12-2013

Bridging Patient Outcome Gap for Type 2 Diabetes : Can We Bridge Physician Practices to Produce Results Achieved in Evidence-Based Lifestyle Intervention Research?

Brenda Killen Johnson

Thesis Abstract

The United States is abounding in the prevalence and incidence of avoidable chronic diseases, and high among these diseases is type 2 diabetes. Further, according to the National Institute of Health (NIH) Common Fund, 40% of harmful health behaviors is what contributes to chronic diseases, such as type 2 diabetes. NIH noted there are few personalized, effective ways to inspire people to change their behaviors in the short-term, but if done, this behavior is not sustained long-term (The NIH Common Fund, 2011). Yet, this research discovered a Diabetes Prevention Program (DPP) is one of these few personalized, effective interventions that has not become widespread in application. The DPP has over 10 years of effectively demonstrating an impact on diabetes by these outcomes: 1) decrease in the incidence of diabetes, 2) decrease in the costs of diabetes, 3) decrease in death rates of diabetes, 4) absence of differences across ethnic groups, and 5) sustainability over ten years with lifestyle intervention significantly having the greatest impact. Hence this research sought to explore why DPP has not found its way into the practice of treating and preventing diabetes. The over arching research question was: *Can we bridge physician practices to produce results achieved in evidence-based lifestyle intervention research*? Primary research was conducted with physicians treating diabetic and pre-diabetic patients in Connecticut, New Jersey, New York and Pennsylvania using both quantitative and qualitative methods to pursue this inquiry. Research findings revealed unfamiliarity with DPP, barriers to implementing DPP in real world practices, yet an overwhelming interest in DPP, particularly because of the nutrition-based lifestyle component. Consequently, nutrition educators and counselors have an opportunity to emerge as change agents in translating DPP evidence

into practice with the goal of bridging the patient outcome gap for type 2 diabetes. The best opportunity is addressing barriers and limitations identified in this research.

Keywords: Diabetes Prevention Program, bridging evidence-based practices, type 2 diabetes, lifestyle intervention, nutrition-based lifestyle intervention.

Thesis Signature Page

MONTCLAIR STATE UNIVERSITY

BRIDGING PATIENT OUTCOME GAP FOR TYPE 2 DIABETES: CAN WE BRIDGE PHYSICIAN PRACTICES TO PRODUCE RESULTS ACHIEVED IN EVIDENCE-BASED LIFESTYLE INTERVENTION RESEARCH?

by

Brenda Killen Johnson

A Master's Thesis Submitted to the Faculty of

Montclair State University

In Partial Fulfillment of the Requirements

For the Degree of

Master of Arts

December 2013

College of Education and Human Services

Department of Nutrition and Food Science

Thesis Committee:

[redacted]

Dr. Charles Feldman
Thesis Chair

Certified by:

[redacted]

Dr. Francine Peterman
Dean,
College of Education and Human Services

[redacted]

Dr. Amanda Birnbaum
Department Chair

December 9, 2013
Date

[redacted]

Dr. Angela Chale
Committee Member

[redacted]

Dr. Doreen Liou
Committee Member

[redacted]

Dr. Pearl Stewart
Committee Member

Acknowledgements

God has been with me every single step of the way. Thank you! Next I want to express profound gratitude to my husband Michael for his untiring and unrelenting support. You are my gold standard for what the word commitment means. My son and granddaughter are also appreciated for their contribution in helping, in so many different ways, to complete this research. Finally, I would like to give my sincere thanks and appreciation to members of my thesis committee for giving me guidance along the way and supporting me through completion.

Table of Contents

I. Table of Contents

II. Introduction

The United States is abounding in the prevalence and incidence of avoidable chronic diseases, and high among these diseases is type 2 diabetes. The National Institute of Health (NIH) Common Fund, stated that 40% of harmful health behaviors do in fact contribute to chronic diseases, such as type 2 diabetes. Furthermore, the fund argued there are few personalized, effective ways to inspire people to change their behaviors in the short-term, and when they do, this behavior is not sustained in the long-term (The NIH Common Fund, 2011). Yet notably, a Diabetes Prevention Program (DPP) is one of these few personalized, effective interventions for the treatment of pre-diabetic and type 2 diabetic persons.

