Controlling Diabetes - Are Clinical Practice Guidelines the Answer?

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PIP: Controlling Diabetes - Are Clinical Practice Guidelines the Answer?

Chapter 1

Diabetes is a challenging disease that affects almost every organ system in the body. Every 17 seconds, someone is diagnosed with diabetes (Awareness Matters, n.d.). The World Health Organization (WHO, 2003) predicts that 350 million people worldwide will have type 2 diabetes by 2030. Meanwhile, the International Diabetes Federation (IDF) believes nearly 400 million people have some form of diabetes today, and this number is expected to climb to 600 million over the next 25 years. To paint a clearer picture, this means one in ten people will be diagnosed with diabetes by 2035 (American Broadcasting Company [ABC], 2013).

According to the Hawai‘i Island Beacon Community website (2013), Hawai‘i island is approximately the same size as the state of Connecticut; and while Connecticut has 34 major hospitals, the Big Island of Hawai‘i has three. Sixteen percent of Hawai‘i island residents report not having a primary-care provider (North Hawaii Outcomes Project, 2011). Hawai‘i island providers are overwhelmed with patient loads, and patients experience long wait periods when trying to see a provider. The global epidemic of type 2 diabetes requires an innovative approach to prevention and treatment. The role of culture and socioeconomics must be acknowledged in the development of new interventions to prevent and control the disease. A clinical practice guideline (CPG) is essential to providing the best evidence-based care to patients with type 2 diabetes.

Needs Assessment

The prevalence of diabetes is three point seven percent higher in Hawai‘i (58 per 1,000 people) compared overall to the United States (54 per 1,000 people). Native Hawaiians have the highest incidence (63 per 1,000 people) of developing diabetes (Aitaoto, Braun, Ichiho, &
Kuhau, 2005) and Hilo has the highest prevalence of diabetes on Hawai’i island, also known as the Big Island, at eight point four percent (Hawai’i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai’i State Department of Health, 2010). Native Hawaiians living in Hawai’i are five point seven times more likely to die from complications associated with diabetes compared to whites living in Hawai’i (Whitney, 2007). Studies found (Ko, Delafield, Davis, & Mau, 2013) that health disparities of Native Hawaiians are further exacerbated when they reside in rural communities. Thirty-three percent of Hawai’i’s state population lives in rural communities compared to seventeen percent of the total United States population (Ko, Delafield, Davis, & Mau, 2013). The Hawai’i State Department of Health found adult diabetes prevalence is significantly higher \( (p < 0.05) \) among those at the lowest income levels. Those with the lowest income levels are approximately three times as likely to be diagnosed with diabetes than those at the highest income level. People with less than a high school education have a significantly higher rate of diabetes and a higher mortality rate compared to those with a college degree. Of those individuals diagnosed with diabetes, in Hawai’i, 53.6 percent have a body mass index (BMI) classification of obesity, and 30.5 percent have a BMI classification of overweight (Hawai’i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai’i State Department of Health, 2010).

Diabetes was previously considered a disease of minor significance to world health; however, it is rapidly becoming a major health threat (Zimmet, Alberti, & Shaw, 2001). According to the American Diabetes Association (ADA) (2010), diabetes is the seventh leading cause of death in the United States and is the fifth cause of death in in Hawai’i. One theory suggests Native Hawaiians have a thrifty genotype, meaning there is an increased ability to store
calories as fat tissue. This has been considered a survival mechanism in times of famine; however, today food is more plentiful than ever, and minimal exertion is required to get it (Furubayashi & Look, 2005). In addition, Hawaiians, no longer hunters and gatherers, often have an increased sedentary lifestyle and frequently have an energy dense diet, which increases occurrence of diabetes related to obesity, also known as, diabesity (American Broadcasting Company [ABC], 2010, p. 1).

**Burden of Disease**

In addition to being a leading cause of death, Zhou, Zang and Hoerger (2013) found type 2 diabetes is placing a substantial economic burden on the healthcare system. The ADA (2013) estimates the cost associated with diagnosed diabetes was $245 billion in 2012. The estimated costs associated with Hawaiians living with diabetes was more than $1 billion in 2006 (Hawai’i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai’i State Department of Health, 2010). Complications of type 2 diabetes include: heart and blood vessel disease, neuropathy, nephropathy, retinopathy, periodontal disease, pregnancy complications, amputation and metabolic syndrome (high blood pressure, high fasting blood glucose levels, increased fat around the abdomen and abnormal cholesterol levels) (National Heart, Lung and Blood Institute [NHLBI], 2011). According to the Centers for Disease Control and Prevention (CDC) (2011) medical costs for individuals with diabetes are more than twice that of individuals without diabetes. Hawai’i has the highest rate of end-stage renal disease (ESRD) in the nation at nine per 10,000 people, and the island of Moloka’i has the highest rate of any island in the state at 19 per 10,000 people (Aitaoto, Braun, Ichiho & Kuhau, 2005).
Problem Statement

The state of Hawai‘i faces a significant healthcare problem. There is an overwhelming prevalence of type 2 diabetes in Hawai‘i and a severe lack of primary-care providers to handle the diagnosis and management of this disease.

Aims

The overarching aim of this project is to determine whether primary-care providers are currently delivering comprehensive management of type 2 diabetes to patients in accordance with the ADA CPGs. This Practice Inquiry Project (PIP) consists of three specific aims:

Aim 1: Assess the clinic’s management and treatment of type 2 diabetes

Objective 1: To examine the workflow at Hawaii Island Family Health Center (HIFHC) for treating type 2 diabetes.

Objective 2: To investigate the utilization of ADA CPGs to treat patients with type 2 diabetes.

Aim 2: Evaluate the gaps in order to strengthen diabetes care.

Objective 1: Analyze data from the microanalysis and adherence to ADA CPGs.

Objective 2: Identify other strategies or decision-making approaches being used to treat type 2 diabetic patients in the HIFHC.

Aim 3: Develop a strategic plan for dissemination of information about adherence to ADA CPGs at the HIFHC.

Objective 1: Identify the barriers to practice change.

Objective 2: Identify the facilitators to practice change.
Significance to Advanced Practice Nursing

This PIP meets the eight essentials of doctoral education for the advanced nursing practice as defined by the American Association of Colleges of Nursing. These essential include:

I. Scientific Underpinnings for Practice
II. Organizational and Systems Leadership for Quality Improvement and Systems Thinking
III. Clinical Scholarship and Analytical Methods for Evidence-Based Practice
IV. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care
V. Health Care Policy for Advocacy in Health Care
VI. Interprofessional Collaboration for Improving Patient and Population Health Outcomes
VII. Clinical Prevention and Population Health for Improving the Nation’s Health
VIII. Advanced Practice Nursing

This PIP achieves these established goals as it advocates for the improvement in patient outcomes through utilization of nationally recognized standards of care. This PIP is significant to advanced nursing practice as diabetes has become a disease of importance that threatens health both locally and nationally. Through mapping the workflow process, identification of areas of improvement for clinic needs were obtained in order to make changes and adaptations in the identification of diabetic patients. This project and its processes have facilitated the DNP’s role in improving future healthcare and research.
Chapter 2 – Project Description (Project Aim, Objective and Review of Literature)

Extensive research has been conducted on type 2 diabetes. Diabetes is an economic burden, in addition to being a major health and social concern. The literature regarding this disease highlights the extent of the problem. In this chapter, the review of literature will be presented. The focus of this literature review is three-fold. First, to discuss diabetes as a medical problem, along with its comorbidities. Second, to examine the ADA diabetic guidelines. And third, to address the relationships between type 2 diabetes and environment, attitude, beliefs, education, standards of care, and primary care. Finally, quality care measures of diabetes.

Review of Literature

eBook Collection (EBSCOhost), European Views of the Americas: 1493 to 1750, Applied Science & Technology Full Text (H.W. Wilson), Philosopher's Index, Hospitality & Tourism Index and National Guideline Clearinghouse (Agency for Healthcare Research and Quality – AHRQ). The keywords used to retrieve articles included: diabetes mellitus, type 2 diabetes mellitus, type 2 diabetes interventions, native Hawaiians and type 2 diabetes, Hawai‘i and diabetes, guidelines and type 2 diabetes, conceptual framework and type 2 diabetes, nutrition and type 2 diabetes, socioeconomic status and type 2 diabetes, type 2 diabetes and knowledge, advanced practice nursing and type 2 diabetes, and type 2 diabetes prevention.

Concept Map

![Concept Map](image)

*Figure 1. Concept map about knowledge*
A concept map, (seen above in Figure 1), was the starting point for the review of literature completed for this PIP. The concept of knowledge is especially significant to patients with type 2 diabetes because a “patient’s knowledge about diabetes is associated with better medication adherence and better glycemic control” (Al-Qazaz et al., 2011, p. 1028).

**Diabetes – Understanding the disease**

Type 2 diabetes, a metabolic disorder, affects the way the body metabolizes glucose by either 1) an insufficient amount of insulin produced by the pancreas or 2) a lack of response from the body’s cells to the insulin available, also known as insulin resistance. In the latter incidence, the pancreas attempts to produce more insulin to compensate for the resistance but, eventually, cannot keep up the production of sufficient amounts to regulate blood sugar. Symptoms of type 2 diabetes are the same as with type 1 diabetes, but they tend to develop slower. These symptoms include: increased thirst, increased urinary frequency, unexplained weight loss, increased fatigue, blurred vision and slow wound healing.

Unlike type 1 diabetes, type 2 diabetes is largely preventable. Type 2 diabetes was previously known as non-insulin dependent diabetes mellitus (NIDDM) or adult-onset diabetes. NIDDM is no longer appropriate nomenclature, as insulin is often used to treat type 2 diabetes. “There are two times to start insulin for type 2 diabetes. … The first is any time blood sugar is significantly out of control and a patient has symptoms. … The second time is when type 2 diabetes has progressed over many years and the pancreas can no longer make enough insulin to respond to other diabetes medications” (Iliades, 2014, p. np). Adult-onset is also no longer an appropriate description because children are now being diagnosed with the disease. The youngest case to date is a three-year-old girl, weighing 35 kilograms or 77 pounds (Welch, 2015,
September 17). To put this in perspective, according to the CDC growth chart (2000), an average three-year-old should weigh 15 kilograms, or 35 pounds.

