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Practitioners' Use of Clinical Practice Guidelines: An Evidence-Based Approach

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PRACTITIONERS' USE OF CLINICAL PRACTICE GUIDELINES IN PATIENTS WITH PRE-DIABETES: AN EVIDENCE-BASED APPROACH

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Abstract

Pre-diabetes is a serious health problem in the United States. Distinguished by plasma glucose levels that are above the normal threshold, patients with pre-diabetes are 10 times more likely to develop type 2 diabetes. Patients with pre-diabetes suffer the same complications as patients with diabetes including diabetic retinopathy, nephropathy, and microalbuminuria.

There is considerable evidence to support the idea that early identification and aggressive treatment of pre-diabetes has the potential to delay disease progression. The American Diabetes Association's clinical practice guideline recommends management of with lifestyle modification and metformin for patients who are at risk for developing type 2 diabetes. The purpose of this project was to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care providers at a volunteer-run clinic located in a large metropolitan area in the southeastern United States.

This study, even with a small sample size (n=26) revealed that the providers at the clinic had not implemented the 2012 ADA clinical practice guidelines. Clinical practice guidelines promote health care interventions that have proven benefits and improve the consistency of care provided to patients. The greatest benefits of implementing clinical practice guidelines for patients with pre-diabetes are early diagnosis and aggressive disease management. This would improve patient outcomes and in the long run, decrease the cost of medical care.

Keywords: pre-diabetes, clinical practice guidelines, impaired fasting glucose, impaired glucose tolerance, metformin, pharmacologic intervention, prevention of type 2 diabetes

Chapter One: Introduction

Pre-diabetes is a precursor to diabetes and is a public health epidemic in the United States (Centers for Disease Control and Prevention [CDC], 2011). Diabetes develops insidiously, during which time glucose metabolism progresses from normal to pre-diabetes, then to diabetes (Rhee et al., 2010). Although most patients with pre-diabetes experience no symptoms, it, like diabetes, has the potential for significant morbidity and mortality. This chapter provides an overview of pre-diabetes, discusses the extent and significance of the problem, and describes the current standards of care in pre-diabetes management. It concludes with the clinical problem, purpose of project, and an operational definition of terms.

Background

Pre-diabetes is one of the most common medical conditions encountered in primary care (Fonseca, 2007; O'Mara, 2008). This chronic condition is distinguished by plasma glucose or glycosylated hemoglobin (HbA1C) levels that are above the normal threshold (American Diabetes Association [ADA], 2012; Fonseca, 2007; O'Mara, 2008). Pre-diabetes includes impaired fasting glucose (IFG), impaired glucose tolerance (IGT), and a combination of both IGT and IFG (ADA, 2012; Aroda & Ratner, 2008; CDC, 2011; Fonseca, 2007; World Health Organization [WHO], 2006). The WHO and International Diabetes Federation defines IFG as a fasting plasma glucose (FPG) between 110 mg/dL and 126 mg/dL, and IGT as a FPG less than 126 mg/dL and blood glucose levels between 140 mg/dL and 200 mg/dL two hours after a 75 gram glucose drink (WHO, 2006). The American Diabetes Association uses slightly lower criteria in the diagnosis of pre-diabetes (ADA, 2012). Associated laboratory values for pre-diabetes include FPG levels between 100 mg/dL and 125 mg/dL, postprandial blood glucose levels between 140 mg/dL and 199 mg/dL two hours after a 75 gram oral glucose load on a two hour oral glucose tolerance test

(2h OGTT), or a HbA1C range of 5.7 to 6.4% (ADA, 2012; Biuso, Butterworth, & Linden, 2007; Fonseca, 2007; Pagana & Pagana, 2011). Table 1 presents a comparison of the laboratory tests, values and associated pre-diabetic conditions according to the ADA and WHO.

Table 1

Comparison of Pre-Diabetes Laboratory Values by Health Organization

Pre-Diabetic Condition	**Laboratory Test**	**Diagnostic Laboratory Values`**	
		ADA	**WHO**
IFG	FPG	100-125 mg/dL	110-125 mg/dL
IGT	FPG	---	<126 mg/dL
	2h OGTT	140-199 mg/dL	≥140 and <200 mg/dL
Pre-Diabetes (IFG/IGT)	HbA1c	5.7-6.4%	Not recommended

Note. Adapted from "Standards of Medical Care in Diabetes – 2012" by American Diabetes Association, 2012, *Diabetes Care*, *35*(Supplement 1), p. S16. Copyright 2012 by the American Diabetes Association. Adapted from "Definition and Diagnosis of Diabetes Mellitus and Intermediate Hyperglycemia" by World Health Organization, 2006, Geneva, Switzerland: World Health Organization, p. 3. Copyright 2006 by the World Health Organization.

Prevalence of Pre-Diabetes and Diabetes

The prevalence of diabetes continues to grow exponentially. Diabetes was the seventh leading cause of death in the United States in 2007 and the risk of death among people with diabetes is nearly double that of people of similar age who do not have diabetes (CDC, 2011). In 2011, approximately 79 million, or 26%, of U.S. adults over 20 years of age had pre-diabetes (CDC, 2011; Cowie et al., 2009). The latest data from the Centers' for Disease Control (CDC) (2011) indicate that nearly 35% of non-Hispanic whites, 35% of non-Hispanic blacks, and 36% of Mexican Americans have pre-diabetes.

Currently there are no data for the prevalence of pre-diabetes in the state of Florida or Duval County. Data regarding diabetes, however, are suggestive that pre-diabetes is also a state and local problem as the prevalence of Floridians with diabetes increased by 57.4% from 1999 to 2009 (Florida Department of Health, Bureau of Epidemiology [Florida DOH], 2011). According to self-reported

Behavioral Risk Factor Surveillance System (BRFSS) surveys, 10.7% of Florida adults have diabetes, which is approximately 1.5 million residents (Florida DOH, 2011). The most recent data from the BRFSS indicate that 9.5% of non-Hispanic whites, 13.5% of non-Hispanic blacks, and 12.1% of Hispanics living in Florida have diabetes (Florida DOH, 2011).

Diabetes and its complications are substantial causes of morbidity and mortality, reduced quality of life, and economic loss (CDC, 2011; Cowie et al., 2009). The annual financial burden of diabetes in the U.S. exceeds $174 billion. The average medical expenditure for patients with diabetes is 2.3 times higher than those without diabetes (CDC, 2011).

Patients with pre-diabetes are 10 times more likely to develop type 2 diabetes (Rhee et al., 2010). These patients also suffer the same complications and comorbidities as patients with diabetes (ADA, 2012; Milman & Crandall, 2011; Rhee et al., 2010). Evidence suggests even slight elevations in plasma glucose levels are associated with concomitant diabetic retinopathy, nephropathy, and microalbuminuria (Aroda & Ratner, 2008; Milman & Crandall, 2011, Ngatena & Kapustin, 2011; Parikh et al., 2010). Other comorbidities associated with pre-diabetes include atherosclerosis, peripheral vascular disease, hyperlipidemia, cardiovascular disease, and stroke (ADA, 2012; Fonseca, 2007; Salyers, 2011; Scheen, 2007; WHO, 2006).

Standards of Care

Early identification and aggressive treatment of persons with pre-diabetes has the potential to minimize disease progression and delay the onset of comorbidities associated with diabetes (ADA, 2012; CDC, 2012; Ngatena & Kapustin, 2011; Yuen, Sugeng, & Weiland, 2010). The primary goal of clinical management of pre-diabetes is to help the body to use insulin properly while preventing or delaying the onset of overt type 2 diabetes. "The Standards of Medical Care in Diabetes – 2012," the ADA's clinical practice guideline (CPG), recommends clinical management of pre-diabetes with lifestyle modification

(LSM) and metformin (ADA, 2012). Pharmacotherapy with metformin is recommended as first line treatment for those at very-high-risk for developing type 2 diabetes. This includes patients with a history of gestational diabetes (GDM), patients who are obese, and those with severe or progressive hyperglycemia (ADA, 2012). Table 2 depicts the recommendations for the management of patients with metformin to prevent or delay progression to type 2 diabetes.