The DPP, funded by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), began as a clinical trial study using three treatment groups to explore treatment effects of both lifestyle and drug interventions on the incidence and mortality of people considered high risk for type 2 diabetes. Interventions tested were: standard lifestyle intervention along with a placebo; standard lifestyle intervention along with a drug; and intensive lifestyle modification and no drug treatment. (Diabetes Prevention Program Research Group, 2002; NIH, 2006).

The standard lifestyle intervention treatment involved lifestyle recommendations provided through written material and an annual 20 to 30-minute one-on-one session that stressed the benefits of a healthy lifestyle, following the Food Guide Pyramid to lose weight and engaging in physical activity. The intensive lifestyle program included much more: behavior modification along with diet and exercise training delivered through a one-on-one 16-week lesson curriculum to support the intensive lifestyle group

participants in achieving and maintaining a minimum goal of seven percent weight loss and 150 minutes of exercise weekly. Lessons were delivered over a period of 20 to 24 weeks and varied in duration from 1/2 hour to one hour and involved a variety of activities such as weigh-ins, review of diaries, identifying personal barriers/challenges and goal-based action plans. (Ackerman & Marrero, 2007; Diabetes Prevention Program Research Group, 2002; NIH, 2006). Thereafter, one-on-one sessions were conducted monthly supplemented by group sessions so that behavioral changes were reinforced. (Diabetes Prevention Program Research Group, 2002). Notably, the DPP curriculum was culturally sensitive, provided flexibility and was individualized. Metformin, used as the DPP drug intervention, is an FDA approved drug used to treat diabetes by controlling the amount of glucose absorbed or made in the body, and by increasing insulin response in the body (Diabetes Prevention Program Research Group, 2009, 2003, 2002; Medline Plus, 2012).

The specifics of the DPP trial inquiry entailed assessing whether: 1) lifestyle or a drug could be used to prevent or delay the occurrence of type 2 diabetes; 2) a difference existed in the effectiveness between the two interventions; 3) and would the effectiveness vary by age, sex, race or ethnicity (Diabetes Prevention Program Research Group,2009, 2003, 2002). Outcomes of the DPP study are striking because they showed that among the participants studied: 1) the incidence of diabetes fell by 58% from lifestyle intervention and 31% from the metformin intervention when compared to the placebo effect; 2) the lifestyle intervention evidenced a significantly greater effect than metformin; and 3) that after 10 years, the incidence of diabetes dropped by 34% and 18% respectively for lifestyle and metformin. (Diabetes Prevention Program Research Group,

2009, 2003, 2002; Herman, Hoerger, Brandle, Hicks, Sorenson, Zhang, Hamman, Ackermann, Engelgau, & Ratner, 2005).

Analyses of costs of morbidity and mortality impacts from the DPP study considered lost time from normal activities such as work or school as an average number of days lost due to death over a 3-year period and was estimated as $108 per day lost for each of the three interventions. After three years, the lifestyle intervention and metformin morbidity and mortality costs were respectively $174 less than and $230 greater than costs due to the placebo intervention (Diabetes Prevention Program Research Group, 2003). The number of deaths over three years was 3, 6 and 5 for lifestyle, metformin and placebo respectively but, according to the Diabetes Prevention Program Research Group, additional follow-up analysis would give further long-term outcomes of intervention effects (Diabetes Prevention Program Research Group, 2009, 2003). Intervention costs of lifestyle and metformin were also evaluated from the perspectives of a health system and society. This evaluation evidenced $24,000 and $34,000 of costs incurred for each instance of diabetes either prevented or deferred and $51,600 and $99,200 for each quality-adjusted life-year (QALY) added by lifestyle intervention or metformin respectively when viewed from a societal perspective (Diabetes Prevention Program Research Group, 2009, 2003).