According to the National Institute of Diabetes and Digestive and Kidney Diseases (2014) website, several blood tests are used to diagnose type 2 diabetes. A glycohemoglobin (HbA1c), a fasting plasma glucose (FPG) test, or an oral glucose tolerance test (OGTT) is used to diagnose diabetes or prediabetes. An HbA1c is a blood test, which shows a patient’s average blood glucose in the past three months. This test is considered convenient because it does not require a patient to fast, and, therefore, can be done at any time. An HbA1c result of six point five percent or above indicates diabetes. However, an FPG test is the most common test used due to its low cost. This test measures a person’s blood glucose level after having been fasting for at least eight hours. An FPG of more than 126 indicates diabetes. Lastly, the OGTT measures the blood glucose of a person who has fasted for a minimum of eight hours and two hours after having consumed a liquid containing 75 grams of glucose dissolved in water. A result of 200 or greater indicates diabetes. Choosing the right test enables healthcare providers to diagnose and treat pre diabetes. Testing is a high priority because early treatment can delay or even prevent type 2 diabetes from occurring (National Institute of Diabetes and Digestive and Kidney Diseases, n.d.).

Some people do not exhibit any symptoms of diabetes until late in the disease process. The ADA (2015) recommends testing for diabetes in adults who are asymptomatic with the following criteria: BMI greater than or equal to 25 kilograms per meter squared, sedentary lifestyle, first-degree relative with diabetes, high risk race/ethnicity (Asian American, Pacific Islander, Latino, African American or Native American), history of gestational diabetes or delivery of a baby weighing greater than or equal to nine pounds, hypertension (≥ 140/90 mmHg
or receiving treatment for hypertension), polycystic ovary syndrome (POCS), high-density lipoprotein (HDL) less than 35 milligrams per deciliter and/or triglyceride greater than 250 milligrams per deciliter, history of cardiovascular disease, history of prediabetes or HbA1c greater than or equal to five point seven percent. If none of the above criteria apply, testing should start at age 45. If results are normal, recommended testing is at three-year intervals (ADA, 2015).

The CDC (2016) website estimates one out of three adults in the United States is prediabetic. Prediabetes is a condition where blood glucose levels or HbA1c levels are higher than normal but not high enough to be considered type 2 diabetes. These individuals have a higher risk of developing type 2 diabetes if lifestyle modification changes do not occur during the next three-year period (CDC, 2013).

Type 2 diabetes is the most common form of diabetes and represents 90 to 95 percent of all cases in the U.S. An active, healthy lifestyle, including moderate exercise and a low-fat diet, can help prevent the occurrence of type 2 diabetes. Research (Alberti, Zimmet, & Shaw, 2007) shows obesity and type 2 diabetes are correlated. Paul Zimmet, Director Emeritus of the Baker IDI Heart and Diabetes Institute, references this connection with the term “diabesity” (American Broadcast Company, 2010, p. 1). A genetic link and the development of type 2 diabetes has been speculated, however, this link is not clearly understood.

**Complications of Diabetes/Comorbidities**

As mentioned earlier, complications of type 2 diabetes include: heart and blood vessel disease, neuropathy, nephropathy, retinopathy, periodontal disease, pregnancy complications, amputation and metabolic syndrome (NHLBI, 2011). Insulin is an anabolic hormone that plays a role in the regulation of glucose, lipid and protein metabolism and storage of glucose in the form
of glycogen in the liver and skeletal muscles (Schulman & Zhou, 2009). Insulin is essential to the intracellular transportation of glucose into insulin-dependent tissues like muscle and fat (Wilcox, 2005). “Physiologically, at the whole body level, the actions of insulin are influenced by the interplay of other hormones. … Insulin resistance in most cases is believed to manifest at the cellular level via post-receptor defects in insulin signaling” (Wilcox, 2005, p. 26).

According to the American Heart Association (AHA) website (2016) at least 68 percent of people with diabetes, age 65 years or older, die from some form of heart disease. The AHA (2016) website also states adults with diabetes are two to four times more likely to have heart disease or a stroke than those without diabetes. Diabetes is considered to be one of seven major controllable risk factors for cardiovascular disease (AHA, 2016). Metabolic syndrome and cardiovascular comorbidities share common physiological pathways including “increased oxidative stress, defective glucose and lipid metabolism, low grade inflammation, hypercoagulability and endothelia damage” (Zhou, Wang, & Yu, 2014, p. 1). According to the National Institute of Diabetes and Digestive and Kidney Diseases (n.d.) website, 60 to 70 percent of people with diabetes have some type of neuropathy. Neuropathy occurs as a result of nerve damage caused by prolonged exposure to elevated blood glucose levels and abnormal blood fat levels due to the lack of or resistance to insulin. The University of Washington (n.d.) estimates that 20 to 40 percent of people with diabetes will develop nephropathy. The pathophysiologic mechanisms are not completely understood but the earliest abnormalities include intrarenal hypertension, hyperfiltration and microalbuminuria (Evan & Capell, 2000). Retinopathy is the leading cause of blindness in adults with diabetes, caused by changes in the blood vessels of the retina. Diabetic retinopathy is usually symptomless until the very late stages causing cloudy or blurred vision (Boyd, 2013). Periodontitis is stated to be the sixth complication of diabetes and
is more severe in those with diabetes than those without (Daniel, Gokulan than, Shanmugasundaram, Lakshmigandhan, & Kavin, 2012).

The complications associated with undiagnosed and/or uncontrolled type 2 diabetes have both economical and personal costs. The key to preventing these complications is the ability to control blood sugar as part of the overall treatment plan. Utilization of clinical practice guidelines can help providers to provide evidence based management and thereby minimize the costs associated with this disease.

**Clinical Practice Guidelines (CPGs)**

According to the Institute of Medicine (IOM), “clinical practice guidelines (CPGs) are intended to provide a systematic aid to making complex clinical decisions. When rigorously developed using a transparent process that combines scientific evidence, clinician experiential knowledge and patient values, CPGs have the potential to improve many clinician and patient healthcare decisions and enhance healthcare quality and outcomes” (Graham, Mancher, Wolman, Greenfield, & Steinberg, 2011, p. ix). Guidelines improve care by offering specific treatments, while allowing for monitoring adherence to treatment plans. The developers of CPGs must be cognizant of the four pillars of medical ethics (autonomy, justice, beneficence and nonmaleficence) when creating a trustworthy clinical guideline (Fulda, 2014, August 4). Not all CPGs are trustworthy; therefore, Chant (2013) recommends critical appraisal of CPGs utilizing a validation tool, “just as they would a randomized controlled trail, before deciding whether to adopt any of the guideline’s recommendations.” There are many validation tools in existence. One such validation tool is AGREE (Appraisal of Guidelines for Research and Evaluation). The AGREE validation tool “was developed by a group of researchers from 13 countries to provide a systematic framework for assessing guideline quality” (MacDermid et al., 2005, p. 2). Another
validation tool is GRADE (Grading of Recommendations Assessment, Development and Education). GRADE utilizes a patient’s perspective, quality of life and cost effectiveness when arriving at the strength of recommendations (Chant, 2013).

Several organizations have made recommendations regarding diabetes diagnosis and management. For purposes of this literature review the following five groups will be discussed: American Diabetes Association (ADA), American Association of Clinical Endocrinologists (AACE), United States Prevention Service Task Force (USPSTF), World Health Organization (WHO), and Centers for Medicare and Medicaid Services (CMS).

**ADA Guidelines.** Many organizations have recommended use of guidelines for screening for type 2 diabetes in asymptomatic adults (Dall et al., 2014). The ADA was founded in 1940 to aid physicians, medical professionals and research scientists in the treatment of patients with diabetes. The ADA Standards of Medical Care in Diabetes – 2016 covers the latest updates on the association’s “position statements.” These “statements” are recommendations that have the best chance of improving clinical outcomes in patients with type 2 diabetes (ADA, 2013). Dall et al. (2014, p. 19) found “ADA guidelines detect more people with diabetes and prediabetes compared to United States Preventative Services Task Force guidelines.” In addition, “ADA guidelines detect more people with diabetes and prediabetes among racial and ethnic minorities and low-income households that historically have had less access to the healthcare system” (Dall et al, 2014, p. 20). This makes the ADA guidelines ideal for this project because Hawai’i is believed to have the highest racial minority population of any state, at 75 percent, according to the U.S. Census (NPR, 2009).

**AACE Guidelines.** The AACE was founded in 1991 with a mission to serve as a voice for clinical endocrinologists among the healthcare policymakers within the Health Care
Financing Administration. The goal of the organization is to provide quality, cost-effective care to patients with endocrine disorders and diseases. In 2015, the AACE published an updated CPG for diabetes mellitus. The latest version includes “expanded information on vaccinations; cancer risk; and management of obesity, sleep disorders and depression among persons with diabetes mellitus, as well as medical management of commercial vehicle operators and others with occupations that put them at increased risk of obesity and diabetes mellitus, or in which hypoglycemia might endanger other individuals” (Handelsman et al., 2015, p. 4).

**USPSTF Guidelines.** The USPSTF was created in 1984 as an independent, volunteer panel of national experts in prevention and evidence-based medicine. The group’s goal is to improve the health of all Americans by making evidence-based recommendations on risk versus benefit, and “an assessment of the balance. The USPSTF does not consider the costs of providing a service in this assessment” (Siu, 2015, p. 1). While the USPSTF does not present a CPG, recommendations for screening and treatment interventions are addressed at uspreventiveservicestaskforce.org (USPSTF, 2015).

**WHO Guidelines.** The WHO began in 1948, and consists of more than 7,000 people in 150 different country offices. The WHO works with policymakers, global health partners, civil society, academia and the private sector to develop and implement national health plans in order to promote good health across the life course. The WHO does not present a CPG but, like the USPSTF, has made recommendations for screening and treatment interventions (WHO, n.d.). These recommendations can be found at who.int/mediacentre/factsheets/fs312/en/.

**CMS Guidelines.** In 1965, President Lyndon B. Johnson signed a bill into law that led to the creation of Medicare and Medicaid. The original program included Part A: Hospital Insurance and Part B: Medical Insurance. CMS is a part of the Department of Health and Human
Services (HHS). CMS does not present a CPG but does have services that are covered related to diabetes screenings. Coverage information can be found at medicare.gov/coverage/diabetes-screenings.html.

Table 1 (seen below) provides a synopsis of the diagnostic criteria and clinical management issues addressed by each of the agencies in order to provide input into diabetes screening and management.