Table 2

Recommendations for the Management of Patients with Metformin

Risk Factor or Medical Condition
-Patients with IGT
-Patients with IFG
-Patients with a HbA1c of 5.7-6.4%
-Body mass index (BMI) $\geq$35 kg/m^2 [a]
-Age >60 years *
-Women with prior diagnosis of gestational diabetes mellitus[a]

Note. Adapted from "Standards of Medical Care in Diabetes – 2012" by American Diabetes Association, 2012, *Diabetes Care, 35*(Supplement 1), p. S16. Copyright 2012 by the American Diabetes Association.
[a] Metformin should be considered especially if these patients have IGT, IFG, or HbA1c 5.7-6.4%

Abbreviated Literature Review

Several studies and clinical reviews have examined the efficacy of various pharmacologic agents in preventing type 2 diabetes (Knowler et al., 2002; Lily & Godwin, 2009; Salpeter, 2008; Yuen et al., 2010). Metformin, however, is currently the only pharmacologic therapy recommended for the treatment of pre-diabetes (ADA, 2012). Evidence has found that metformin was as effective as LSM in preventing type 2 diabetes in patients with a history of GDM and those patients with a BMI index of 35 kg/m2 or greater (ADA, 2012; Knowler et al., 2002).

Problem

The health clinic utilized for this project provides free primary care and preventive medical services to the working uninsured in Jacksonville, Florida. Chronic and acute conditions such as asthma, chronic

obstructive pulmonary disease, hypertension, hyperlipidemia, diabetes, coronary artery disease, upper respiratory infections, and pneumonia are managed through diagnosis, education, and medications. The ADA's clinical practice guidelines regarding the management of diabetes are updated and published in January of each year. This provided an opportunity to evaluate the practices of health care providers at the clinic regarding the implementation of the 2012 ADA standards of care for the management of patients with pre-diabetes in the clinic. The PICO statement for this project is: (P) Did health care practitioners providing primary care services at a clinic for the working uninsured (O) adhere to the (C) 2012 ADA clinical practice guidelines for the management of patients with pre-diabetes six months after (I) they were published?

Project Purpose

The purpose of this project was to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care providers at a clinic for the working uninsured. Specifically this project evaluated if health care providers implemented the 2012 ADA standards of care when managing patients with pre-diabetes using lifestyle modification, medication, or a combination of both.

Project Description

The paradigm of evidence-based practice served as the framework for this project. Evidence-based practice is the diligent, precise, and thoughtful use of the best evidence when making decisions and providing care to patients (Melnyk & Fineout-Overholt, 2011). This practice requires the health care practitioner to integrate clinical expertise with the best relevant, clinical evidence while considering the individual preferences of the patient (Melnyk & Fineout-Overholt, 2011; Sackeit, Rosenberg, Muir-Gray, Haynes, & Richardson, 1996).

This project utilized a retrospective analysis to evaluate provider practice regarding the management of patients with pre-diabetes starting six months after the publication of the guidelines. The outcome measure was implementation of the 2012 ADA standards of care for patients with pre-diabetes.

Definition of Terms

Fasting Plasma Glucose (FPG)

A laboratory test that measures the amount of glucose in a person's blood plasma after a period, usually eight hours, of fasting. This test is used to screen for pre-diabetes and diabetes (Pagana & Pagana, 2011).

Gestational Diabetes (GDM)

High blood sugar or diabetes that starts or is first diagnosed during pregnancy. This condition usually occurs approximately half way through the pregnancy. Pregnant women are screened between the 24^{th} and 28^{th} week of pregnancy for this condition (ADA, 2012).

Hemoglobin A1c (HbA1c)

A laboratory test that measures the amount of glucose attached to hemoglobin. It is used to diagnose and monitor pre-diabetes and diabetes treatment. This test reflects the amount of glucose available in the blood stream over a red blood cell's 120 day life span. This test is also used to assess blood glucose control over a three to four month period (Pagana & Pagana, 2011).

Impaired Fasting Glucose (IFG)

A pre-diabetic state in which the fasting blood glucose level is consistently elevated above the normal level, however, it is not high enough to be diagnosed as diabetes mellitus. The ADA criterion defines IFG as having fasting glucose levels 100 mg/dL and 125 mg/dL (ADA, 2012).

Impaired Glucose Tolerance (IGT)

A pre-diabetic state of hyperglycemia where the glucose level is elevated after a two hour oral glucose load, however the glucose level does not meet criteria for type 2 diabetes mellitus. A two-hour glucose level of 140 to 199 mg/dL on the 75-g oral glucose tolerance test is considered IGT (ADA, 2012).

Lifestyle Modification (LSM)

Activities such as improved diet and nutrition, weight management, and exercise aimed at preventing diabetes and improving plasma glucose levels in patients with pre-diabetes (ADA, 2012).

Metformin

The oral diabetic medication in the biguanide class that is approved for use in the United States. It is the first-line drug of choice for the treatment of pre-diabetes. Metformin works by suppressing glucose production and improving insulin action in the liver (Rizza & Vella, 2009).

2 Hour Oral Glucose Tolerance Test (2h OGTT)

Referred to as the glucose tolerance test, this laboratory assay measures the body's ability to metabolize glucose. The test can be used to diagnose pre-diabetes, diabetes, or gestational diabetes (Pagana & Pagana, 2011).

Pre-Diabetes

For the purposes of this study, the ADA (2012) criteria was used for the diagnosis of pre-diabetes (see Table 3).

Table 3

ADA Diagnostic Criteria for Pre-Diabetes

Diagnostic Test	**Laboratory Value**
FPG	100-125 mg/dL
2h OGTT	140-199 mg/dL
HbA1c	5.7-6.4%

Note. Adapted from "Standards of Medical Care in Diabetes – 2012" by American Diabetes Association, 2012, *Diabetes Care, 35*(Supplement 1), p. S16. Copyright 2012 by the American Diabetes Association.

Type 2 Diabetes

A chronic disease in which there are elevated levels of glucose in the blood. Type 2 diabetes is the most common form of diabetes (ADA, 2012).

Working Uninsured Population

Persons who are employed and live in or work an average of 20 hours per week in Duval County or Jacksonville, Florida , and have an income of 1.5 times the poverty level or hold no health insurance.

Chapter Two: Review of Literature

This chapter provides an overview of the literature sources and search strategies that were used to locate and retrieve the best evidence regarding the pharmacologic management of pre-diabetes with metformin. This is followed by a discussion of the evidence regarding the use of HbA1c in the diagnosis and management of pre-diabetes. Next the ADA clinical practice recommendations will be analyzed using the Appraisal of Guidelines for Research and Evaluation II (AGREE II) Instrument. This chapter concludes with a synthesis and discussion of the evidence regarding the use of metformin and LSM in the treatment of pre-diabetes.

Literature Sources and Search Strategies

For this review, the following databases were searched: UNF One Search, OVID, Medline, and Cochrane. The following terms were used in various combinations to search the above databases: ADA clinical practice recommendations, impaired fasting glucose, impaired glucose tolerance, pre-diabetes, metformin, prevention of type 2 diabetes, pharmacological intervention, and HbA1c. The initial search yielded 76,099 articles. Searches were then limited to the years 2002 to 2012, the English language, meta-analyses, and randomized controlled trials that were conducted with human subjects investigating the treatment of pre-diabetes with metformin or LSM. A manual search of citations for duplicate articles, seminal studies, and relevant review articles was conducted. The search was then updated through an examination of references from the RCT and meta-analyses. The final search yielded four recent meta-analyses, one CPG, and one randomized controlled trial (RCT).

HbA1c in the Diagnosis and Management Pre-Diabetes

In the past, pre-diabetes and diabetes were diagnosed exclusively using the FPG and OGTT. The HbA1c, however, has emerged as a reliable and convenient tool in assessing plasma glucose levels. The ADA now recommends using the HbA1c in the diagnosis and management of patients with pre-diabetes (ADA, 2012; Tankova, Chakarova, Dakovska, & Atanassova, 2011). The use of HbA1c has some advantages over FPG and OGTT testing. It does not require fasting or special scheduling. The HbA1c also provides a clearer representation of chronic hyperglycemia and is more closely associated with the co-morbidities associated with diabetes (Bonora & Tuomiletho, 2011; Buell, Kermah, & Davidson, 2007; Olson, Rhee, Herrick, & Ziemer, 2010; Tankova et al., 2011).

