rates, with 83% of the participants completing the course. Although Kramer et al. (2009) did not charge a fee for service they estimated program cost at $300 per person when conducted in groups of eight. The most costly program, by Pagoto et al. (2008), was $800 out of pocket, which despite the high fee was able to recruit a large sample size (n=118). However, there was no information on the socioeconomic status of this study group. This program, which was implemented in the
University of Massachusetts Memorial Medical Center, may not be as feasible for a low-income population.

A wellness program is sought for its ability to cut direct medical costs and dollars lost to disability, missed workdays, and activity limitations (Woolf, 2008). Unfortunately at this time, many health insurance companies do not cover such programs. Therefore, when translating the DPP into a community it is necessary to assess program costs and the affordability of that program to the people in that community.

*Program Sessions and Length*

The amount of sessions and the length of the programs have also differed between studies. The DPP provided 16 sessions over a 24-week period. As in the DPP, most programs (4 out of the 11) provided 16 sessions. However, these programs were conducted over a more condensed time period, meeting once weekly for 16 weeks. The next most common program length was 12 sessions with three of the studies providing weekly sessions over a 12 to 15 week period. Programs with 12 to 16 sessions proved to be highly successful in producing significant weight loss in its participants.

Matvienko et al. (2009) provided 24 sessions over a 24-week period, however it did not produce better outcomes than the 16 session programs. Cramer et al. (2007) had the second shortest program with only seven sessions, meeting once a month for a seven-month period. This study produced the poorest results with a mean weight loss of 2.69% from baseline. One of the factors that may have led to the program outcomes is that the sessions were separated by large gaps of time, not allowing participants to implement all interventions earlier in the study period. Without more frequent follow up, participants may have lost motivation between sessions.
Whittemore et al. (2009) had the shortest program with only six sessions over a 24-week period. Despite this, the program produced positive results, with 25% of its participants losing 5% of their baseline weight. While there were only six sessions in the Whittemore et al. (2009) study, the sessions were not as spread out which may have led to better retention of material and program adherence. Based on these studies, a program with at least 12 sessions, over a 12-week time period has proven to be effective.

*Group and Individualized Programs*

The DPP provided individualized sessions that were culturally sensitive and flexible (The DPP Research Group, 2002). While the individualized approach was proven effective, many of the translational studies found this method to be too costly. Eight out of the 11 programs utilized a group-based format in order to cut costs. The group-based programs were not less successful than the individualized programs. In fact, all but one group based program produced better weight loss results than the individualized programs. Therefore, the group based program aids in keeping costs down, while maintaining effectiveness of the program.

*Ethnic Diversity and Cultural Modifications*

The DPP was effective among people from various ethnic backgrounds, with 45% of its participants belonging to minority groups. In the DPP, participants were paired with a case manager of the same ethnicity who was tasked with culturally tailoring interventions to meet the participant’s needs. Lessons were made available in Spanish and handouts with food types and cooking methods were also tailored to be culturally relevant for the different ethnic groups in the study (The DPP Research Group, 2002).
The majority of translational research studies completed thus far have been composed of primarily non-Hispanic whites. The next most common ethnic group represented was African Americans. One study was conducted solely on an African American population (Boltri et al., 2008) and another study was conducted solely on a Latino population (Merriam et al., 2009). Only one study, Pagoto et al. (2008), had a Pacific Islander participant, comprising 1% of the study population (n=118). This highlights the lack of ethnically diverse studies.

Some studies altered the DPP content to make it culturally relevant to their study participants. Cramer et al. (2007) reported modifying the DPP content to include the use of the Southern food guide pyramid due to the program being implemented in a primarily African American community. Whittemore et al. (2009) provided culturally competent care to program participants. Merriam et al. (2009) altered the DPP content to meet the needs of its Latino population by providing food guides with Latino foods and cooking sessions that focused on making traditional Latino dishes healthy.

**Recruitment Methods**

Recruitment for the DPP spanned a three-year time frame, resulting in 3,234 study participants (The DPP Research Group, 2002). As in the DPP, a variety of recruitment methods were used in the reviewed studies, including informational mailings, flyers, open screenings, referrals, newspaper, radio, and television advertisements. Not all studies disclosed the amount of time spent on recruiting study participants. Boltri et al. (2008) had the smallest sample size (n=26), which was likely due to its short recruitment period of two weeks and the limited sampling area, a single Baptist church. Merriam et al. (2009) recruited the largest group (n=312) over a 34-month recruitment and screening period. As described earlier, the researchers’
recruitment methods were extensive, mailing letters, following up with telephone calls, and then making a reminder call the day before or the morning of the potential participant’s screening appointment. In an effort to reach their target population, the Latino community, the study advertised publicly on a local Spanish radio program and in bilingual newspapers (Merriam et al., 2009).