Herman (1999) puts intervention costs in perspective by acknowledging diabetic persons account for only three percent of the United States (U.S.) population, yet cost nearly 12% of total expenditures on health care. Furthermore, over a 10-year period the combined cumulative costs of intervention from direct medical care provided within and outside of the DPP study per person were $29,164 (lifestyle), $27,915 (Metformin) and

$28,236 (placebo) but quality of life factors were better for individuals who received the lifestyle intervention (Diabetes Prevention Program Research Group, 2012).

Herman et al. (2005) examined the cost-effectiveness of a modified lifestyle or the metformin drug in preventing type 2 diabetes among people who had impaired glucose tolerance and found: 1) lifestyle and metformin interventions would hold back the development of type 2 diabetes 11 to 3 years respectively, as compared to the placebo intervention compared with the placebo intervention (Herman et al., 2005); 2) a 20% to 8% reduction respectively, in the incidence of diabetes (Herman et al., 2005); 3) diabetes-related complications and survival rates were improved respectively by 0.5 and 0.2 years (Herman et al., 2005); and 4) "the lifestyle intervention dominated the metformin intervention" (Herman et al., 2005, p.323). From an insurance perspective, Ackerman et al. (2006) examined how the DPP lifestyle intervention could be financed and found that cost-sharing strategies could be financially advantageous to private insurance providers and Medicare. Finally, the Diabetes Prevention Program Research Group concluded after a 10-year investigation that "lifestyle is indeed cost-effective, and metformin is marginally cost-saving or at least cost-neutral compared with placebo" (Diabetes Prevention Program Research Group, 2012, p. 728).

Hence, the aforementioned studies provide evidence of DPP impacts: a decrease in the incidence of diabetes, a decrease in the costs of diabetes, a decrease in death rates of diabetes, absence of differences across ethnic groups, and intervention sustainability over ten years with the lifestyle intervention significantly having the greatest impact (Ackerman, Marrero, Hicks, Hoerger, Sorensen, Zhang, Engelgau, Ratner, & Herman,

2006; Diabetes Prevention Program Research Group, 2012, 2009, 2003, 2002; Herman et al., 2005; Herman, 1999).

Given the strong possibility of preventing diabetes as evidenced in the DPP study, this thesis research considered the comparison of DPP evidence against other reported data to be a reasonable next step. A comparison of DPP evidence-based outcomes against reported data on diabetes maintained by the Office on Minority Health and others (e.g. Centers for Disease Control) presented a striking difference. While the DPP study evidenced similar results for all ethnic groups which were sustained over time, reported data shows a distinct contrast in diabetes-related outcomes across these same ethnic groups. Specifically, reported data shows a high and troublesome incidence of type 2 diabetes and ensuing diabetes-related outcomes among people of African descent.

According to the Office on Minority Health, adults who are non-Hispanic blacks are twice as likely than non-Hispanic whites to be diagnosed by a physician as having diabetes. Also, non-Hispanic black men are 2.2 times more likely to begin end-stage renal disease treatment related specifically to diabetes than non-Hispanic white American men. Furthermore, 2006 data shows diabetic non-Hispanic blacks were 1.5 times more likely to be hospitalized than diabetic non-Hispanic whites. Finally, non-Hispanic black Americans were 2.3 times more likely to experience death due to diabetes than non-Hispanic whites. (Office Of Minority Health, 2010). Within the state of New Jersey for instance, the rate of African Americans dying from diabetes is more than double that of other ethnic groups. (The Henry Kaiser Family Foundation, 2010).

Since the DPP evidenced-based research suggests that type 2 diabetes can be substantially reduced and sustained across all ethnic groups and disparities between

diabetes-related outcomes can be erased using lifestyle-based interventions (Diabetes Prevention Program Research Group, 2009, 2003, 2002), this research considered possible reasons for the gap between evidence and real-world outcomes by exploring the perspective of treating physicians to be another reasonable step.