The HbA1c assay is as precise, if not more accurate, in diagnosing and managing patients with pre-diabetes than the FPG and the OGTT. A study conducted by Silverman et al. (2011) confirmed the ADA standard of a HbA1c of 5.7% as the optimal cutoff for pre-diabetes. This study found that a HbA1c of 5.7% yielded a sensitivity of 54.8%, a specificity of 71.3%, a positive predictive value of 51.4, and a negative predictive value of 74.1 (Silverman et al., 2011). A review of the 1999-2004 National Health and Nutrition Examination Survey (NHANES) data also found that a HbA1c of 5.8% has a sensitivity of 86% and a specificity of 92% for diagnosing pre-diabetes (Buell et al., 2007; Ngatena & Kapustin, 2011). Once a patient has been diagnosed with pre-diabetes, HbA1c can be used to trend and monitor changes and improvements in glycemic control as it accurately reflects a patient's average plasma glucose levels over a period of three to four months (ADA, 2012; Olson et al., 2010).

Evaluation of the ADA Clinical Practice Recommendations

Evidence-based CPGs are systematically developed assertions intended to assist clinicians in making informed making health care decisions (AGREE Next Steps Consortium, 2009; Brouwers, Makarski, & Levinson, 2010). Clinical practice guidelines can also have a significant impact on health

care policy (Brouwers et al., 2010). The "Standards of Medical Care in Diabetes-2012" is the ADA's most recent CPG. This document is reviewed and updated annually and also serves as the ADA's all-inclusive position statement (ADA, 2012).

The AGREE II Instrument was used to assess the global quality, methodological rigor, and transparency of the "Standards of Medical Care in Diabetes-2012." The purpose of this instrument is to provide a uniform approach and framework for assessing the quality of CPGs (AGREE Next Steps Consortium, 2009). It is comprised of 23 criteria that assess CPGs according to six domains including scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, and editorial independence (AGREE Next Steps Consortium, 2009; Brouwers et al., 2010). A seven point likert scale, anchored with "1: strongly disagree" and "7: strongly agree," was used to measure the extent to which each of the criteria are met by the CPG.

The "Standards of Medical Care in Diabetes-2012" was evaluated by three board certified nurse practitioners that routinely encounter patients with pre-diabetes in their daily practice. In general, the ADA's CPG was considered a quality guideline receiving a 15 out of 21 (71%) on the overall assessment. The guideline received the highest score in Domain 1 with 60 out of 63 (95%), which appraises the reporting of the scope and purpose of the guidelines and the clarity of presentation of the guidelines and their lowest score in Domain 5 with 32 out of 84 (38%), which assesses the applicability of the guidelines. Although there is no recommended monitoring or benchmarking criteria presented in the CPG, it was found to be a quality guideline and is recommended for use. Table 4 provides information regarding the overall assessment and domain scores for the "Standards of Medical Care in Diabetes – 2012" using the AGREE II Instrument.

Table 4

Assessment of ADA Clinical Practice Guidelines Using AGREE II

Domain/Area	Evaluator 1	Evaluator 2	Evaluator 3	Total Score %	Best Possible Score
Domain 1: Scope and Purpose	21 (100%)	20 (95%)	19 (90%)	60 (95%)	63
Domain 2: Stakeholder Involvement	18 (85%)	18 (85%)	19 (90%)	55 (87%)	63
Domain 3: Rigor of Development	48 (86%)	48 (86%)	51 (91%)	147 (88%)	168
Domain 4: Clarity of Presentation	20 (95%)	19 (90%)	19 (90%)	58 (92%)	63
Domain 5: Applicability	7 (25%)	12 (43%)	13 (46%)	32 (38%)	84
Domain 6: Editorial Independence	11 (79%)	11 (79%)	11 (79%)	33 (79%)	42
Overall Assessment (Scale of 1-7)	5 (71%)	5 (71%)	5 (71%)	15 (71%)	21
Recommended for Use?	Yes	Yes	Yes	Yes	Yes

Note. Adapted from "The AGREE II Instrument" by AGREE Next Steps Consortium, 2009, retrieved from http://www.agreetrust.org. Copyright 2009 by the AGREE Research Trust.

Analysis of Individual Studies

The disease trajectory for pre-diabetes indicates that approximately one quarter of patients will progress to type 2 diabetes within three to five years and up to 83% of patients with pre-diabetes will develop overt diabetes (Nathan et al., 2007). There is compelling evidence from several clinical trials and meta-analyses that this course can be changed. Pharmacologic intervention with metformin combined with LSM can prevent or delay the progression to diabetes (ADA, 2012; Gillies et al., 2007; Knowler et al., 2002; Lily & Godwin, 2009; Salpeter, 2008; Yuen et al., 2010). The data supporting this relationship are outlined in Table 5 and Table 6.

Table 5

Characteristics of Meta-Analyses and RCTs Investigating Metformin

Author (Date)	Design	Sample	Outcome	Intervention	Results	Limitations
Knowler et al. (2002)	RCT Seminal study	3,234 participants from 27 clinical centers around U.S. who were overweight and had pre-diabetes.	Development of type 2 diabetes	Four groups: 1. LSM 2. Metformin twice a day 3. Control 4. Troglitazone	LSM and treatment with metformin reduced the incidence of diabetes. LSM was more effective than metformin.	Did not take into account relative contribution of LSM in reduction of diabetes.
Gillies et al. (2007)	Meta-analysis	RCTs that evaluated interventions to delay type 2 diabetes in participants with IGT.	Development of type 2 diabetes	No intervention, meta-analysis of 17 RCTs	LSM and pharmacological interventions slowed the progression to type 2 diabetes.	Used Jadad scoring to rate RCTs however no explanation of tool.
Salpeter (2008)	Meta-analysis	RCTs that compared metformin with placebo or no treatment.	Development of type 2 diabetes	No intervention, meta-analysis of 31 RCTs	Improvements in weight, lipid profiles, fasting glucose levels, and insulin resistance noted. Patients treated with metformin had a 40% decrease in the progression to diabetes	No discussion of tool or instrument used to rate studies.
Lily & Godwin (2009)	Meta-analysis	RCTs involving administration of metformin to prevent diabetes in subjects with IFG/IGT.	Development of type 2 diabetes	No intervention, meta-analysis of 3 RCTs	Metformin was effective in delaying the progression to diabetes.	No use of electronic databases for search with overlap of some articles.

Author (Date)	Design	Sample	Outcome	Intervention	Results	Limitations
Yuen, Sugeng, & Weiland (2010)	Meta-analysis	RCTs that followed participants for one year. Studies compared intervention with oral hypoglycemic and anti-obesity agents.	Development of type 2 diabetes	No intervention, meta-analysis of 4 RCTs	Oral hypoglycemic and anti-obesity agents reduce the incidence of diabetes.	Internal validity of instrument used to assess studies for inclusion.

Note. Adapted from *Evidence Based-Practice in Nursing and Healthcare* (2nd ed.) (p. 515-516) by B. M. Melnyk and E. Fineout-Overholt, 2011, Philadelphia, PA: Lippincott Williams & Wilkins. Copyright 2011 by Wolters Kluwer Health Lippincott Williams &Wilkins.