Table 1

*Key Points of Diagnostic Criteria*

<table>
<thead>
<tr>
<th>Laboratory Diagnostics</th>
<th>ADA 2015</th>
<th>AACE 2015</th>
<th>USPSTF</th>
<th>WHO</th>
<th>CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c</td>
<td>&gt;6.5%</td>
<td>&gt; 6.5%</td>
<td>&gt; 6.5%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Fasting plasma glucose</td>
<td>&gt; 126 mg/dL</td>
<td>&gt; 126 mg/dL</td>
<td>&gt; 126 mg/dL</td>
<td>&gt; 126 mg/dL</td>
<td>&gt; 126 mg/dL</td>
</tr>
<tr>
<td>Oral glucose tolerance test (OGTT)</td>
<td>&gt; 200 mg/dL</td>
<td>&gt; 200 mg/dL</td>
<td>&gt; 200 mg/dL</td>
<td>&gt; 200 mg/dL</td>
<td>&gt; 200 mg/dL</td>
</tr>
<tr>
<td>Blood pressure goal</td>
<td>&lt; 130/80 mm Hg</td>
<td>&lt; 130/80 mm Hg</td>
<td>N/A</td>
<td>&lt; 130/80 mm Hg</td>
<td>&lt; 130/80 mm Hg</td>
</tr>
<tr>
<td>LDL cholesterol goal</td>
<td>&lt; 100 mg/dL without overt CVD</td>
<td>&lt; 100 mg/dL without overt CVD</td>
<td>N/A</td>
<td>&lt; 100 mg/dL without overt CVD</td>
<td>&lt; 100 mg/dL without overt CVD</td>
</tr>
<tr>
<td>Triglycerides goal</td>
<td>&lt; 150 mg/dL</td>
<td>&lt; 150 mg/dL</td>
<td>N/A</td>
<td>&lt; 150 mg/dL</td>
<td>&lt; 150 mg/dL</td>
</tr>
<tr>
<td>HDL cholesterol goal</td>
<td>&gt; 50 mg/dL in men; &gt; 50 mg/dL in women</td>
<td>&gt; 40 mg/dL for men; &gt; 50 mg/dL for women</td>
<td>N/A</td>
<td>&gt; 45 mg/dL for men; &gt; 50 mg/dL for women</td>
<td>&gt; 40 mg/dL in men; &gt; 50 mg/dL in women</td>
</tr>
</tbody>
</table>

*Guideline Development*

The wellness goal for individuals with type 2 diabetes is to optimize glycemic control and minimize complications (ADA, 2015). To achieve this goal, individuals with diabetes, must be able to access healthcare providers who are experts in the field of diabetes. The ADA has been
chosen as the evidenced based practice guideline for this project based on clarity of presentation and ease of applicability.

A CPG is a compilation of suggestions used to optimize patient care based on a systematic review of evidence and an assessment of the risks and benefits of other care options utilizing a transparent process for translating the evidence into recommendations (Institute of Medicine of the National Academies [IOM], 2011). A CPG eliminates the “one-size-fits-all approach to patient care. CPGs offer an evaluation of the quality of the relevant scientific literature and an assessment of the likely benefits and harms of a particular treatment” (IOM, 2011). CPGs were originally developed by the IOM to enhance care by reducing inappropriate practice variations and streamline translation of research into practice, allowing the patients to receive the most current, up-to-date treatments, and thus, improve quality and safety (Kung, Miller, & Mackowiak, 2012). While these recommendations do not replace a medical provider’s independent judgment, nor are they considered “medical advice,” they were designed to assist the provider in making decisions based on the best evidence available, instead of on tradition or personal bias).

According to Gross et al. (2003), in order for patients to benefit from CPGs, the adherence to the CPGs must be optimized. For this to happen, the CPGs must be 1) medically correct 2) easily understood by the provider and 3) feasible to put in to practice. Furthauer, Flamm and Sonnichsen (2013) found that 70 percent of guideline non-adherence is due to lack of physician knowledge and lack of patient awareness. This leaves room for improvement in both physician and patient diabetes educators in order to increase patient involvement. Fauthauer, Flamm and Sonnichsen (2013) also found that 30 percent of the indicators were not met due to non-adherence, such as a patient having an adverse reaction to the medication or a patient’s
unwillingness to take a recommended medication. Similarly, Sinclair et al. (2012) found that only 55 percent of individuals with diabetes agreed to participate in diabetes education programs, with Native Hawaiians being less likely to participate than Caucasians or Japanese individuals in the state.

Factors Affecting Self-Management of Diabetes

During initial investigation into the topic of CPGs for type 2 diabetic patients, a practice gap was identified. There is a disparity in addressing factors that affect an individual’s “capacity to self-manage diabetes, such as … indigenous origin, socioeconomic status [and] health literacy,” or knowledge about disease (Leach & Segal, 2010, p. 575). Therefore, these factors were included in the review of literature with the hope that identifying what contributes to the high prevalence of type 2 diabetes in Hawai’i can lead to culturally competent interventions that will empower patients to take control of their disease based on best evidence-based practice. Doing so will help the Hawaiian population fight this epidemic.

Knowledge

As stated earlier, the concept of knowledge is especially significant to patients with type 2 diabetes because a “patient’s knowledge about diabetes is associated with better medication adherence and better glycemic control” (Al-Qazaz et al., 2011, p. 1028). The goal of empowering patients with diabetic knowledge is to enhance metabolic control, prevent acute and chronic complications and improve quality of life. Healthcare providers have been trying to make treatment of chronic disease more patient-centered. Knowledge is power. Empowering patients may motivate them to take a personal stand in controlling their disease. Diabetic knowledge will help them make informed decisions about how to modify their lifestyle (i.e.
increased physical activity, healthier eating habits) in addition to increased medication compliance.

Before healthcare providers can expect to change or influence a patient’s behavior, a bond of trust must be established with the patient. Building trust takes time, but a strong patient rapport will improve the ability to provide the best possible care. Levin, Cross, Abrams and Lesser (2002) found two types of trust that affect acquisition of knowledge: “benevolence-based” and “competence-based” trust. Benevolence-based trust occurs when there is the belief that an individual will not cause intentional harm to another. Competence-based trust, on the other hand, is when an individual believes another person shows expertise or knowledge about a subject. Both of these types of trust can then be applied to type 2 diabetes care. An interaction with a healthcare provider can be seen as benevolence-based trust. Establishing trust in the patient-provider relationship can help healthcare providers bring about change.

Environment

Socioeconomic status (SES). Socioeconomic status and socioeconomic position are sometimes used interchangeably. Socioeconomic status commonly refers to an individual’s ability to access resources such as money, power, healthcare and educational opportunities. Socioeconomic position refers to a diversified measurement of class or social standing of an individual or group and is usually examined in terms of occupation, income and education level. SES can be thought of as a ladder, with the rungs on that ladder representing the resources. In this example, the depiction of high SES versus low SES becomes clear. Individuals at the top represent those with higher education, better paying jobs, more opportunities to gather wealth, better health and better access to healthcare resources. Those at the bottom represent individuals with poorer education, lower paying jobs and even sometimes unemployment, and limited access
to healthcare resources (Nancy E. Adler, John D. and Catherine T. MacArthur Foundation, 2007). For the purpose of this paper, the operational definition of the term SES will encompass an individual’s ability to access resources as measured in terms of occupation, income and educational opportunities. Since differences in SES mean differences in access to high-quality education, availability of safe places to exercise, availability and affordability of healthy foods, and access to healthcare services and treatment options, it is important to determine if there is a link between SES and type 2 diabetes.

**Lower SES and Type 2 Diabetes.** Many studies have shown statistical significance between the risk of developing type 2 diabetes and lower SES. For example, Larranaga et al. (2005) found an inverse relationship between type 2 diabetes and SES. More specifically, they found type 2 diabetes occurred two and half times more often when the women in a study had a lower SES compared to women of higher SES (Larranaga et al., 2005). The differentiation between gender in terms of lower SES and type 2 diabetes risk encouraged the further breakdown of the effect of SES into the following groups: childhood SES, educational level, occupation type and income level in relation to type 2 diabetes.

**Childhood SES and Type 2 Diabetes.** Maty, Lynch, Raghanthan, and Kaplan (2008) found a strong correlation in low childhood SES and a later incidence of type 2 diabetes. Their study was especially significant in finding that type 2 diabetes occurs disproportionately higher in women than men who experienced childhood disadvantages. It is interesting to see that low childhood SES remained a strong factor in developing type 2 diabetes despite one’s current occupation or income level. Similarly, Tamayo, Christian and Rathmann (2010) found women with low childhood SES were 3.2 times more likely to develop type 2 diabetes as an adult compared to the women in the study who had higher childhood SES. Demakakos, Marmot and
Steptoe (2012) found that in men, childhood SES was not associated with an incidence of type 2 diabetes, but that current SES was a better determinant of risk for developing type 2 diabetes.

According to Cohen, Janicki-Deverts, Chen and Matthews (2010), low childhood SES exposes the child to toxic physical and environmental factors, such as low quality housing, residential crowding (which has been associated with increased aggression), lower air, noise and water quality, and decreased healthful food options. These disadvantages lead to language and reading impairments, increased aggression, social maladjustments, decreased physical activity and a more sedentary lifestyle and health disparities like type 2 diabetes. McEwen (2008) found childhood experiences determine how an individual will react as an adult when put in new situations. This early imprinting affects behavioral and physiological pathways, effectively changing how allostatic load will affect these individuals.

Allostasis and allostatic load need to be explained because of the role they play in health disparities. Allostasis refers to the body’s ability to maintain homeostasis in the midst of change (McEwen, 2008). Allostatic load, on the other hand, refers to the body’s response to an excess of stress, or the wear and tear from repeated stressors (McEwen, 2008). Fiscella and Williams (2004) found continued exposure to stress, whether due to lack of resources or limited access to health care is detrimental to one’s health because it results in continued wear and tear, or allostatic load.

According to Stringhini, et al. (2013), and their analysis of the Whitehall II prospective cohort study, an individual with cumulative exposure to low SES throughout his lifetime has an even higher risk for developing type 2 diabetes. So, in addition to risks developed from childhood disparities, continued exposure to disparities also negatively impacts health.
Trying to implement interventions to change someone’s SES is a daunting task. However, an article by Hankonen, Absetz and Haukkala (2009) found that SES did not affect the effectiveness of the interventions applied to encourage behavioral changes in patients with type 2 diabetes. The insignificance of SES on effectiveness of interventions is especially encouraging because anyone, no matter the circumstances or station in life, can make positive changes that affect the outcome of type 2 diabetes.