Given the substantial evidence that recognizes a compelling need to address the chronic health challenge of type 2 diabetes (Contento, 2007; Diabetes Prevention Program Research Group, 2012, 2009, 2003, 2002; Finch, Kelly & Ackerman, 2009; Herman et al., 2005; National Institute of Health, 2011; Office of Minority Health, 2010; Zerhouni, 2006) and the need to address health disparities that prevail between non-Hispanic blacks and non-Hispanic whites (Betancourt, Green & Carrillo, 2003; Duru, Mangione, Steers, Herman, Karter, Kountz, Marrero, Safford, Waitzfelder, Gerzoff, Huh & Brown, 2006; The Henry Kaiser Family Foundation, 2010; Office of Minority Health, 2010; van Ryn & Burke, 2000), this research obtained the perspective of physicians engaged in the practice of treating pre-diabetic and diabetic patients to explore the question "Can we bridge physician practices to produce results achieved in evidence-based lifestyle intervention research?"

The challenge in bridging evidence to practice for type 2 diabetes is varied and includes the need for evidence that points to convincing effectiveness, awareness of this evidence on the part of physicians, and the likelihood of physicians bringing evidence-based protocols into real-world settings. Furthermore, research has shown a nutrition-based lifestyle approach is effective in treating or preventing type 2 diabetes. Hence, the primary focus in this study was to explore the perspective of physicians treating diabetic and pre-diabetic patients to: 1) identify barriers and limitations in providing lifestyle

intervention treatment; 2) factors that contribute to creating gaps between DPP evidence and practice, and 3) possible solutions that could render DPP evidence-based outcomes more likely in real-world settings. A key consideration for this research approach is the possibility of physicians being able to mitigate adverse outcomes of type 2 diabetes, significantly reduce the presence of this disease, or eliminate outcome disparities, particularly among population groups most impacted. The specific research objectives were the following.

1. Explore the perceptions of physicians on the effectiveness of nutrition-based lifestyle interventions.
2. Compare and contrast intervention strategies delivered to non-Hispanic blacks and non-Hispanic whites.
3. Identify barriers and limitations of incorporating nutrition-based lifestyle interventions.
4. Investigate perceptions on patient affordability and provider costs of using nutrition-based lifestyle interventions.

Research survey questions were designed to support research objectives, the overall aim of better understanding why the gap between evidence and practice continues to exist, and reveal possibilities for bridging this gap in diabetes prevention and treatment through physician practices. The importance of bridging this gap is underscored by achievements obtained through science-based research and behavioral interventions, as well as rising medical costs and increased disparities between population segments, both of which have adverse economic and social impacts.

The direction this research has taken is consistent with recommendations of NIH which support the concept that dissemination and implementation research is needed to close the gap between evidence-based research and practice (National Institutes of Health, 2011). NIH recognizes the cost implications of chronic and end-stage disease and has encouraged a pro-active approach using molecular knowledge and behavioral-based interventions as the only realistic strategy for sustaining the health of Americans (Zerhouni, 2006). NIH also asserts that experts are aware of evidence-based strategies for treating many chronic illnesses, but that healthcare providers are not always using these strategies (National Institutes of Health, 2011).

III. Literature Review

The purpose of the literature here is to provide supportive evidence for the findings and implications in this research.

A. Objective 1: Perceptions on the Effectiveness of Nutrition-based Lifestyle Interventions

NIH (2006, 2011), Shaik, Vinokur, Yaroch, Williams, & Resnlcow, (2011), Mathers (2008), Contento (2007, 2011), and Pelto & Freake (2003) provide evidence for both the importance of, and interest in nutrition-based intervention strategies (*Research Objective 1*). NIH (2011) acknowledged the need for strategies that tackle health behaviors that contribute to diseases such as type 2 diabetes. Shaik et al. (2011) focused on dietary intake behavior to examine direct and mediated effects from intervention mediators. Mathers (2008) asserts there is evidence that diet influences epigenetic (which studies changes in gene expression due to factors unrelated to the sequence of DNA) markers and gene expression and pushes for more research. Consideration for this proposed additional research would include an examination of whether nutritional interventions can change adverse effects of exposure to harmful environments and decrease the likelihood of an adverse health condition such as type 2 diabetes. The Mathers argument is based on evidence that type 2 diabetes and other disease states can be established *in utero* through high-risk lifestyles and environmental conditions. Contento (2007) argued for nutrition-based lifestyle interventions in addressing obesity, diabetes and other chronic disease through nutrition education. Pelto & Freake (2003) argued that biology alone does not explain the obesity epidemic. Rather, there are mechanisms or intermediate paths between outcomes of nutrition-related behavior and social determinants (e.g. education) not clearly understood by investigators. This knowledge gap in turn affects