Table 6

Characteristics of Clinical Trials Evaluating the LSM and Medication

Trial/Year	**Location**	**Population**	**Age/Gender**	**Intervention[a]**	**Conclusion**	**Criteria**
Pan, 1997	China	n=530 with IGT	>25 years 283 men/247 women	LSM	LSM decreases the incidence of diabetes among those with IGT.	WHO 1985
Finnish Diabetes Prevention Study, 1993	Finland	n=522 with IGT	AGE 33% men/67% women	LSM	LSM reduced diabetes risk.	WHO 1985
Japanese Diabetes Prevention, 2005	Japan	n=240 with IGT	Mean Age=51 51% men/49% women	LSM	LSM is useful in preventing diabetes in Japanese with IGT.	WHO 1999
Kosaka, 2005	Japan	n=356 with IGT	Age 30-70 100% men	LSM	LSM aimed at achieving ideal body weight in men with IGT is effective.	WHO 1980
Liao, 2002	U.S.	n=70 with IGT	Mean Age 55.8 45% men/55% women	LSM	LSM may prevent diabetes in Japanese Americans with IGT	WHO 1998
Wein, 1999	Australia	n=200 with history of GDM and IGT	Age 38-40 100% women	LSM	Incidence rates of diabetes mellitus were lower with metformin than control group.	WHO 1985

Trial/Year	Location	Population	Age/Gender	Intervention[a]	Conclusion	Criteria
EDIT, 2003	UK	n=631, some with IGT	Age 30-70 49% men/51% women	M	Risk of diabetes not reduced with metformin or combination therapy. The ability of therapies to reduce risk of diabetes may differ for those with IGT or IFG.	WHO 1985
Li, 1999	China	n=90 with IGT	Age 30-60	M	Metformin reduces the rate of type 2 diabetes.	WHO 1985
Diabetes Prevention Program, 2002	U.S.	n=3234 with IGT	Age $\geq$ 25 33% men/68% women	B	LSM and treatment with metformin reduced the incidence of diabetes.	ADA 1997
Indian Diabetes Prevention Program, 2006	India	n=531 with IGT	Age 35-55 79% men/21% women	B	LSM and metformin reduced the incidence of diabetes in Asian Indians with IGT; there was no added benefit from combining them.	WHO 1999

Note. Adapted from "Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance" by Gillies et al., 2007, *British Medical Journal*, *334*, pp. 2-3. Copyright 2012 by BMJ Publishing Group Limited.

[a] Intervention abbreviations – LSM=lifestyle modification, M=metformin, B=LSM and metformin

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Randomized Control Trial: Seminal Study

The Diabetes Prevention Program Research Group (DPP) conducted a seminal study regarding the management of patients with pre-diabetes in the United States. This landmark, multicenter RCT evaluated the effect of pharmacotherapy with metformin and LSM on the development of type 2 diabetes in 3,234 obese participants with pre-diabetes (Knowler et al., 2002). In the DPP, participants from 27 clinical sites in the United States were randomly assigned to one of four different interventions: LSM, metformin, troglitazone, and placebo or control. The troglitazone portion of the study was discontinued prior to the completion of the study, because troglitazone was discovered to cause liver damage.

The goal for participants assigned to the LSM segment of the DPP was moderate weight loss through improved nutrition and increased physical activity. Participants in LSM group partook in a 16-week curriculum covering exercise, nutrition, and behavior modification strategies while participants assigned to the metformin group received 850 mg of metformin twice daily. The LSM group experienced a 58% (95% Confidence Interval [CI], 48-66) reduction in the risk of developing diabetes and the metformin group experienced a 31% (95% CI, 17-43) reduction in the risk of developing diabetes (Knowler et al., 2002). Metformin was maximally effective in participants from ages 25 to 44 years and those who were at least 60 pounds overweight (Knowler et al., 2002).

The results of the DPP are significant and imply that LSM and pharmacotherapy with metformin are useful in the prevention of diabetes. Participants in both the LSM and metformin groups experienced lower rates of progression to overt diabetes as compared to 11% for those participants assigned to the placebo or control group. These findings were true for both genders and across all ethnic groups included in the study (Knowler et al., 2002).

Meta-Analyses

Gillies et al. (2007) performed a meta-analysis of RCTs that examined the efficacy of lifestyle and pharmacologic interventions designed to delay or prevent type 2 diabetes in patients with IGT. A total of 17 trials from 1979 to 1996 with 8,084 participants were included. Based on the time period covered in the meta-analysis, multiple diagnostic criteria for type 2 diabetes and IGT were used. Most diagnostic criteria for type 2 diabetes however, were analogous, as they required a plasma glucose level of ≥11.1 mmol/l on the 2 h OGTT and a FPG concentration of ≥7.8 mmol/l. The criterion used to define IGT was 7.8-11.1 mmol/l on the 2 h OGTT.

Gillies et al. (2007) performed four meta-analyses on studies targeting LSM and pharmacologic interventions. Each meta-analysis yielded evidence that LSM and pharmacologic intervention can successfully prevent or delay the onset of type 2 diabetes. A comprehensive meta-analysis of LSM employed revealed a pooled hazard ratio of 0.51 (95% CI, 0.44-0.60, $p<0.001$) indicating a 49% relative reduction in the development of diabetes. The pooled hazard ratio for anti-diabetic medications was 0.44 (0.28-0.69, $p<0.001$) for anti-diabetic medication indicating a 56% reduction in the relative risk of developing diabetes.

The RCTs included in the meta-analysis by Gillies et al. (2007) were heterogeneous in terms of interventions applied, ethnicity, weight, and age. The meta-analysis of LSM identified no reporting or publication bias (Begg's test $p=0.945$ and Egger's test $p=0.340$). Reporting biases however, may have limited the assessment of the efficacy of anti-diabetic medications in reducing or delaying the onset of type 2 diabetes (Begg's test $p=0.012$ and Egger's test $p=0.058$).

A similar meta-analysis by Yuen et al. (2010) included a total of four RCTs. The number of subjects in the included studies ranged from 178 to 3,234. The primary outcome measure for each RCT was the diagnosis of type 2 diabetes according to the 2h OGTT. The criteria used to

define type 2 diabetes however, varied from study to each study. The ADA criterion for type 2 diabetes was used in one study, and the WHO criteria were used in three. The overall risk of bias in the four studies was high. Based on the evidence presented in each study, the authors did not speculate as to which intervention was more effective in preventing type 2 diabetes. The authors however, concluded that LSM and pharmacologic intervention with metformin slow the onset of type 2 diabetes in patients with pre-diabetes.

Lily and Godwin (2009) conducted a meta-analysis of RCTs that evaluated the efficacy of metformin in preventing the onset of type 2 diabetes in patients with IFG or IGT. Incident diabetes was a required outcome measure; follow-up time of a minimum of six months was also required. A total of three RCTs from 1999 to 2002 with 42,932 participants from India, China, and the United States were included. The metformin dosage administered and the rate of progression to diabetes varied across the RCTs. This meta-analysis revealed that regardless of gender or ethnicity, study participants who were treated with metformin experienced a lower rate of conversion from pre-diabetes to diabetes (Odds Ratio [OR] 0.65, 95% CI, 0.55-0.78, $p<.00001$). These findings support the hypothesis that pharmacotherapy with metformin delays the onset of type 2 diabetes in patients with pre-diabetes.

A recent meta-analysis by Salpeter (2008) showed that metformin is beneficial in the treatment of pre-diabetes. This study included 31 RCTs with 4,570 patients who were monitored for 8,267 patient years. The trials included in this meta-analysis assessed pre-diabetic patients from various populations and ethnic backgrounds. Metformin was shown to significantly decrease weight, improve insulin resistance, and reduce the incidence of type 2 diabetes by 40% with a pooled OR of 0.6 (95% CI, 0.5-0.8).

Summary

In summary, the evidence from the clinical trials and meta-analyses demonstrates that pharmacologic intervention with metformin combined with LSM can prevent or delay the progression to diabetes. Many of the clinical trials included in these meta-analyses serve as the basis of the 2012 ADA standards for patients with pre-diabetes. Due to the insidious nature of pre-diabetes, aggressive management with LSM and medication are now cornerstones of care. These are the standards by which the clinical management of pre-diabetes was evaluated at the clinic for the working uninsured.

Chapter Three: Methodology

This chapter includes a description of the design, sample, and data collection tool used for this quality improvement project. There is also a discussion of the methods and procedures for the project including the protection of human subjects. The purpose of this project was to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care practitioners at a clinic for the working uninsured.

Study Design

This study utilized a retrospective review with a one-group post only design. Data was collected from patient charts for the three month period between July and September 2012. This time period was chosen because it was six months after the 2012 ADA clinical practice guidelines were published.

Setting

The setting for this study was a volunteer-run clinic located in a large metropolitan area in the southeastern United States. This clinic includes both physicians and nurse practitioners who provide primary care services to uninsured, working adults and their families.

Sample

A retrospective analysis of 50 medical records were reviewed sequentially to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care practitioners at the clinic for the working uninsured. Permission to conduct this quality improvement project was obtained from the investigator's

project committee, the Institutional Review Board (IRB) at the University of North Florida, and the executive board of the clinic (Appendix B and Appendix C).