**Occupational status and type 2 Diabetes.** Occupational status is undoubtedly linked with educational level; however, in a study by Rautio et al. (2011), occupation was found to be a stronger indicator than education in developing type 2 diabetes. Additionally, men who were unemployed were found to have a higher BMI, and, therefore, be at higher risk of developing type 2 diabetes. Having a lower occupational status showed a 1.86-fold greater risk of developing type 2 diabetes compared to those in the highest occupational group. The study by Rautio et al. (2011) correlates with data collected for the Hawai’i Diabetes Report 2010 (Hawai’i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai’i State Department of Health, 2010). The Hawai’i Diabetes Report 2010 found the prevalence for type 2 diabetes was highest among those retired or disabled at 10.8 percent, followed by 9.9 percent among those unemployed, and was lowest among those employed individuals at 6.1 percent.

**Income level and Type 2 Diabetes.** Education level, occupation and childhood SES all play a role in the risk for developing type 2 diabetes. It stands to reason then that income would also play a role because income is intrinsically linked to occupation and education level. Drewnowski (2009) found that as income levels decline, energy-dense foods become the best way to provide affordable sustenance. Energy-dense foods are mostly likely to be nutrient poor.
High-fructose corn syrup is a perfect example of an energy-dense food that costs pennies to produce. Consumers will find high-fructose corn syrup in numerous products, including baked goods, beverages, canned and packaged foods, candies, jams, condiments, and roasted nuts.

Researchers from the University of Oxford and University of Southern California found “type 2 diabetes prevalence was 20 percent higher in countries where the food supplies contained high-fructose corn syrup” (“High fructose corn syrup and type 2 diabetes,” 2012, p. np). Drewnoskwi (2009) also found that type 2 diabetes and obesity tend to follow the socioeconomic gradient. There is also a growing price gap between healthy and unhealthy foods, which contributes to the diabetes epidemic.

Data collected for the Hawai’i Diabetes Report 2010 (Hawai’i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai’i State Department of Health, 2010) provides support for Drewosnki’s findings in the Hawaiian population. According to the report, individuals at the lowest income level, or less than $15,000 a year, were three times more likely to have been diagnosed with diabetes compared to those at the highest level of income, or greater than $75,000 a year.

Beliefs

Understanding of an individual’s beliefs is just as important as assessing baseline knowledge about a disease. Many beliefs are tied to culture. Inouye, Li, Davis and Arakaki (2012) found culture and ethnicity are major factors in determining the role of health status, perception of disease and disease management. Participants who classified themselves as Native Hawaiians or other Pacific Islanders were less likely to consider diabetes a serious disease and, further, did not perceive this disease to have a major impact on their lives. One reason may be that the culture is more accepting of larger body mass, despite the fact that larger body mass is
associated with obesity (Tung, 2012). A challenge toward overcoming this cultural belief is to be able to differentiate between being obese due to genetics and being obese due to overeating.

Beyond body weight, other beliefs can impact intervention strategies. Traditional Hawaiian healing is practiced with the whole-person concept in mind (Shintani, Beckham, O’Connor, Hughes, & Sato, 1994). The term “Lokahi i ke ola or Ola Lokahi” is used to describe the whole person and that person’s relationship to the universe (Shintani et al., 1994). Interventions that include the incorporation of traditional Hawaiian culture have been found useful when encouraging adherence to lifestyle modification programs used to treat type 2 diabetes (Shintani et al., 1994).

**Culture.** According to Nam, Chesla, Stotts, Kroon and Janson (2011, p. 3) “cultural factors to consider in diabetes management include food and dietary preferences, lifestyles, traditional and religious beliefs, and beliefs about general health.” In the Hawaiian culture, “‘ohana” (Wight, 1997, p. 212) plays a vital role. This word extends the traditional use of the word family. ‘Ohana includes all who are brought into a family group. When specifically evaluating “‘ohana” and type 2 diabetes, found that patients who had ‘ohana support showed a greater change to more nutritious diets and had an increase in physical activity compared to those in the control group who had no ‘ohana support. Therefore, culturally competent care appears to have an impact on lifestyle changes among Native Hawaiians.

**Attitude**

Attitude also plays an equally important role in knowledge acquisition. Serrano-Gil and Jacob (2010) found personal behavior to be influenced by perception and attitude. It is also thought that adults are more likely to make a change in their behavior - and stick with it - if they are internally motivated. Similarly, Svenningsson, Marklun, Attvall, and Gedda, (2011) found
that a person’s attitude toward a disease can influence everyday management skills. They found a negative attitude toward diabetes may prevent an individual from achieving better glycemic control.

**Education**

Agardh, Allebeck, Hallqvist, Moradi, and Sidorchuk (2011) found a 45 percent increased risk of developing type 2 diabetes among those with a lower education level. For the state of Hawai‘i, education was found to be a better predictor than income to determine risk of obesity, and, therefore, diabetes prevalence (Brown, Hampson, Dubanoski, Stone-Murai, & Hillier, 2009). The researchers also found that Hawaiian/Pacific Islanders had lower educational attainment and, on average were heavier and had larger waist circumferences, which are secondary risk factors for developing the disease. To put the importance of education in perspective, the study conducted by Inouye, Li, Davis, and Arakaki (2012), found 38.9 percent of the participants with type 2 diabetes who identified themselves as Native Hawaiian or Pacific Islander had only a high school education or less. The study by Sacerdote et al. (2012) emphasized the role of education by expanding the sample population. This study found that lower educational levels were associated with an increased risk of developing type 2 diabetes in both men and women in Western European countries.

Results from these studies are consistent with data collected by the Hawai‘i State Diabetes Prevention and Control Program, Chronic Disease Management and Control Branch, Hawai‘i State Department of Health in their Hawai‘i Diabetes Report 2010. This report shows that the prevalence of diabetes decreased with increased education. The prevalence was only 4.8 percent for individuals with a college degree, and increased to 7.7 percent for those with some college but no degree. It climbed up to 9.3 percent for those with only a high school education
and ended at the highest rate, 10.6 percent, for those with less than a high school degree. A study released by the American Journal of Health Promotion discusses the role of amplified disadvantage – which means being disadvantaged in both income and education – and makes the connection that when compared head to head, education, not income, has a stronger association with BMI and, therefore, education level can be a predictor of risk for developing type 2 diabetes (Williams, Andrianopoulos, Cleland, Crawford, & Ball, 2013).

**Adherence**

Poor adherence to drug treatment for type 2 diabetes has been found frequently among adults requiring chronic therapy (Guenette et al., 2015). “It is estimated that 20 to 50 percent of patients with chronic conditions such as diabetes are not adherent to their prescribed medication regimen, with non-adherence being defined as < 80 percent adherence to relevant prescribed medication” (Varming, Hansen, Andresdottir, Husted, & Willaing, 2015, p. 1243). An individualized patient-centered approach is recommended to increase internal motivation and thereby, increase adherence (Varming et al., 2015). One way to improve adherence is to consider a multidisciplinary approach. “Underserved patients with suboptimally controlled type 2 diabetes who were cared for by pharmacists were more adherent to their medication regimen and had better blood sugar control than those who did not have a pharmacist in their care team” ("Care Team - pharmacist," 2015, p. 5).

**Importance of workflow analysis in the management of diabetic patients**

“Workflow, loosely defined, is the set of tasks – grouped chronologically into processes – and the set of people or resources needed for those tasks, that are necessary to accomplish a given goal” (Cain & Haque, 2008, p. 217). Workflow analysis can reveal important information about what occurs in any organization. Insufficient workflow is a problem in many businesses.
Shortcomings surrounding the care of diabetic patients have been largely attributed to fragments and disorganization in the healthcare system (Zai et al., 2008).

**Provider Decision-Making**

Optimal treatment of type 2 diabetes must consider the various comorbidities common to the disease process. “These include coronary artery disease, heart failure, renal and liver disease, dementia and increasing propensity to (and greater likelihood of experiencing untoward outcomes from) hypoglycemia” (Inzucchi et al., 2015, p. 437). Early treatment of hyperglycemia, along with persistent titration of therapy, reduces the development and progression of both micro- and macrovascular complications (Unger, Hinnen, Schreiner, & Parkin, 2013). Effective management requires treatments that address key metabolic deficits and continual reassessment of glycemic targets (Unger et al., 2013).

**Barriers to Using Guidelines**

Diabetes is a complex disease with multifactorial barriers to its treatment and management. “Patients and clinicians differ substantially in their perceptions, knowledge and attitudes, which may lead to confusion and conflict, and in turn, to poor outcomes” (Nam et al., 2011, p. 4). The providers’ attitude toward diabetes management is thought to be more important than their actual understanding of the disease (Nam et al., 2011). However, the providers’ knowledge about evidence-based guidelines is still an important part of affecting the outcome of diabetes care. Harrison, Legare, Graham and Fervers (2010) acknowledge the lack of provider skills and expertise to implement an intervention as a barrier to implementation of a guideline’s recommendation.
Conclusion of Literature Review

Diabetes is a pervasive disease associated with complications that carry high morbidity. The economic burden of diabetes is challenging. Factors that contribute to the development of type 2 diabetes need to be assessed in order to pinpoint gaps in current CPGs. Those individuals with lower SES have a higher risk for developing type 2 diabetes. Allostatic load is another contributing factor to type 2 diabetes. Allostatic load leads to high-risk behaviors such as smoking, overeating, increased alcohol consumption, and decreased sleep quality, leading to elevated evening cortisol, insulin and blood glucose. This contributes to chronic diseases like obesity, type 2 diabetes and coronary artery disease (McEwen, 2008).

There are many high level of individuals with decreased SES in Hawai’i, and access to health care and treatment options for type 2 diabetes is also limited. Consideration of SES is important because even though the patient may come to see a provider, financial limitations might preclude: purchase of the medication(s) prescribed, inability to safely make lifestyle modifications (no safe place to exercise and/or not being able to afford healthful food options). Cultural beliefs and attitudes about type 2 diabetes also affect adherence to CPGs.
Chapter 3 – Project Design and Evaluation Plan

This chapter presents the project design, aims and objectives, and identification of evaluation methods utilized. Discussion of a proposed budget and projected timeline are also included. The methods and project design were derived from the ACE Star Model of Knowledge Transformation (Stevens, 2004). Star Points 1 and 2 were the basis of this PIP.