the capacity of investigators to fully inform how to design and implement nutrition programs. Hence, according to these investigators, capacity is among the factors needed to pursue what Pelto & Freake consider a complicated interaction between biology and lifestyles (Pelto & Freake, 2003). These authors offer the explanation that not everyone can benefit from nutrition-based intervention programs as there may be preexisting conditions (e.g. biological or social) that preclude one from benefiting, therefore attention should be paid to "determinants of capacity to benefit" (Pelto & Freak, 2003, p.1233).

B. Objective 2: Disparities in Diabetes-Related Care

van Ryn & Burke (2000), van Ryn (2002), Jenkins, McNary, Carlson, Hossler, Zheng, Linnen, Thomas, Powell & Ma (2004), and Betancourt et al. (2003) contributed to the assessment of whether differences in intervention strategies delivered to non-Hispanic blacks and non-Hispanic whites occur by comparing and contrasting strategies delivered to both ethnicities (*Research Objective 2*).

van Ryn & Burke (2000) found evidence that physicians perceive patients differently in terms of race and socio-economic factors. van Ryn further suggested that all human beings share the trait of making the world as manageable as possible by using strategies to categorize and generalize in order to turn varied, and often complex, information or stimuli received into a more simple form for processing, and thus by default, stereotype individuals (van Ryn, 2002). Therefore, the end result of this stereotyping impacts how different ethnic groups are treated and contributes to health disparities.

Jenkins, Myers, Kelechi & Buckner-Brown, (2011) argued that the absence of best practices in applying evidence-based research contributes to ethnic disparities. These conclusions were reached based on an assessment of a 10-year intervention designed to

improve diabetes-related outcomes related to lower-extremities. This assessment revealed that compared to the national baseline (i.e. in 1997) there were 2.6 lower-extremity amputations per 1000 whites for persons considered white compared to 4.8 for blacks. While the 2010 goal for Healthy People is 1.8 lower extremity amputations per 1000, blacks are still far removed from achieving this goal. Furthermore, by inspecting other measures, Jenkins et al. (2004) provided evidence that after 24 months of implementing a program to eliminate health disparities among minorities, annual A1c testing had changed, but changes in other areas such as clinical education, nutrition education and A1c control did not occur. Hence, evidence from Jenkins et al. suggests disparities remained.

C. Objective 3: Barriers and Limitations to Nutrition-based Lifestyle Interventions

Betancourt et al. (2003) argued that socio-cultural barriers are pervasive in health and healthcare systems including among other things care processes and provider-patient interactions. Consequently, Betancourt et al. suggest that cultural competent interventions must emerge to improve healthcare for everyone and eradicate health disparities. Notably, it seems that the argument made by Betancourt et al. substantiates stereotyping claims made by van Ryn because the argument can be made that processes and interactions are channels through which stereotyping can emerge.

Contributors to developing an understanding of barriers and limitations of incorporating nutrition-based lifestyle interventions (*Research Objective 3*) included Beverly, Hultgren, Brooks, Ritholz, Abramson & Weinger, (2011), Brown & LeRoith (2010), and Florence & Yeager (1999).

While the analysis and discussion section shows that not all of these investigators directly addressed barriers and limitations to nutrition-based intervention strategies, these investigators did provide compelling information that increased the understanding of how much support physicians really need to be effective in utilizing nutrition-based strategies.

For example, Beverly et al. (2011) mentioned the social and emotional challenges patients have and how physicians are not trained to provide the psychological support patients need. Beverly et al. also explained why physicians experience frustration, inadequacy and feelings of being overwhelmed as they attempt to treat and prevent type 2 diabetes - principally there is insufficient time and knowledge, hence physicians feel treatment options are limited.