Methods

Data was collected for the timeframe covering July to September 2012, which was six months after the 2012 ADA clinical practice guidelines were published. Charts for this study were identified by the clinic staff including individual providers, the chief information officer, and the clinical and medical directors. Potential charts for this study were also identified using a search according to diagnosis and International Classification of Disease Ninth Edition Clinical Modification (ICD-9-CM) codes. Diagnoses that were searched included pre-diabetes, IFG, and IGT. Searches according to ICD-9-CM included 790.21, 790.22, and 790.29.

Data Collection

Data was collected for the timeframe covering July to September 2012. All data was collected by the principal investigator and was de-identified and documented on the study data collection sheet. The data collection sheet that was used in the study is located in Appendix D. After potential charts were identified, the following steps were taken during this project to collect the data:

1. All charts remained at the clinic.
2. Each chart was assigned a unique study "n" number different from the patient identification number used in the clinic. The purpose of the "n" study number was to assist the principal investigator in tracking the total number of charts that were reviewed during the study.

3. Each chart was verified to ensure that the patient was over the age of 18. If there was evidence in the chart that the patient was under the age of 18, the chart was excluded from the study.
4. Each chart was reviewed to verify a diagnosis of pre-diabetes according to the 2012 ADA criteria. If there is no was no evidence of a diagnosis of pre-diabetes according to the ADA 2012 criteria in the patient chart, it was excluded from the study (see data collection tool, Appendix D).
5. Each chart was reviewed to verify that care for pre-diabetes was provided during the timeframe from July to September 2012. If there was no evidence that care for pre-diabetes was provided during that timeframe, it was excluded from the study (see data collection tool, Appendix D).
6. All data was de-identified.
7. Demographic data included the time period or month in which care was provided (see data collection tool, Appendix D).
8. Data collected included treatment modalities employed for the management of pre-diabetes. These treatment modalities included no treatment, LSM, medication, or a combination of LSM and medication (see data collection tool, Appendix D).

Fesaibility

This project was designed to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care providers at a clinic for the working uninsured. The staff at the clinic is dedicated to providing evidence-based primary care and specialty services to the community's working uninsured. The

clinic staff is continuously looking toward quality improvement and are willing to update and change their practices to benefit patients. The data and results obtained from this quality improvement project are not generalizable. The outcomes however, will provide valuable information to the clinic staff regarding the implementation of the 2012 ADA standards of care by the providers.

Income and Expenses

The primary expenses for this project included office supplies and printing. These expenses were considered negligible and were incurred by the principal investigator.

Protection of Human Subjects

This study evaluated existing data from patient charts. Minimal risk was associated with this project. A waiver of consent and a waiver of the Health Insurance Portability and Accountability Act of 1996 (HIPAA) regulations was requested and granted by the IRB at the University of North Florida. Risk of breach of confidentiality however, is an associated risk with any chart review. To mitigate this risk and to ensure that the privacy and security of the data obtained during the study, all HIPAA regulations were followed. All patient records remained at the clinic. Additionally, no individually identifying data was collected. Data from this project was collected and recorded on the data collection sheet and transferred to an electronic spreadsheet (Appendix D).

Confidentiality

Data was stored in a locked file cabinet in the home office of the principal investigator. The data was de-identified and not linked to any identifiable information from the medical record, and used only in aggregate. Each record was assigned a unique study number which was recorded on the data collection sheet.

Data was entered into an electronic spreadsheet on the principal investigator's laptop computer, which was protected by a password. Data from the spreadsheet was uploaded into a Statistical Package for the Social Sciences (SPSS) database. Once data collection was complete, all data was entered, verified and analyzed, all project-related documents were destroyed.

Data Analysis Plan

All raw data entered was entered into the computer and checked for errors. Data was analyzed using SPSS (version 21.0, 2012, Armonk, NY) with statistical significance determined at $p \leq 0.05$. Descriptive statistics such as frequency, percentage, mean, and significance level were used to analyze the implementation of the 2012 ADA standards of care for patients with pre-diabetes at the clinic. Trends in the implementation of the 2012 ADA standards of care were considered significant.

Summary

This chapter describes the methodology for this project, the permissions that were obtained in order to conduct this quality improvement project, and the data analysis plan. Data for this projected were collected using the timeframe covering July to September 2012. Data collected during this project were used to evaluate provider practices regarding the management of pre-diabetes according to the 2012 ADA standards of care. Data analysis provided valuable information for the clinic providers regarding evidence-based practice when caring for patients with pre-diabetes.

Chapter Four: Results

This chapter provides a description of the sample and the disposition of the medical records that met inclusion criteria. Sample characteristics including the time period in which pre-diabetes care was received, treatment modality provided, and if the pre-diabetes care that was provided met the 2012 ADA standards of care, were described using descriptive statistics including the frequency and percentage of the variables. Analyses were executed using SPSS statistical software (version 21.0, 2012, Armonk, NY) with statistical significance determined at $p \leq .05$.

Sample Characteristics

Fifty medical records were initially identified for inclusion in the study. Medical records of 26 patients met the inclusion criteria and were included in the final analysis. All charts included in the study were of patients over the age of 18 who met the ADA criteria for a diagnosis of pre-diabetes and had care for pre-diabetes documented during the period from July-September 2012. A total of 24 charts were excluded: five charts were unavailable because the patients were no longer enrolled in the clinic; four charts did not meet the ADA diagnostic criteria for pre-diabetes; and, 15 charts did not have care documented during the time period of interest. Figure 1 depicts the disposition of the charts identified for inclusion in the study (see Figure 1).

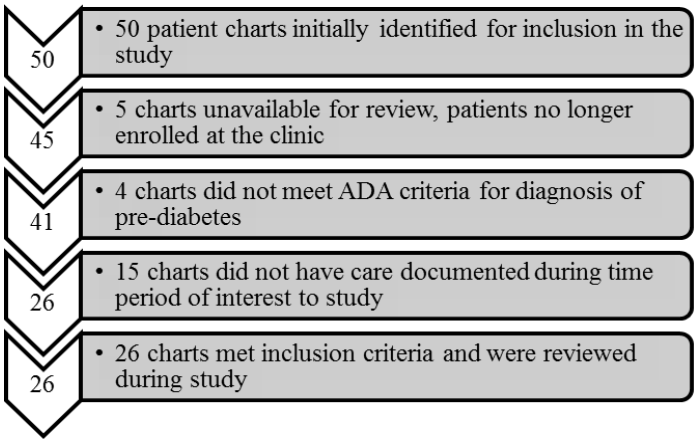

Figure 1. Chart disposition. This figure illustrates the disposition of the charts identified for inclusion in the study.

Time Period of Pre-Diabetes Care

The medical records reviewed had pre-diabetes care documented in each of the three time periods representing July 2012, August 2012, and September 2012 with equal probability, $\chi^2(25, n=26) = 0.34$, $p=.05$. During the period covering July 2012, 12 (46.2%) records had care documented for pre-diabetes. Eight charts (30.8%) had care for pre-diabetes documented during the period covering August 2012, and six charts (23.1%) had pre-diabetes care documented during the period covering September 2012. Table 7 depicts the time period in which pre-diabetes care was provided during the study.

Table 7

Time Period of Pre-Diabetes Care

Month	Frequency	Percent
July	12	46.2
August	8	30.8
September	6	23.1
Total	26	100.0

Treatment Modality

Eight (30.8%) of the medical records reviewed during the study had no documentation of treatment for pre-diabetes. A total of 18 of the medical records reviewed (69.2%) had documentation of some type of treatment for pre-diabetes documented during the study period. One (3.8%) medical record had evidence of a combined approach using LSM and metformin to manage pre-diabetes, while 17 (65.4%) medical records had evidence of LSM as the primary treatment modality for pre-diabetes.

The categories of LSM documented in the medical records that were reviewed included singular modifications such as nutrition counseling (n=6, 35.3%), increased activity or exercise (n=1, 5.9%), weight loss (n=1, 5.9%) as well as combined adjustments including nutrition counseling and increased activity or exercise (n=1, 5.9%), and nutrition counseling and weight loss (n=8, 47.1%) (see Table 8). The type of LSM documented in the reviewed records occurred with different probabilities, $\chi^2(16, n=17) = 0.010$, $p=.05$.