Conceptual Framework

The conceptual model, (seen below in Figure 2), chosen for this project is the ACE Star Model of Knowledge Transformation (Stevens, 2004). This model was created to help understand the process of knowledge transformation. Knowledge transformation is a cyclical process that starts with discovery, moves to summary, then translation, integration and evaluation. The ACE Star Model of Knowledge Transformation is best for understanding the characteristics of knowledge that are utilized in evidence-based practice (EBP). This model allows for old and new concepts to be integrated in order to improve patient care.

![ACE Star Model of Knowledge Transformation](image)

*Figure 2. ACE Star Model of Knowledge Transformation - reproduced with expressed permission*
**Star point 1 – discovery research.** This is better known as the knowledge-generating stage. New knowledge is discovered through research results. This stage builds the core of research about the clinical interventions to be enacted.

**Star point 2 – evidence summary.** This is the first step in synthesis of the evidence into a single statement. In this stage, knowledge is also generated at the same time summary synthesis is occurring. Evidence summaries are like those used in the Agency for Healthcare Research and Quality or a systematic review like the Cochran Collaborative.

**Star point 3 – translation to guidelines.** Translation of evidence occurs in two stages. First, the translation of evidence into practice recommendations, and then, the integration of evidence into practice. These recommendations are usually called CPGs in the form of protocols, algorithms or clinical pathways.

**Star point 4 – practice integration.** This stage involves changing the formal and informal practices of an organization to integrate the new evidence.

**Star point 5 – process, outcome evaluation.** In this final stage evaluation of the integrated information is achieved. The evaluation is important to examine the patient health outcomes, satisfaction of both patient and provider, efficiency of intervention, cost analysis and health status impact.

**Study Design**

The study design used for the PIP is a quality improvement project plan. “EBP unifies research evidence with clinical expertise and encourages utilization of care through inclusion of patient preferences” (Stevens, 2013, p. np). The ACE Star Model of Knowledge Transformation (Steven, 2004) highlights the essential steps necessary to convert one form of knowledge to the next, combining the best research evidence with clinical expertise and patients preferences in
order to achieve EBP. The ACE Star Model of Knowledge Transformation (Stevens, 2004) offered a comprehensive approach to translating evidence into practice and was utilized as the basis of this quality improvement project.

Setting

The HIFHC was the chosen location to conduct this study. HIFHC is located in the heart of Hilo, Hawai’i, and serves patients from across the island of Hawai’i. HIFHC opened in 2009, and currently has a practice of 1,448 patients, with a six-to-eight month waiting list for evaluation of new patients. HIFHC is a family practice clinic that aims to provide care to the whole family - from helping patients with family planning to providing care during pregnancy, caring for children and helping families through the final stages of life. It is also a teaching facility that provides a multidisciplinary approach to patient care. The clinic is staffed with three full-time family medicine physicians, one obstetrics/gynecology physician, one adult nurse practitioner, one pharmacist and one psychologist. In 2014 the first four medical residents began their three-year training, and in July 2015, four additional medical residents were added. The clinic practices a longitudinal learning approach in the hopes of helping to solve the non-urban primary-care provider shortage.

According to the HIFHC Family Medicine Residency website (Hawaii Island Family Medicine Residency, n.d.), the longitudinal learning approach is designed to give the learner early exposure to hospital and community-based medicine within each available specialty. Then, in a longitudinal fashion, the learner will continue to work with these specialists, continuing to build and expand on their knowledge base, throughout the rest of the training process. While the process of longitudinal learning is specific to the Family Medicine Residents, a longitudinal
learning approach is promoted among all disciplines (ambulatory care pharmacy practice, advanced practice nursing, and health psychology) that train at the HIFHC.

**Data Collection**

**Aim 1:** Assess the clinic’s management and treatment of type 2 diabetes

**Objective 1:** Examine the workflow at HIFHC for treating type 2 diabetes.

**Objective 2:** Investigate utilization of ADA CPGs to treat patients with type 2 diabetes.

- Conduct a retrospective chart review to assess adherence to ADA CPGs.

Approval for protection of human subjects was obtained from the Institutional Review Board (IRB) and a Memorandum of Understanding (MOU) was obtained from the HIFHC. This allowed data collection commencement at HIFHC. A unique number identifier was given to each patient for privacy protection. This also removed any bias associated with analysis of data.

Data collection was consistent with Star Point 1 – Discovery Research. Interviews were conducted with the office staff and the healthcare providers at the HIFHC in order to determine the workflow process for treating patients with type 2 diabetes. Identification of the formal workflow process was essential to identifying gaps in early classification of type 2 diabetic patients in order to optimize treatment of their disease.

A retrospective chart review was proposed to collect data from 200 charts at HIFHC. Data from these 200 charts formed a convenience sample. Information was collected from charts using the Data Collection Tool (DCT) (Appendix 1). After reviewing the 93 page American Diabetes Association Standards of Medical Care in Diabetes – 2015 the following were pulled as key components for the DCT: height, weight, BMI, blood pressure determination, smoking status and cessation support if necessary, HbA1c levels within the past three months, fasting lipid
profile within the last year (including total, LDL and HDL cholesterol and triglycerides), a referral to eye care professionals for an annual dilated eye exam, a referral diabetic self management education (DMSE), a referral to a diabetic self management support (DSMS), and a dental referral for a comprehensive periodontal examination. “DSME and DSMS are essential elements of diabetes care and the current national standards for DSME and DSMS are based on evidence of their benefits” (ADA, 2015, p. 20). HbA1c testing is to be performed at least twice a year for patients who are meeting treatment goals and testing quarterly for those patients whose therapy is being changed or if they are not meeting glycemic goals (ADA, 2015, p. 34).

Recommendations about immunizations include: annual influenza vaccination to all patients with diabetes who are greater than six months old, administration of the pneumococcal polysaccharide vaccine 23 (PPSV23) to all patients greater than two years of age, administration of pneumococcal conjugate vaccine 13 (PCV13) to previously vaccinated adults who are greater than sixty-five years old (ADA, 2015). After initial diagnosis of type 2 diabetes, most patients are encouraged to begin with lifestyle changes, such as weight loss and increased exercise regimen to achieve or maintain glycemic control (ADA, 2015). When lifestyle efforts alone are unable to achieve or maintain glycemic goals, initiation of Metformin is recommended (ADA, 2015). If the target HbA1c is not achieved after three months on Metformin, the addition of another oral anti-hyperglycemic medication is recommended (ADA, 2015). If the patient demonstrates advanced symptoms of hyperglycemia and/or has markedly elevated blood glucose levels or HbA1c levels, insulin therapy should be considered (ADA, 2015). “Cardiovascular disease (CVD) is the major cause of morbidity and mortality for individuals with diabetes and is the largest contributor to the direct and indirect costs of diabetes (ADA, 2015, p. 49). Therefore the ADA (2015) recommends patient with a blood pressure > 120/80 mmHg should receive
education on lifestyle modifications (diet and exercise) in order to reduce their blood pressure. Those patients with blood pressure >140/90 mmHg should have pharmacological intervention in addition to lifestyle modification education (ADA, 2015). “Pharmacological therapy for patients with diabetes and hypertension should comprise a regimen that includes either an angiotensin-converting enzyme inhibitor (ACE) or an angiotensin receptor blocker (ARB)” (ADA, 2015, p. 49). Patient with type 2 diabetes also have an increased prevalence of lipid abnormalities and those patients who are greater than or equal to 40 years old should be treated with a moderate-intensity statin therapy when clinically indicated (ADA, 2015).

The DCT consisted of demographic information about the patient (assigned provider, age, height, weight, calculated BMI, occupational status and health insurance coverage) and key elements from the ADA 2015 guidelines, as described above. Inclusion criteria for the chart review is as follows: between the ages of 21 and 79, HbA1c level > 6.5 percent and < 9.5 percent, diagnosis of type 2 diabetes within a given time period (January 1, 2015 to December 6, 2015 per IRB application). The exclusion criteria: younger than 21 years old (to avoid potential conflicts with adolescent consent) and older than 79 years old (the elderly have more lenient guidelines for blood sugar regulation due to increased risks of hypoglycemia), HbA1c level < 6.5 percent and > 9.5 percent, pregnant, acute illness defined as any illness that develops quickly and lasts a short period of time (i.e. infection, trauma, fracture), and diagnosis of type 2 diabetes for more than one year. Data analysis consisted of comparing the collected data with current practices versus ADA CPGs to assess effectiveness of treatment utilizing qualitative data. Lab values leading to the diagnosis of type 2 diabetes was compared to current practice and ADA CPG using a Yes/No format. The data evaluated included:
1. Diagnostic labs: Hemoglobin A1c (HbA1c) or Fasting plasma glucose (FPG) or 2 hour plasma glucose level from Oral Glucose Tolerance Test (OGTT) – Yes/No

2. HbA1c level every 6 months for those with stable glycemic control – Yes/No

3. HbA1c level every 3 months in patients who have changed therapies or do not have stable glycemic control – Yes/No

4. Use of metformin, if not contraindicated – Yes/No

5. Addition of second oral agent if HbA1c target not met in 3-6 months – Yes/No

   If yes, which second medication was added

6. Received diabetes self management education (DSME) and diabetes self-management support (DSMS) in accordance with National Standards – Yes/No

7. Blood pressure screening – Yes/No

Other data collected consistent with the ADA CPG included:

1. If blood pressure > 120/80 mmHg – advised on lifestyle modification (weight loss, dietary approaches to stop hypertension [DASH]) – Yes/No

2. If blood pressure > 140/80 (in addition to lifestyle modification) – started on pharmacological therapy (ACE inhibitor or ARB) – Yes/No

3. Lipid values (LDL, HDL) – Yes/No

4. Patient placed on statin – Yes/No

5. Smoking cessation measures – Yes/No

6. Immunization status – Yes/No

7. Recommended influenza vaccine to all diabetic patients ≥ 6 months old – Yes/No

8. Recommended pneumococcal polysaccharide vaccine for all diabetic patients ≥ 2 years old – Yes/No
9. Data Collected Related to Provider Expertise

If more than 200 patients met inclusion criteria a table of random numbers would have been utilized to determine which of the 200 patients would be chosen for the sample population. A simple random sample is necessary to guard against bias. A random number table typically contains 10,000 random digits between zero and nine that are arranged in groups of five and displayed in rows. The total number of patients who met criteria would have been given a number starting at one and ending with N (i.e. one through 250). An excel spreadsheet would have been created, utilizing the formula “rand()” in order to assign random numbers to the sample set. This sample set would then be sorted from smallest to largest and based on this information 200 patients would have been selected.