Amundson et al. (2009) was able to recruit a large sample size (n=293) over a fairly short recruitment period (six months). The researchers recruitment methods were expansive from media advertisements, to employers, service groups, churches, and local physicians. McTigue et al. (2009) recruited over a rather long time period (two years), yet for the amount of time spent recruiting, produced a relatively small sample size (n=81). As mentioned earlier, participants were solely recruited from physician referrals at the clinic conducting the study. Less than half of the people referred enrolled in the program. Many factors could have contributed to the small sample size including a small patient population at the clinic, a reluctance to join due to $100 charge for the program, a lack of confidence in the program to produce the desired outcomes, a lack of knowledge on the effects of diabetes. Higher recruitment numbers were seen in programs that mentioned personally talking to potential participants to explain program details (Merriam et al., 2009; Pagoto et al., 2008). Overall, in order to recruit a sample size that adequately reflects the target population and produces a high confidence level (i.e. 95%) and a low confidence interval (i.e. ±3%, ±5%, ±7%), an assortment of recruitment methods must be utilized with planning for at least a six-month recruiting period.
Attendance and Retention

Eight studies provided information on attendance rates. Five of the studies provided information on retention and/or attrition rates. In the study by Seidel et al. (2008) 69% of participants attended at least 75% of classes and 77% of participants completed the program. The researchers credit the high levels of attendance with the use of lay health coaches who were from the community and created a comfortable and familiar environment for study participants.

As mentioned earlier, Whittemore et al. (2009) had a high attendance rate for meetings (96%), but was not as successful with phone sessions (37%). Pagoto et al. (2008) also reported difficulties in implementing follow-up phone calls as part of its program and instead used group meetings.

Amundson et al. (2009) had both a high attendance and retention rate. Eighty-three percent of the participants completed the course, 43% of participants attended all 16 sessions, and 91% attended at least 12 of 16 sessions. These outcomes may be due to several factors including the charging of a fee for service making participants not want to waste their money, the use of a readiness and commitment contract in order to join the program, personal enjoyment of the classes, or perhaps the location and/or timing of the classes (e.g. 6 p.m.) were convenient for study participants.

Attrition rates in the studies varied from 6% to 23%. Attendance rates also varied significantly between and within studies. For example, in the study by Kramer et al. (2009) Phase 1 attendance rates were poor with only 61% attending at least half of the sessions and in Phase 2 attendance rates were much improved with 95% of participants attending at least half of the sessions. The difference is attendance rates were not discussed. Lack of evaluative data in the
studies as to why participants chose to drop out or not attend classes made it difficult to ascertain best practices. Also, the lack of clarity as to who was defined as a “drop out” made comparing and contrasting this study outcome difficult.

Physical Activity

One of the primary goals of the DPP lifestyle modification group was to increase the amount of physical activity to at least 150 minutes per week (The DPP Research Group, 2002). While all the studies listed participation in moderate physical activity of at least 150 minutes per week as a goal, only four of the studies reported outcomes for this goal. Although Whittemore et al. (2009) provided data on the percentage of participants meeting the physical activity goal; the researchers did not provide much detail as to how physical activity levels were tracked.

Amundson et al. (2009) reported that 70% of its study participants reached the physical activity goal. At week two, participants were required to keep a weight and fat intake log. Amundson et al. (2009) found that those who consistently tracked fat intake for at least three weeks were more likely to meet the physical activity goal. At week five in the program, participants were required to keep a log of their physical activity and were given the opportunity to participate in twice weekly group events such as walking or swimming. The use of group activities and logs for tracking fat intake, weight, and physical activity seemed to have a positive effect on physical activity numbers.

Cramer et al. (2007) provided participants with a physical activity log and encouraged them to track their physical activity, but did not require it. The program produced modest increases in weekly physical activity levels, increasing the mean minutes per week from 56 at baseline to 90 upon completion of the program. The use of a physical activity log alone or simply
encouraging the tracking of activity may not be enough to help participants meet their physical activity goals. The incorporation of a food diary into the program to track caloric intake or at least fat intake may aid participants in motivating them to meet their physical activity needs.

Matvienko et al. (2009) reported high levels of baseline physical activity, with 53.6% of participants reporting 150 minutes of moderate intensity physical activity per week. This number remained the same upon completion of the core phase of the program and then increased to 61.5% after completion of the maintenance phase. Matvienko et al. (2009) cited inaccurate reporting and a misunderstanding of the meaning of “moderate intensity” as possibly affecting study outcomes. Seidel et al. (2008) also cited inaccurate reporting of physical activity levels as a study problem. Thus, future studies should consider utilizing standardized physical activity logs, providing more teaching on moderate physical activity, and providing handouts with caricatures and a description of what constitutes moderate intensity physical activity.

Weight Loss

While the primary goal of the DPP was a 7% weight loss from baseline, many of the programs used a 5% weight loss as the program goal. The DPP established that a 5% weight loss was associated with a 58% risk reduction for diabetes incidence (Ackermann et al., 2009). All programs provided data on weight loss. Figure 2 shows the percentage of weight loss achieved by participants in the various studies.
FIGURE 2: Percentage of Participants Meeting Weight Loss Goals upon Completion of Core Phase of Program.

Three studies were not included in the graph due to weight loss data provided as a mean percentage as opposed to an individual outcome. Boltri et al. (2008) participants had a 3.6% mean weight loss, Ackermann et al. (2008) participants had a 6%, and Cramer et al. (2007) participants had a 2.69%.