Table 8

Type of LSM Documented in Records Reviewed

Type of LSM	Frequency	Percent
Nutrition	6	35.3
Weight	1	5.9
Exercise	1	5.9
Nutrition + Weight	8	47.1
Nutrition +Exercise	1	5.9
Total	**17**	**100.0**

Standards of Care

Of the medical records reviewed for the study, 25 (96.2%) had no evidence that the 2012 ADA standards of care for patients with pre-diabetes was provided. This included eight (30.8%) records that had no documented treatment for pre-diabetes and 17 (65.4%) records that had evidence of only LSM for the treatment of pre-diabetes. One (3.8%) medical record met the standard of care with documentation of a combined approach using LSM and metformin for the treatment of pre-diabetes (See Figure 2).

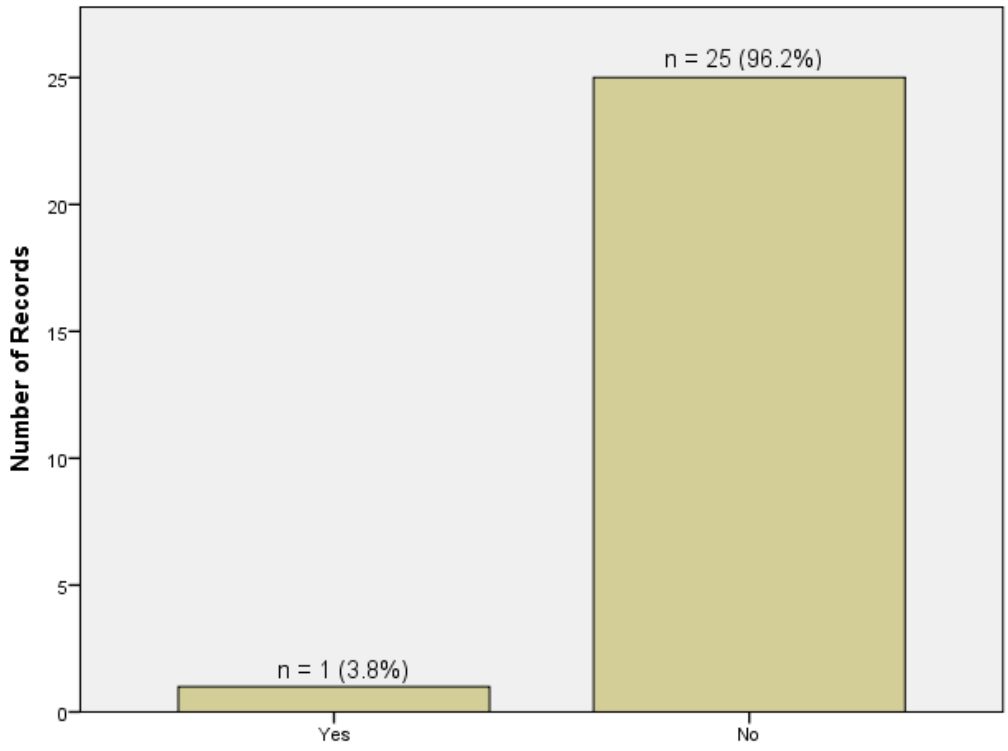

Figure 2. Charts with evidence that standard of care was met. This bar graph compares the number of records that met the standard of care with the number record that did not meet the standard of care.

Summary

This chapter provided a description and discussion of the characteristics of the medical records that were reviewed during this study. It describes the study outcomes according to the time period that pre-diabetes care was provided and the treatment modality prescribed. A comparison of the prescribed treatment modality documented in the medical records according to the 2012 ADA standards of care is also made in this chapter.

Chapter Five: Discussion

This chapter provides a discussion of the project outcomes relevant to the practitioners' use of clinical practice guidelines for patients with pre-diabetes. This discussion is followed by the limitations of the study. Implications for evidence-based practice and recommendations for future projects are also presented.

Discussion

Pre-diabetes is one of the most common conditions encountered in primary care. Nearly one quarter of adult patients over the age of 20 have pre-diabetes (CDC, 2011; Cowie et al., 2009). There is compelling evidence that early identification and aggressive treatment of persons with pre-diabetes with metformin and LSM can slow or prevent disease progression (ADA, 2012; Gillies et al., 2007; Knowler et al., 2002; Lily & Godwin, 2009; Salpeter, 2008; Yuen et al., 2010).

The purpose of this project was to evaluate the implementation of the 2012 ADA clinical practice guidelines regarding the management of patients with pre-diabetes by the health care providers at a clinic for the medically uninsured. Specifically, this project evaluated if the health care providers at the clinic implemented the 2012 ADA standards of care when managing patients with pre-diabetes using LSM, medication, or a combination of both. The desired outcome was that the health care providers treated patients with pre-diabetes according to the 2012 ADA standards of care and used a combined approach of LSM and medication. Although majority of records reviewed in this study had documentation of LSM as the primary treatment modality for pre-diabetes, only one medical record reviewed during this study met the 2012

ADA standards of care. These results suggest that in the charts reviewed for this study that the providers at the clinic were not following the 2012 ADA standards of care.

When examining the time periods when pre-diabetes care was provided, it was expected that during each successive month a greater percentage of charts would meet the 2012 ADA standards of care. The medical records reviewed in this study were evenly distributed across the three time periods of care. The only medical record that met the 2012 ADA standards of care, however, had pre-diabetes care documented during July 2012, the first period of care.

Limitations

There were many limitations to this project that should be noted. These include sample size, study design, and study setting. The project design was chosen because it was a good fit based on the time constraints and setting where this quality improvement project was conducted.

This study utilized a retrospective review with a one-group post only design. A one-group post-only design does not provide baseline information for comparison, nor does it account for extraneous influences that may have an effect on the dependent variable. A one-group pretest-posttest design is a more suitable option in future studies. This design provides baseline information that measures the effect by examining the difference between the pretest and posttest scores.

Another limitation to the study was the small sample size. The final sample included a convenience sample of 26 medical records. For this reason, the findings from this study cannot be generalized to the broader community. The small sample size and the demographic information collected also precluded any complex statistical evaluation. Future quality improvement projects utilizing medical records reviews to evaluate clinical practice should perform an ongoing review with a larger, more robust sample. With an expected attrition of

approximately 50% of the medical records, there would be a more realistic approximation of a normal distribution.

This study was conducted at only one institution in a large metropolitan area in the southeastern United States. The clinic has a unique provider base and serves a specialized population. Most of the primary care providers at the clinic are volunteers and many of the providers are retired. The clinic serves working uninsured patients and their families. This study requires replication in settings with paid providers as well as in settings with insured patients.

Implications for Practice

The results of this project highlight some of the complex issues associated with implementing evidence-based practice changes. Evidence-based practice requires healthcare providers to synthesize and apply credible evidence to individual patient situations while using their clinical judgment and considering the patient's values and resources (Melnyk & Fineout-Overholt, 2011). Implementing evidence-based clinical practice guidelines also requires a concerted effort from the leadership and individual providers. Although some providers may follow evidence-based guidelines, a large majority of providers do not subscribe to them.

It is recommended that the clinic identify a clinical area such as pre-diabetes to promote best practice and the implementation of the 2012 ADA clinical practice guidelines. Adoption of the 2012 ADA clinical practice guidelines has the potential to improve patient outcomes. Treating patients according to the 2012 ADA standards of care will also ensure that the providers at the clinic are delivering standardized, high-quality care in a cost-effective manner.

Recommendations

The strategic plan at the clinic includes improving the health of the community through education and preventative medicine. The adoption of the 2012 ADA clinical practice guidelines

for patients with pre-diabetes fits into this strategic plan. The leadership, the providers, and the support staff at the clinic need to be involved in future projects.

With a few modifications, this project could easily be reproduced in the clinic. An educational program regarding pre-diabetes could be created for patients and providers. This program would provide disease specific information and would focus on the importance of treating pre-diabetes according to the 2012 ADA clinical practice guidelines. Early identification and aggressive treatment of pre-diabetes has the potential to delay disease progression and the development of type 2 diabetes.