**Aim 2:** Evaluate the gaps in order to strengthen diabetes care.

**Objective 1:** Analyze data from the microanalysis and adherence to the ADA CPGs

**Objective 2:** Identify other strategies or decision-making approaches being used to treat type 2 diabetic patients in the HIFHC.

a. Star Point 2 - Evidence Summary. Compare the current standards of care implemented at HIFHC, compared to ADA CPG.

b. Perform a knowledge gap analysis to determine areas of emphasis for change to become aligned with ADA CPG.

c. Perform a needs assessment and knowledge gap analysis (Figure 3 – see below) of current standards at HIFHC, compared to ADA CPG.
Aim 3: Develop a strategic plan for dissemination of information about adherence to ADA CPGs at the HIFHC.

Objective 1: Identify the barriers to practice change.

Objective 2: Identify the facilitators to practice change.

a. Create a gap analysis report on findings and provided a copy to HIFHC stakeholders (doctors, adult nurse practitioner, pharmacists) with recommendations for how to improve guideline use.

Project Timeline

The estimated time frame from start of project to spanned over three years. The initial project planning began in September of 2013. The proposed project was discussed on December 4, 2015 with the first and second chairs of this PIP. Submission of Scientific Review Committee (SRC) application was performed on December 4, 2015. Submission to IRB was performed on December 6, 2015. IRB approval was received on December 24, 2015. Start of project did not commence until January of 2016. The first six to eight weeks of the project was focused on data collection. During the subsequent weeks data analysis, knowledge gap analysis and recommendations for practice change took place.
Estimated Budget

A budget is a key element of most proposals as it serves as an outline for spending of the project’s funds. An effective proposal budget defines the proposed project in fiscal terms and aids the reviewer in determining how the project will be conducted. Budget information describes activities planned and personnel involved in order to provide an in-depth picture of how the project will be structured and managed. The proposed budget can be seen below in Table 2.

Table 2

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Summary

This evidence-based project was designed to evaluate the current management style of type 2 diabetic patients at the HIFHC. Use of the ADA (2015) Standards of Medical Care In Diabetes assisted in the creation of the DCT. The DCT validated The ACE Star Model of Knowledge Transformation (Stevens, 2004), methodology, evaluation plan, timeline and budget were the organizational tools used to give this project structure.
Chapter 4 – Results

The purpose of this PIP was to determine whether primary-care providers at the HIFHC are currently delivering comprehensive management of type 2 diabetes to patients in accordance with the ADA CPGs. Proposed outcomes of this project included 1) mapping the workflow analysis of patients with type 2 diabetes at the HIFHC, 2) determining which CPG is utilized in the treatment of type 2 diabetes at the HIFHC, and 3) formulate a plan for dissemination of information found in from this PIP to primary stakeholders at the HIFHC. The results of this quality improvement project are presented in this chapter.

Human Study Protection

The author received approval from the IRB at the University of Hawai‘i on December 24, 2015. Informed consent was not required as this project consisted of a retrospective chart review of type 2 diabetic patients at the HIFHC. Confidentiality was ensured as only the author had access to the patient’s electronic medical records and each patient was given a unique identification code. All data was stored on a thumb drive that was password protected. The data will be stored for 5 years and then will be destroyed on January 1, 2021.

Aim 1: Assessed the clinic’s management and treatment of type 2 diabetes

Objective 1: Examined the workflow at HIFHC for treating type 2 diabetes.

Objective 2: Investigated utilization of ADA CPGs to treat patients with type 2 diabetes.

• Conducted a retrospective chart review to assess adherence to ADA CPGs.

ACE Star Model for Knowledge Transformation: Star point 1 – discovery research. Interviews with the HIFHC office staff and healthcare providers were performed in order to ascertain how diabetic patients are managed. Due to the six-month wait list, prospective patients
must apply to be accepted as patients at the clinic. At this time the perspective patient is told that this is a primary teaching clinic with medical residents, advanced nurse practitioner students, PharmD students, behavioral psychology students and nursing students. The prospective patient is given the opportunity to reconsider moving forward with the application if they are not comfortable with this “learner-centered” environment. The application and previous medical records are then screened by the front office staff for record completeness and evaluation of initial interaction with perspective patient. This information is then passed onto the healthcare providers. New patients are given to the provider who has the most room on their “panel.” The panel is defined as the provider’s overall patient workload. If the patient is accepted into the practice the assigned provider then schedules an initial appointment to “establish” care. Once a patient is identified as a type 2 diabetic patient, based on the individual provider’s discretion, a referral to involve the onsite PharmD in the overall diabetic management of the patient will be generated. If the provider decides not to utilize the PharmD for additional diabetic management; the provider can opt to refer the patient to the Diabetic Education Group. In addition to be an educational group, it also acts as a support group by bringing together other patients with type 2 diabetes at the HIFHC. The Diabetic Education Group meets the third Friday of every month from 1:00 p.m. to 3:00 p.m. This group is lead by the onsite PharmD. At the conclusion of the appointment the patient is given follow up paperwork to be given to the front office staff upon checkout. At checkout the front office staff schedules additional appointments in accordance with the exit paperwork. The workflow process was transformed into a diagram and can be seen below in Figure 4.
Figure 4. Workflow process at HIFHC

A retrospective chart review was performed, at the HIFHC to collect data from the charts of diabetic patients. All medical records at the HIFHC are in electronic format and are accessed through Health Community Connect, a MEDITECH product. The author received database
access from Hilo Medical Center, as HIFHC is considered one of the outpatient clinics, in February of 2014, when advanced practice clinical training commenced.

Providers were labeled as A, B, C, and D to remove bias. Provider A has over 12 years of experience as a family physician. Provider B has over 34 years of experience as a family physician. Provider C has two years of experience as a family physician. Provider D has over 10 years experience as an adult nurse practitioner. There is currently only one PharmD on staff who has one year of clinical experience. Collectively the practice has a total of 59 years experience, with an average of 14.75 years of experience per primary care provider, in caring for patients with diabetes. Due to only one PharmD being onsite, there remains only one-year clinical experience in diabetic management from this discipline.

The HIFHC has 201 patients identified as diabetic in the whole practice. The original list of patients was obtained from the HIFHC’s Program Director utilizing the Health Community Connect electronic medical record (EMR) system; a query was run using the icd-10 codes associated with diabetes. The list was used as a starting point and each of the 201 electronic medical records were reviewed for accuracy and to obtain required information as described in the DCT. For ease of use, the DCT was translated into an excel spreadsheet. All 201 charts were reviewed and the sample size obtained, based on inclusion and exclusion criteria, was 10 patients. During the data collection phase of this PIP, it was determined the HIFHC utilizes the ADA CPGs as the driving force for diabetic care. As mentioned earlier, the HIFHC is a teaching clinic and the model promoted by the PharmD is the ADA CPGs.

Ethnicity data was not part of the original data collection tool but during the data collection phase the author added this information to see if ethnicity had any bearing on outcomes in the treatment of type 2 diabetes. The ethnicity breakdown of the sample population
(n=10) was 40 percent Caucasian (n = 4), 20 percent Native Hawaiian (n = 2) 20 percent Asian (n =2), and 20 percent Portuguese (n = 2). The ethnicity breakdown of the sample population can be seen below in Figure 5.

![Ethnicity of Patients](image)

*Figure 5. Ethnicity breakdown of population in chart review*

The DCT originally listed occupation status as a category of information to be collected. However, during the electronic medical record review it was discovered that this information was not available. In order to obtain this information interviews with selected patients would have been needed and was beyond the scope of the IRB application. Therefore this section was removed from the DCT.

The patient’s ages ranged from 40 to 75 years old with the median age being 51. There were six men and four women. The BMI ranged from 22.6 to 41.9 with a median of 30.31. Four of the 10 (40%) patients listed Quest as the main insurance; four of the 10 (40%) patients listed Medicare B as the main insurance; one (10%) patient listed UH Community Plan as the main insurance; and one (10%) patient listed Blue Cross/Blue Shield as the main insurance. Four of
the 10 (40%) patients had stable HbA1c levels and were having the levels drawn every six months. Three of the 10 (30%) patients were having HbA1c levels drawn every three months along with therapy changes. The remaining three out of 10 patients (30%) did not have sufficient time to have the next HbA1c level drawn in order to be included in the data; cutoff date for the data collection per IRB regulations was December 6, 2015 and the diagnosis date for these two patients were October 6, 2015, and November 3, 2015. Metformin was prescribed on six out of 10 (60%) patients. Three out of 10 (30%) patients were not on Metformin because their HbA1c levels dropped below 6.5%. The remaining patient (10%) was unable to be prescribed Metformin because it was contraindicated due to a creatinine level of 2.17. Two out of 10 (20%) patients were on an additional oral anti-diabetic agent in the form of Glipizide and another two (20%) patients were on insulin in addition to Metformin. Ten out of 10 (100%) patients have received DSME/DSMS. Seven of the 10 (70%) patients have been referred to the PharmD for additional diabetic management. Ten out of 10 patients were diagnosed with hypertension and all (100%) were advised on lifestyle modification in addition to being on and ACE or an ARB. Eight out of 10 (80%) patients were diagnosed with hyperlipidemia and of those eight all (100%) were on a statin. Only one patient out of 10 (10%) was noted to be a smoker and received smoking cessation counseling (100%). Seven out of 10 (70%) patients received the influenza vaccine and six out of 10 (60%) received the pneumonia vaccination. Zero out of 10 (0%) of patients were diagnosed with neuropathy while three out of 10 (30%) patients were given a comprehensive foot exam or a referral to a podiatrist. Four out of 10 (40%) patients were referred to for a retinal exam while zero out of 10 (0%) patients had documented dental referrals. These results can also be seen in Table 3 below.
Table 3