The DPP provided participants with individualized “toolboxes” in order to assist them in overcoming barriers and adhering to the program guidelines. These toolboxes cost roughly $100 per person per program year. Examples of “tools” used include providing portion-controlled meals, cookbooks, and enrolling the participant into a local exercise class (The DPP Research Group, 2002). This “toolbox” method was cited by several of the researchers as being too costly and out of the studies budgets. These programs created a modified toolbox that consisted of pedometers, recipe swapping, fat and calorie counting books, and a chart for recording weight (Kramer et al., 2009; Pagoto et al., 2008; Seidel et al., 2008). The programs that provided
participants with pedometers produced significant weight loss results. The pedometer is an effective, yet inexpensive tool to help program participants meet their physical activity goals.

Amundson et al. (2009) and Matvienko et al. (2009) also produced significant weight loss results, despite not providing participants with pedometers. In addition to the program sessions, the researchers relied on weekly physical activity sessions and self-monitoring activities to keep participants motivated and losing weight.
CHAPTER 3: DISCUSSION

This review of literature aids in identifying the most successful means of implementing the DPP into a community setting. The knowledge gained from this review can be used to address several issues involved in translational research including participant recruitment, attendance and attrition rates, costs, and probably the most important aspect, producing positive or similar outcomes to those produced in the original study.

Implications for Advanced Nursing Practice

Advanced practice nurses are in an ideal position to address the ever-growing need for high quality and accessible health care (American Association of Colleges of Nursing [AACN], 2005). The role of the advanced practice nurse is diverse, from clinical practitioner, to coach and guide, researcher, collaborator, and leader (Hamric, Spross, & Hanson, 2009). APNs have a unique skill set. They are capable of coaching and guiding their patients through difficult transitions and at the same time act as a provider to attend to their medical needs. APNs can use their interpersonal skills and expert knowledge to motivate people and identify those ready for change.

Several studies have shown that APNs are more than capable of providing quality care. In a randomized trial by Mundinger et al. (2000), the researchers found that when nurse practitioners were given the same authority, duties, and facilities as primary care physicians, there were no significant differences in patient outcomes. In another study by Gambino, Planavsky, and Gaudette (2009), the researchers found that APNs managing patients with diabetes, hypertension, and dyslipidemia were just as effective as physicians in decreasing cardiovascular risk factors through medical management and patient education. Furthermore, in
both studies patient satisfaction with the nurse practitioner provided care was high. The ability of APNs to assume these various roles and provide care that is cost-effective and comparable to that of a physician makes them an invaluable asset in today’s health care setting (AACN, 2005).

Recommendations for Future Study

Translational research on the DPP continues to emerge; yet there remain limited studies on its implementation among the Pacific Islander population. A review of the literature revealed that there is a continued need for translational research among this ethnic group, as they are a vulnerable population. Behavior modification is a complex human action that requires the recognition of the multiple factors that come into play when trying to modify lifestyles. Future studies should also consider the use of a theory that takes these factors into account when translating the DPP. It would be beneficial to discover how the use of a theory, such as the SCT, could affect outcomes when translating the DPP into the community.

Application to the Practice Inquiry

The findings from this review of literature will serve as the foundation for my practice inquiry project. I intend to implement a translational pilot study of the DPP in a low income, underserved, Pacific Islander population. The knowledge gained will be used as a guide to project development and design. The SCT will be the theoretical framework used to understand behavior change and guide the creation of effective lifestyle modification interventions.

Project Limitations

Although an extensive and thorough literature search was performed it is possible that there are other DPP translational studies that have been completed, but were not included in this review. There was also a lack of consistency in reporting study procedures and findings, some
authors excluded information on recruitment timelines, modifications to the DPP, ethnic backgrounds of participants, instructor training, and a majority of the studies did not include physical activity outcomes. For example, Boltri et al. (2008) cited the use of “volunteer medical personnel” as class instructors and provided no further information on their background, McTigue et al. (2009) did not mention any type of training for program instructors, and Cramer et al. (2007) and Matvienko et al. (2009) did not disclose session lengths (e.g., 15 minutes, 30 minutes, one hour). Three of the studies (Ackermann et al., 2008; Boltri et al., 2008; Cramer et al., 2007) provided weight loss results as a mean number, as opposed to the majority of studies which disclosed what percentage of participants reached the five or 7% weight loss goals. This lack of consistency in the reporting of study findings made it difficult to draw conclusions and determine what variables led to poorer outcomes and vice versa.

Summary and Conclusions

There is a continued need for the translation of the DPP into the community in order to create evidence-based best practices, especially in minority populations. The alarming incidence and prevalence rates of diabetes, its damaging health sequelae, and its cost to the U.S. government are valid and compelling reasons for the current health care reform towards health promotion and disease prevention. With the U.S. paying the highest percentage of its gross domestic product on health care when compared to any other country, the push towards preventive care is necessary (Ginsburg, 2008). Health promotion and disease prevention cut the problem off at the source, decreasing the incidence and severity disease and thereby decreasing the ever-climbing health care costs (Woolf, 2008).
REFERENCES