Conclusion

Pre-diabetes remains a serious health problem in the United States. The presence of pre-diabetes significantly increases the risk of type 2 diabetes. Management of patients with pre-diabetes according to the 2012 ADA standards of care has the potential to delay the onset of type 2 diabetes and its associated comorbidities. The challenge is motivating health care providers to implement evidence-based practice changes and use clinical practice guidelines.

Even with a small sample size, this study revealed that the providers did not use the 2012 ADA clinical practice guidelines. Clinical practice guidelines such as the 2012 ADA standards of care promote health care interventions that have proven benefits. Clinical practice guidelines improve the consistency of care provided to patients. The greatest benefits of implementing clinical practice guidelines for patients with pre-diabetes include early diagnosis and aggressive disease management. This would improve patient outcomes and, in the long run, decrease the cost of medical care.

Appendix A: Critical Analysis Table: Review of Meta-analyses

Question	**Lily & Godwin. (2009)**	**Salpeter. (2008)**	**Yuen, Sugeng, & Weiland. (2010)**
Will the answer if true, have a direct bearing on the health of patients?	Yes	Yes	Yes
Is the outcome or topic something that patients/clients/population groups would care about?	Yes	Yes	Yes
Is the problem addressed in the review one that is relevant to practice?	Yes	Yes	Yes
Will the information, if true, require a change in practice?	Yes	Yes	Yes
Was the question for the review clearly focused and appropriate?	Yes	Yes	Yes
Was the search strategy used to locate relevant studies comprehensive? Were the databases searched and the search terms used described?	Yes	Yes	Yes
Were explicit methods used to select studies for the review? Were inclusion/exclusion criteria specified? Were selection methods unbiased?	Yes	Yes	Yes
Was there an appraisal of the quality/validity of studies included in the review? Were appraisal methods specified, appropriate, and reproducible?	Yes	Yes	Yes
Were specific treatments/interventions/exposures described? Were treatments similar enough to be combined?	Yes	Yes	Yes
Was the outcome of interest clearly indicated? Were other potential harms and benefits considered?	Yes	Yes	Yes
Were processes for data abstraction, synthesis, and analysis described? Were they applied consistently? Was there appropriate use of qualitative and/or quantitative synthesis? Was variation in findings among studies analyzed? Was heterogeneity considered? If data from studies were aggregated for meta-analysis, was the procedure described?	Yes	Yes	Yes
Are the results clearly presented in narrative? If summary statistics are used, are levels of significance and/or confidence intervals included?	Yes	Yes	Yes
Are conclusions supported by results with biases and limitations taken into consideration? Are limitations of the review identified and discussed?	Yes	Yes	Yes
Was bias due to the review's funding or sponsorship unlikely?	No	No	No

Note. Adapted from *Evidence Based-Practice in Nursing and Healthcare* (2nd ed.) (p. 515-516) by B. M. Melnyk and E. Fineout-Overholt, 2011, Philadelphia, PA: Lippincott Williams & Wilkins.

Appendix B: Volunteers in Medicine Letter of Support for Project

41 East Duval Street • Jacksonville, Florida 32202 • Ph: (904) 399-2766 • Fax: (904) 549-8300 • www.vim-jax.org

February 28, 2013

University of North Florida
Office of Research and Sponsored Programs
1 UNF Drive
Jacksonville, Florida 32244-2665

Dear Members of the Institutional Review Board:

This is a letter of support for Sondra M. Santana, ARNP regarding her proposed project with the working title "*Practitioners' Use of Clinical Practice Guidelines for Patients with Pre-Diabetes*." Ms. Santana is a provider with privileges at this clinic. She currently has access to the clinic's medical records and will have access to the clinic records in order to retrieve the necessary data for her project.

It is expected that as the principal investigator that Ms. Santana is the only person collecting the data for this project. It is further expected that all records remain in the clinic and that the Health Insurance Portability and Accountability Act of 1996 (HIPAA) rules be followed throughout the entirety of the project. No Protected Health Information (PHI) will be recorded. Each record will be assigned a unique study number different than the patient number. Additionally all data will be de-identified and reported in aggregate. Upon completion of the project, Ms. Santana should also provide a presentation or discussion of the results to the clinic.

Should you have any questions regarding the conduct of this project at the Volunteers in Medicine Jacksonville Clinic, I can be reached at (904) 399-2766 or via e-mail at nina.smith@unf.edu

Sincerely,

Nina Smith, MSN, ARNP-BC

cc: Dr. Victoria Findley, MD, Medical Director

Appendix C: University of North Florida IRB Approval Letter

UNF
UNIVERSITY of NORTH FLORIDA.
Office of Research and Sponsored Programs
1 UNF Drive
Jacksonville, FL 32224-2665
904-620-2455 FAX 904-620-2457
Equal Opportunity/Equal Access/Affirmative Action Institution

MEMORANDUM

UNF IRB Number: 416299-2
Approval Date: 04-03-2013
Expiration Date: 04-03-2014
Processed on behalf of UNF's IRB KCC

DATE: April 3, 2013

TO: Ms. Sondra Santana

VIA: Dr. Michele Bednarzyk
Nursing

FROM: Dr. Krista Paulsen, Chairperson
On behalf of the UNF Institutional Review Board

RE: Review of New Project Revisions by the UNF Institutional Review Board IRB#416299-2: "Practitioners' Use of Clinical Practice Guidelines in Patients with Pre-Diabetes"

This is to advise you that your project, "Practitioners' Use of Clinical Practice Guidelines in Patients with Pre-Diabetes" underwent "Expedited category 5" review on behalf of the UNF Institutional Review Board. Your reviewer recommended approval without further modifications.

This approval applies to your project in the form and content as submitted to the IRB for review. Any variations or modifications to the approved protocol and/or informed consent forms as they relate to dealing with human subjects must be cleared with the IRB prior to implementing such changes. Any unanticipated problems involving risk and any occurrence of serious harm to subjects and others shall be reported promptly to the IRB within 3 business days. Because HIPAA is applicable to your project, please note that applicable records will need to be maintained for 6 years from the date of creation or the date when the documents were last in effect, whichever is later (45.164.316).

Your study has been approved for a period of 12 months as of 4/03/2013. If your project continues for more than one year, you are required to provide a completed Status Report to the UNF IRB prior to **3/03/2014** if your study will be continuing past the 1-year anniversary of the approval date. *We suggest you submit your status report 11 months from the date of your approval date as noted above to allow time for review and processing.* When you are ready to close your project, please complete a Closing Report Form which can also be found in the documents library called "Forms and Templates" in IRBNet. All records relating to this research shall be retained for at least 3 years after completion of the research. Data containing protected health information are to be retained for 6 years.

As you may know, **CITI Course Completion Reports are valid for 3 years**. Your completion report is valid through 2/19/2016 and Dr. Bednarzyk's completion report is valid through 1/27/2016, Dr. Ledbetter's completion report is valid through 1/25/2015, and Dr. Loriz' completion report is valid through 5/08/2014. If your completion report expires within the next 60 days or has expired, please take CITI's refresher course and contact us to let us know you have completed that training. If you have not yet completed your CITI training or if you need to complete the refresher course, please do so by following this link: http://www.citiprogram.org/. Should you have questions regarding your project or any other IRB issues, please contact the research integrity unit of the Office of Research and Sponsored Programs by emailing IRB@unf.edu or calling (904) 620-2455.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within UNF's records. All records shall be accessible for inspection and copying by authorized representatives of the department or agency at reasonable times and in a reasonable manner. A copy of this approval may also be sent to the dean and/or chair of your department.