Results from data collection

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>HbA1c levels drawn every 6 months if stable</td>
<td>N=6</td>
<td>N=4</td>
<td>N=4 had HbA1c levels drawn every 3 months due to care changes</td>
</tr>
<tr>
<td>HbA1c levels drawn every 3 months in patient with care changes</td>
<td>N=2</td>
<td>N=8</td>
<td>N=6 had HbA1c levels drawn every 6 months due to stable levels, N=2 insufficient time for 3 months to pass due to IRB limitation</td>
</tr>
<tr>
<td>Metformin prescribed</td>
<td>N=6</td>
<td>N=4</td>
<td>N = 3 Hba1c &lt; 6.5, N = 1 contraindicated d/t Cr 2.17</td>
</tr>
<tr>
<td>Second oral agent used</td>
<td>N=2</td>
<td>N=8</td>
<td>Glipizide was the second oral agent</td>
</tr>
<tr>
<td>DSME/DSMS received</td>
<td>N=10</td>
<td>N=0</td>
<td></td>
</tr>
<tr>
<td>Blood pressure 120/90 – advised on lifestyle modification</td>
<td>N=0</td>
<td>N=10</td>
<td></td>
</tr>
<tr>
<td>Blood pressure &gt; 140/80 – advised on lifestyle and placed on ACE</td>
<td>N=8</td>
<td>N=2</td>
<td>N=2 were on ARB instead of an ACE</td>
</tr>
<tr>
<td>Blood pressure &gt; 140/80 – advised on lifestyle and placed on ARB</td>
<td>N=2</td>
<td>N=8</td>
<td>N=8 were on ACE instead of an ARB</td>
</tr>
<tr>
<td>LDL &gt; 100 mg/dL, Triglyceride &gt; 150 mg/dL – placed on statin medication</td>
<td>N=8</td>
<td>N=2</td>
<td>N=2 not diagnosed with LDL &gt; 100 mg/dL or Triglycerides &gt; 150 mg/dL</td>
</tr>
<tr>
<td>Smoking cessation counseling done</td>
<td>N=1</td>
<td>N=9</td>
<td>N=9 were non-smokers and did not require counseling</td>
</tr>
<tr>
<td>Flu vaccine given</td>
<td>N=7</td>
<td>N=3</td>
<td></td>
</tr>
<tr>
<td>Pneumonia vaccine given</td>
<td>N=6</td>
<td>N=4</td>
<td></td>
</tr>
<tr>
<td>Comprehensive foot exam at least annually</td>
<td>N=3</td>
<td>N=7</td>
<td></td>
</tr>
<tr>
<td>Dilated retinal exam annually</td>
<td>N=4</td>
<td>N=6</td>
<td></td>
</tr>
<tr>
<td>Dental exam every 6 months</td>
<td>N=0</td>
<td>N=10</td>
<td></td>
</tr>
</tbody>
</table>

Aim 2: Evaluate the gaps in order to strengthen diabetes care.

Objective 1: Analyze data from the microanalysis and adherence to the ADA CPGs

Objective 2: Identify other strategies or decision-making approaches being used to treat type 2 diabetic patients in the HIFHC.

ACE Star Model for Knowledge Transformation: Star point 2 – evidence summary.

Analyzing information involves examining it in ways that reveals relationships, patterns, and trends. Using the DCT, the author compiled the quantitative data as seen above and then
compared this data to the original EMR query. This process was based on the Ace Star Model for Knowledge Transformation (Stevens, 2004) Star point 1 – discovery research. The data collected during the workflow analysis shows adherence to the ADA CPGs (see Figure 6 below). Therefore, a needs assessment and knowledge gap analysis were not needed to assist the HIFHC in becoming aligned with ADA CPGs.

<table>
<thead>
<tr>
<th>Future State</th>
<th>Current Situation</th>
<th>Next Action/Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>The HIFHC will utilize the ADA Guidelines to deliver comprehensive care to patients with Type 2 diabetes</td>
<td>The HIFHC utilizes the ADA Guidelines to deliver care to patients with Type 2 diabetes</td>
<td>No further action needed</td>
</tr>
</tbody>
</table>

*Figure 6. Knowledge Gap Analysis: Use of ADA CGPs in the treatment of patients with Type 2 diabetes at the HIFHC*

**Aim 3: Developed a strategic plan for dissemination of information about adherence to ADA CPGs at the HIFHC.**

**Objective 1:** Identify the barriers to practice change.

**Objective 2:** Identify the facilitators to practice change.

DNP programs have begun to provide leaders in healthcare and therefore, “DNP students and graduates must be prepared to think strategically and develop strategic plans to practice strategic management effectively. Acquisition of such skills are needed to ensure patient-centered care, informed by a nursing perspective”. There is no universal template for developing a strategic plan. However, Drucker (2009, p. 125) defines strategic planning as “the continuous process of making present entrepreneurial (risk-taking) decisions systemically and with the greatest knowledge of their futurity; organizing systematically the efforts needed to carry out
these decisions; and measuring the results of these decisions against the expectations through organized, systematic feedback.”

The first step in the strategic planning process was to identify the mission. In this case, the mission is to create a plan for dissemination of information about the HIFHC’s adherence to ADA CPGs. The second step in the plan was to perform a strategic analysis of the data collected utilizing the DTC. Detailed information about the second step was addressed in the section above, Aim 1. Awareness of what needs to change and why is vital to the third step in the strategic planning process. Examination of the internal issues including facilitators and barriers to practice change are also included in this step. There were several internal issues discovered including: 1) there are no universal criteria identified for when to involve the onsite PharmD in the diabetic management process, 2) individual provider expertise needs to be factored into how decisions are made about diabetic management, 3) there is a problem with the accuracy of imported data from the EMR query to the original diabetic list, and 4) there needs to be a process to reach patients who have been referred to PharmD and/or the Diabetic Education Group but have chosen not to attend. The two strongest facilitators to practice change were 1) HIFHC being a “teaching clinic,” and 2) all primary care providers were invested in improving the learning process. The barriers to practice change include 1) the individual provider’s attitudes and beliefs about the best way to manage type 2 diabetes, and 2) with the constant influx of new learners, frequent reassessment of individual abilities needs to be completed to ensure that all providers are on the same page in order to provide the best evidence based care. The next step involves the examination of external factors that affect management of patients with type 2 diabetes. External barriers are defined as those outside of the control of the HIFHC. These include: 1) the patient’s perception of their disease severity and their willingness to comply with
ADA CPGs, 2) the patient’s willingness to meet with the PharmD for further diabetic management, once the primary care provider makes the referral and 3) the Diabetic Education Group is not at a date and time that is convenient for all type 2 diabetic patient’s within the practice. The final step in the strategic plan is to summarize the strengths, weaknesses, opportunities for change and threats to change. This summary can be seen in below in Figure 7.

As this is a DNP PIP, this final paper will be presented to the University of Hawai’i, Hilo Department of Nursing with defense of this project. These findings will also be available to the stakeholders at the HIFHC. The main stakeholders at the clinic include Provider A, Provider B, Provider C, Provider D and the PharmD. The HIFHC will receive a summary of the finding in the form of Figure 7 as seen below.
Propose Mission

- Develop a strategic plan for dissemination of information about adherence to ADA CPGs

Strategic Analysis

- Retrospective Chart Review of Type 2 Diabetic Patients at the HIFHC

Examine Internal Issues

- No universal criteria for referral to Pharm D
- Differing provider opinions on how to manage type 2 diabetic patients (Pharm D has only 1 year experience)
- EMR Access/Information not seen by all providers re: diabetic patient
- EMR importing incorrect data
- Needs to be a process to reach patients who have been referred to PharmD and/or the diabetic education group but have chosen not to attend

Examine External Issues

- Patients are not always willing to follow up with Pharm D
- Patients are not always willing to attend Diabetic Education Group
- Diabetic Education group is not at a time convenient for all patients

Summarize Finding in a Strengths, Weaknesses, Opportunities and Threats analysis

- Strength: teaching clinic
- Weaknesses: no standardized criteria for when to involve the Pharm D.

Figure 7. Strategic Action Plan
Summary

This chapter outlined the outcomes from the data analysis and were summarized in table 3 and figures 6 and 7. The findings identified that the HIFHC promotes and follows the ADA CPG for diabetes management. The strategic action plan was created to provide feedback on ways to further strengthen and improve the current diabetic management process.
Chapter 5 – Recommendations and Conclusions

As described above the overarching aim of this project was to determine whether primary-care providers at the HIFHC were delivering comprehensive management of type 2 diabetes to patients in accordance with the ADA CPGs. According to the data collected the HIFHC does deliver comprehensive care to patients with type 2 diabetes in accordance with the ADA CPGs. However, this PIP revealed areas for improvement to better serve the type 2 diabetic patients at the clinic.

Relation to Theoretical Framework

The ACE Star Model of Knowledge Transformation (Stevens, 2004) was utilized as the theoretical framework for this DNP project. “Knowledge transformation is defined as the ‘conversion of research findings from primary research results, through a series of stages and forms, to impact on health outcomes by way of evidence-based care (Stevens, 2004)” (Keele, 2012, p. 79). This PIP focused on star points 1 and 2: knowledge discovery and evidence summary.

Significance to Practice Setting, Advanced Practice Nursing and Healthcare

Overall the findings suggest that the HIFHC provides care to diabetic patients in accordance with the ADA CPGs. First and foremost there is a need to repeat this project with a larger sample size. This will hopefully be achieved once the administrative issues at the HIFHC have resolved and the clinic is accepting new patients. Patients with diabetes need more contact with healthcare providers to optimal care and management. While there is no single intervention shown to improve patient adherence, an assessment of the patient’s knowledge and their understanding of the treatment plan, along with clear communication between health professionals and the patient are ways to cultivate trust and a therapeutic relationship and thus
improve outcomes in patients with type 2 diabetes (Martin, Williams, Haskard, & DiMatteo, 2005). The multidisciplinary setup, (primary care physicians, an adult nurse practitioner, and a PharmD), at the HIFHC provides the ideal environment to improve current diabetic management. In an article published in Clinical Diabetes (2011) proved that both pharmacist led disease management programs and those led by an advanced practice nursing working in collaboration with primary care physicians improved HbA1c levels and patient satisfaction (Willens, Cripps, Wilson, Wolff, & Rothman, 2011). The pharmacist model and the advance practice nurse model are both are already in place at the HIFHC.

**Strengths, Weaknesses and Limitations**

During Star Point 1 of the ACE Star Model of Knowledge Transformation the HealthConnect Community EMR was utilized in the data collection process. A strength of this PIP was the identification of several EMR flaws. Once a patient has been diagnosed with type 2 diabetes, the healthcare provider has the option to add a “diabetes” section tab to the chart. This tab is accessed within the EMR by clicking on the “Health Maintenance” tab and locating the “diabetes mellitus” tab at the top of the page. The “diabetes mellitus” tab assists the provider in meeting the ADA Guidelines (2015) for comprehensive diabetes care by highlighting the pertinent information in one place. There is a section entitled “general data” which lists the systolic and diastolic blood pressure trends, care plan with individual goals, dental consult, monofilament sensory exam – feet, nutrition counseling, retinopathy screening, tobacco use screening, immunizations received (specific to influenza and pneumococcal), laboratory data (including creatinine, HbA1c, lipid profile, urine albumin/creatinine ratio, urine microalbumin), height, weight, BMI, and current medication list. While the main components ADA Guidelines (2015) are being utilized there are areas where patients are either not following up on the
recommendations or referrals or these areas are not being addressed consistently during the office visits. Unless the provider adds this “diabetes” section this information does not automatically populate the provider note during the office visit. This creates a barrier to assessing the pertinent ADA Guideline information.