UNF IRB Number: 416299-2
Approval Date: 04-03-2013
Expiration Date: 04-03-2014
Processed on behalf of UNF's IRB KLC

Appendix D: Data Collection Sheet

Data Collection Sheet: Practitioners' Use of Clinical Practice Guidelines in Patients with Pre-diabetes

Study n # _____

Chart of patient over the age of 18? □ Yes □ No*

Care provided during July-September 2012 timeframe? □ Yes □ No*

Meets ADA 2012 definition of pre-diabetes? □ Yes □ No*

Criteria used to diagnose pre-diabetes, check one:

□ FPG level □ HbA1c level □ 2h OGTT level

Demographic Information	
Time period when care was provided	□ Period 1 □ Period 2 □ Period 3

Comparable Data	
Evidence of treatment for pre-diabetes	□ Yes □ No
Lifestyle Modification	□ Yes □ No
Type of Lifestyle Modification	□ Nutrition □ Exercise □ Weight Management □ Other_____
Medication	□ Yes □ No

* - Initial inclusion criteria not met, stop chart review

References

AGREE Next Steps Consortium. (2009). *The AGREE II Instrument*. Retrieved from http://www.agreetrust.org

American Diabetes Association. (2012, January). Standards of medical care in diabetes - 2012. *Diabetes Care*, *35*(Supplement 1), S11-S63. Retrieved from http://dx.doi.org/10.2337/dc12-s011

Aroda, V. R., & Ratner, R. (2008, September). Approach to the patient with prediabetes. *Journal of Clinical Endocrinology and Metabolism*, *93*, 3259-3265.

Biuso T. J., Butterworth, S., & Linden A. (2007, November). A conceptual framework for targeting pre-diabetes with lifestyle, clinical and behavioral management interventions. *Disease Management*, *10*(1), 6-15.

Bonora, E., & Tuomiletho, J. (2011, May). The pros and cons of diagnosing diabetes with A1C. *Diabetes Care*, *34*, S184-S190. Retrieved from http://dx.doi.org/10.2337/dc11-s216

Brouwers, M. C., Makarski, J., & Levinson, A. J. (2010). A randomized trial to evaluate e-learning interventions designed to improve learner's performance, satisfaction, and self-efficacy with the AGREE II. *Implementation Science*, *5*, 29-35. Retrieved from http://dx.doi.org/10.1186/1748-5908-5-29

Buell, C., Kermah, D., & Davidson, M. B. (2007, September). Utility of A1C for diabetes screening in the 1999–2004 NHANES population. *Diabetes Care*, *30(9)*, 2233-2235. doi:10.2337/dc07-0585

Centers for Disease Control and Prevention. (2011). *National diabetes fact sheet: National estimates and general information on diabetes and prediabetes in the United States,*

2011. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

Cowie, C. C., Rust, K. F., Ford, E. S., Eberhardt, M. S., Byrd-Holt, D. D., Li, C.,...Geiss, L. S. (2009). Full accounting of diabetes and pre-diabetes in the U.S. population in 1998-1994 and 2005-2006. *Diabetes Care*, *32*, 287-294. Retrieved from http://dx.doi.org/10.2337/dc08-1296

Florida Department of Health, Bureau of Epidemiology. (2011). *Florida behavioral risk factors: Results from the 2000-2009 Behavioral Risk Factor Surveillance System* [Report]. Retrieved from Florida Department of Health: http://www.doh.state.fl.us/

Fonseca, V. A. (2007). Identification and treatment of prediabetes to prevent progression to type 2 diabetes. *Clinical Cornerstone, 8*(2), 10-20.

Gillies, C. L., Abrams, K. R., Lambert, P. C., Cooper, N. J., Sutton, A. J., Hsu, R. T., & Khunti, K. (2007, January 19). Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: Systematic review and meta-analysis. *British Medical Journal*, *334*, 1-9.

Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. A., & Nathan, D. M. (2002, February 7). Reduction in the incidence of type 2 diabetes with lifestyle intervention and metformin. *New England Journal of Medicine*, *346*, 393-403. Retrieved from http://dx.doi.org/10.1056/NEJMoa012512

Lily, M., & Godwin, M. (2009, April). Treating prediabetes with metformin. *Canadian Family Physician*, *55*, 363-369. Retrieved from http://www.cfp.ca/content/55/4/363.full

Melnyk, B. M., & Fineout-Overholt, E. (2011). *Evidence based-practice in nursing and healthcare* (2nd ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Milman, S. & Crandall, J. P. (2011, March). Mechanism of vascular complications in prediabetes. *Medical Clinics of North America, 95,* 309-325. Retrieved from http://dx.doi.org/10.1016/j.mcna.2010.11.004

Nathan, D. M., Davidson, M. B., DeFronzo, R. A., Heine, R. J., Henry, R. R., Pratley, R., & Zinman, B. (2007, March). Impaired fasting glucose and impaired glucose tolerance: Implications for care. *Diabetes Care, 30,* 753-759. Retrieved from http://dx.doi.org/10.2337/dc07-9920

Ngatena, I. J., & Kapustin, J. F. (2011, July/August). Preventing type 2 diabetes: What really works. *The Journal for Nurse Practitioners, 7,* 550-558. Retrieved from http://dx.doi.org/10.1016/j.nurpra.2011.01.002

Olson, D. E., Rhee, M. K., Herrick, K., & Ziemer, D. C. (2010, July). Screening for diabetes and prediabetes with proposed A1c-based diagnostic criteria. *Diabetes Care, 33,* 2184-2189. Retrieved from http://dx.doi.org/10.2337/dc10-0433

O'Mara, N. B. (2008, September). Diagnosis and treatment of pre-diabetes. *Pharmacist's Letter/Prescriber's Letter, 24,* 1-5.

Pagana, K. D., & Pagana, T. J. (2011). *Diagnostic and laboratory test reference* (10th ed.). St. Louis, MO: Elsevier Mosby.

Parikh, P., Simon, E. P., Fei, K., Looker, H., Goytia, C., & Horowitz, C. R. (2010, September 1). Results of a pilot diabetes prevention intervention in East Harlem, New York City: Project HEED. *American Journal of Public Health, 100,* S232-S239. Retrieved from http://dx.doi.org/10.2105/AJPH.2009.170910

Rhee, M. K., Herrick, K., Ziemer, D. C., Vaccarino, V., Weintraub, W. S., Venkat Narayan, K. M.,...Phillips, L. S. (2010, January). Many Americans have pre-diabetes and should be

considered for metformin therapy. *Diabetes Care*, *33*, 49-54. Retrieved from http://dx.doi.org/10.2337/dc09-0341

Rizza, R. A., & Vella, A. (2009). Diabetes mellitus. In S. A. Waldman & A. Terzic (Eds.), *Pharmacology and therapeutics: Principles to practice* (pp. 557-571). Philadelphia, PA: Saunders Elsevier.

Sackeit, D. L., Rosenberg, W. C., Muir-Gray, J. A., Haynes, R. B., & Richardson, W. S. (1996, January 13). Evidence based medicine: What it is and what it isn't. *British Medical Journal*, *312*, 71-72. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2349778/pdf/bmj00524-0009.pdf

Salpeter, S. R. (2008, July). A systematic review of metformin treatment in persons at risk for diabetes mellitus. *Cardiology Review*, *25*(7), 14-18. Retrieved from http://www.hcplive.com/publications/cardiology-review-online/2008/july2008/July-2008-Salpeter

Salyers, S. C. (2011, April). Insulin resistance syndrome treatment considerations. *Nutritional Perspectives*, *34*(2), 11-12.

Scheen, A. J. (2007). Antidiabetic agents in subjects with mild dysglycaemia: Prevention or early treatment of type 2 diabetes. *Diabetes and Metabolism*, *2007*, 3-12. Retrieved from http://dx.doi.org/10.1016/j.diabet.2006.11.005

Silverman, R. A., Thakker, U., Ellman, T., Wong, I., Smith, K., Ito, K., & Graff, K. (2011, September). Hemoglobin A1c as a screen for previously undiagnosed prediabetes and diabetes in an acute-care setting. *Diabetes Care*, *34*, 1908-1912. Retrieved from http://dx.doi.org/10.2337/dc10-0996

Tankova, T., Chakarova, N., Dakovska, L., & Atanassova, I. (2011, October 2). Assessment of HbA1c as a diagnostic tool in diabetes and prediabetes. *Acta Diabetologica*, *49*, 371-378. Retrieved from http://dx.doi.org/10.1007/s00592-011-0334-5

World Health Organization. (2006). *Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia*. Geneva, Switzerland: World Health Organization.

Yuen, A., Sugeng, Y., & Weiland, T. J. (2010). Lifestyle and medication interventions for the prevention or delay of type 2 diabetes mellitus in prediabetes: A systemic review of randomised controlled trials. *Australian and New Zealand Journal of Public Health*, *34*, 172-178. Retrieved from http://dx.doi.org/10.111/j.1753-6405.2010.00503.x

Vita

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