A second barrier to addressing the components could be explained by the “learners” not having access to the “diabetes section” information on their progress notes. The main provider is able to see the “diabetes section” information embedded within their progress note as they input the patient information. However “learners”, defined as advanced practice nurses/residents/medical students/pharmacist students, do not have access to this screen. Therefore, unless the provider overseeing the “learner” addresses the information from the “diabetes section” this information might be missed. Access to the full EMR screens by the “learners” will reinforce the use of the ADA CPGs, enhance the “learners” educational opportunities and provide more consistent care to diabetic patients; therefore improving patient outcomes.

Another EMR system flaw is that not all diabetic patients have a “diabetes mellitus” tab added to their chart. Since the addition of this tab is healthcare provider initiated, perhaps the information technology (IT) department could have this tab added when an ICD-10 code for diabetes is added to the patient “problem list.” In addition, the information from the “diabetes mellitus” tab does not always correlate to information from other areas of the chart. For example, one patient had an influenza and pneumococcal vaccination completed but this information failed to show up under the “diabetes mellitus” tab. The information was seen in the “practice notes” section on the date of immunization, as well as under the “immunizations” tab.
The lack of continuity is both cumbersome and inefficient and may result in non-compliance for ADA CPGs.

Testing criteria for diabetes or prediabetes in patients who are asymptomatic includes BMI $\geq 25$ or $\geq 23$ in Asian Americans who have additional risk factors (ADA, 2016). Therefore, monitoring of BMI is an important component in diabetes management. Unfortunately, another inconsistency found in the EMR is that unless the patient’s height is entered on every visit along with their current weight the BMI is not calculated. It would stand to reason that the IT department could arrange for the measurement of the patient’s height from the previous visit could be utilized to calculate the current BMI, especially since the height is not always measured in adults especially after the age of 18 years old.

While the EMR system has some flaws, one strength of the system is the ability to run a report that pulls diabetes data into a spreadsheet to monitor patient progress. When comparing the DCT with the original HIFHC diabetes spreadsheet obtained from the IT query, the HIFHC spreadsheet was more comprehensive. However, utilizing the DCT as a means of validating the information found on the original HIFHC diabetes spreadsheet uncovered inaccuracies of some of the data. For example the creatinine level on a patient was listed as 5473.0. When the chart was opened and the lab values assessed the author found the creatinine level was 1.34. Another inconsistency was the total cholesterol, triglycerides and HDL values are accurate but the LDL column is sometimes left blank when the LDL values can be seen under the “laboratory results” tab. This appears to be an IT query issue. There are other variations in the data recordings and it is unclear if this is due to the healthcare provider not entering the data correctly or if the IT query of the data is the culprit. This is a problem because items such as diabetic education and referrals for a retinal exam or a podiatrist referral are not consistently being credited which
skews the data in a negative light. Fixing these IT problems is in the best interest of the HIFHC because a complete and comprehensive EMR system increases the amount of clinical information available at the point of care and improves patient outcomes (Reed et al., 2012). Perhaps these IT issues could be addressed by utilizing a Computer Science student’s senior project to make these improvements.

The workflow analysis of how type 2 diabetic patients are being treated at the HIFHC was a pertinent part of this PIP. The investigation permitted the data to be processed utilizing the ACE Star Model of Knowledge Transformation (Stevens, 2004) and highlighted areas for improvement. The act of completing the discovery research and evidence summary served as an external validation method of the advantages of diabetic care and management at the HIFHC. Another strength of this PIP was to allow for the analysis of the longitudinal learning approach in combination with a multidisciplinary approach utilized at the HIFHC. The workflow analysis showed there is no standardization as to when to utilize the PharmD services for collaboration in management of type 2 diabetic patients. While this lack of standardization did not appear to affect the outcomes of the 10 patients in this study, future research with a larger sample size is necessary in order to optimize utilization of the PharmD. Additionally the role of years of practical experience in the management of type 2 diabetes versus the strict use of a CPG would be especially interesting as the HIFHC has a number of providers with many years experience while the PharmD has only one year of clinical experience.

The limitations of this study include a small sample size that was performed at one clinic site. While the total number of diabetic patients identified through the EMR was 201, all but 10 patients met criteria of being a new diabetic patient or a new patient at the HIFHC in the last 12 months. During the evaluation period, January 1, 2015 to December 6, 2015 the HIFHC
experienced a change in management in addition to an integral team member being out on leave. These internal issues lead to a hold on accepting new patients into the HIFHC practice as previously anticipated thus resulting in a sample size of 10 for this study.

**Recommendations for Practice**

Based on the internal and external issues found during this project the following interventions are recommended. First, establishing criteria for when to trigger a referral to the PharmD for further diabetic management would be helpful to standardize the process within the practice. Secondly, addressing the flaws with the EMR system are essential to improving the accuracy of data collection as well as improving patient outcomes through the utilization of the ADA CPGs. Third, a process needs to be established for follow up with those patients who have been referred to the PharmD and/or the diabetic education group but have chosen not to attend.

**Future Research and Quality Improvement Projects**

The number of future projects related to the findings of this PIP are numerous. Pay for performance programs generally target people with chronic illnesses. Studies have shown that pay-for-performance programs that focus on diabetes management have improved outcomes. A project that focuses on how pay-for-performance could factor into correcting the current EMR problems as well a workflow analysis of who is responsible for paying for the current EMR access screens could be both interesting and cost effective. The practical experience of the primary care providers at the HIFHC might play a role in the decision making process utilized in the management of patients with type 2 diabetes and could warrant further study. Also, the HIFHC is a training center for the behavioral health psychologists from the I Ola Lahui Psychology Fellowship Training Program. In an article by Harris and Lustman (1998) discussion of the “ideal” diabetes treatment team included a physician, a diabetic nurse educator,
a psychologist and a dietician. Research on the affect of behavioral health psychologists working in collaboration with primary care providers to enhance the outcomes of type 2 diabetic patients would also make an interesting study.

**Conclusion**

The HIFHC has a comprehensive diabetic management system in place in the form of the ADA CPGs. Based on the charts reviewed, providers use the ADA CPGs to provide care to patients with type 2 diabetes. Changes to the EMR as identified above will assist the primary care providers in the management of their patients with type 2 diabetes in addition to enhancing quality control. Repeating this project in the future is warranted to provide the opportunity for a deeper understanding of clinical decisions made by the providers at the HIFHC with a larger sample size.
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Appendix 1

**Data Collection Tool**

<table>
<thead>
<tr>
<th>Patient Identifier to protect privacy #</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age:</strong></td>
</tr>
<tr>
<td><strong>Assigned Provider:</strong>  A B C D</td>
</tr>
<tr>
<td><strong>Height</strong></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
</tr>
<tr>
<td><strong>BMI</strong></td>
</tr>
<tr>
<td><strong>Occupational Status:</strong></td>
</tr>
<tr>
<td><strong>Insurance:</strong></td>
</tr>
<tr>
<td><strong>Lab value at diagnosis (HbA1c, fasting plasma glucose, OGTT)</strong></td>
</tr>
<tr>
<td><strong>Current HbA1c level</strong></td>
</tr>
<tr>
<td><strong>Yes</strong></td>
</tr>
<tr>
<td><strong>HbA1c levels drawn every 6 months if stable</strong></td>
</tr>
<tr>
<td><strong>HbA1c levels drawn every 3 months in patient with care changes</strong></td>
</tr>
<tr>
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<tr>
<td><strong>Pneumonia vaccine given</strong></td>
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</tr>
<tr>
<td><strong>Dilated retinal exam annually</strong></td>
</tr>
<tr>
<td><strong>Dental exam every 6 months</strong></td>
</tr>
</tbody>
</table>

This tool was devised based on ADA 2015 guidelines.
Appendix 2

use of ACE star model

Academic Center for Evidenced-Based Nursing <acestar@uthscsa.edu>
To: Allyson Wong <allyson3@hawaii.edu>

Ms. Wong,

Dr. Stevens has reviewed your request, and you may use it under the fair-use rule, but you will need to give written credit.

However, if you are re-publishing the copyrighted material, specific permission is required.

Dr. Stevens is the copyright holder and grants you permission to include the model image and a paraphrased description of the model. The image must be accompanied with this phrase: "Copyrighted material (Stevens, 2012). Reproduced with expressed permission" and the bibliographic reference included: Stevens, K. R. (2012). ACE Star Model of EBP: Knowledge Transformation. Academic Center for Evidence-Based Practice. The University of Texas Health Science Center San Antonio.

Another resource is the Essential EBP Competencies booklet that was developed through ACE...the description of the development is found at http://www.acestar.uthscsa.edu/ebp_compet.asp. If you’re interested in ordering an Essential Competencies booklet, just complete an Essential Competencies order form and mail it back with your $30 check.

A number of clinical agencies and academic institutions have benefitted from using our EBP readiness survey, called the ACE EBP – Readiness Inventory (ACE-ERI). The ACE-ERI is a self-report instrument based on national consensus EBP competencies (Stevens, 2005 & 2009). The survey is administered electronically and can be used to assesses EBP Readiness in both clinician and student populations. If you are interested in more information about this instrument, contact Dr. Frank Puga, pugaf@uthscsa.edu, 210 567-5846.

On another note, our Center is also involved with the Improvement Science Research Network (ISRN). The ISRN’s work is to advance the emerging field of improvement science. Our mission is to advance the scientific foundation for quality improvement, safety and efficiency through transdisciplinary research addressing healthcare systems, patient centeredness, and integration of evidence into practice. It provides
Appendix 3

December 23, 2015

TO: Allyson Wong
    Alice Davis
    Principal Investigators
    School of Nursing

FROM: Denise A. Lin-DeShetler, MPH, MA
      Director

SUBJECT: CHS #23642- “Controlling Type 2 Diabetes - Are Clinical Practice Guidelines the Answer?”

This letter is your record of the Human Studies Program approval of this study as exempt.

On December 23, 2015, the University of Hawai‘i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45CFR 46.101(b)(Exempt Category 4).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html.

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.