Another example is observed through arguments made by Brown & LeRoith (2010). These authors identified factors, such as poor control of diabetes on the part of patients who are not empowered to prevent or treat hyperglycemia, along with the patient costs and low literacy and support levels associated with addressing diabetes, as reasons that substantiate more support is needed by physicians. On the other hand, as the analysis and discussion in this study shows, Brown, Harris, Webster-Bogart, Wetmore, Faulds & Stewart (2002) identified a myriad of barriers that cover patient barriers, physician barriers and systemic barriers in diabetic treatment.

A final example is illustrated by Florence & Yeager (1999) who identified the limited resources, managed care challenges, and the commonality and under-diagnosis of type 2 diabetes. In other words, physicians are time pressed dealing with so many type 2 diabetic patients, and under-diagnosis of this chronic disease impacts treatment effectiveness.

D. Objective 4: Affordability and Costs of Nutrition-based Lifestyle Interventions

Literature that supports the investigation of patient affordability and provider costs of using nutrition-based lifestyle interventions (*Research Objective 4*) is comprehensive. Some investigators have addressed patient affordability and provider costs directly concerning nutrition-based interventions, while others have done it indirectly. For instance, the introduction of this paper covered research conducted by investigators on health and societal costs associated with type 2 diabetes. Direct articulation of costs included factors associated with patients' time spent in pursuing and receiving nutrition-based interventions and time spent by physicians and other help professionals diagnosing patients and delivering the intervention (Diabetes Prevention Research Group, 2003, 2009, 2012; Herman, 1999).

Several of the investigators listed in this literature review section (NIH, Brown & LeRoith, Brown et al, Florence & Yeager) cited provider costs and patient costs of type 2 diabetes as barriers in obtaining desired outcomes of treatment and prevention. These investigators indirectly address patient affordability for nutrition-based lifestyle interventions because they realized that costs are issues for patients in receiving any intervention. In fact, Brown & Le Roith (2010) recognized that patient costs can be evidenced through lack of adherence to physician recommendations. Brown et al. (2002) indirectly acknowledged patient costs of nutrition-based interventions by noting physician concerns that the need for patients to modify their lifestyles is not at all a small request.

IV. Methods

A quasi-mixed method was used to collect data for this research. Sample was obtained from a proprietary firm that specializes in providing hard to reach sample populations for the purpose of research. The data collection instrument was online data collection methodology and sample was recruited using online data recruiting tools. The survey instrument contained both quantitative (close-ended) and qualitative (open-ended) questions, hence quasi-mixed methods.

Sample

The participant pool recruited for this research was physicians who direct and manage patients who have diabetic or pre-diabetic conditions. The recruitment goal was 29 physicians whose patient base was at least 50% African Americans (defined as Group A) and 28 physicians whose patient base was at least 50% Caucasian Americans (defined as Group B). A total of 57 physician responses were expected for this survey.

Physicians were recruited from a medical panel of healthcare providers owned and maintained by Research Now, a data collection company headquartered in Dallas, Texas, that focuses on recruiting respondents for research purposes. In accordance with the approved Montclair State University Institutional Review Board (MSU IRB) protocol, participating physicians remained anonymous for the purposes of this study and their responses will not be shared with Research Now.

The total number of panel members for Research Now across the United States and other countries, panel members exceeds six million. The sample selected for this study was obtained through automatically randomized email invitations to panelists. Exclusion of panelists from participation by Research Now was based on the number of times a

panelist completed a survey in the period of 12 months, the number of times a panelist completed a survey on the topic under study, and whether the panelist met the study specifications (e.g. study area and physician title).

For this study, approximately 1,000 physicians were randomly selected for the targeted areas - Connecticut, New Jersey, New York and Pennsylvania and the targeted population - Endocrinologists, Family Practitioners, General Practitioners and Internal Medicine Specialists. A total of 256 physicians responded to participate in this study and 151(59%) physicians failed to meet the defined screening criteria. Among the physicians who qualified, only one failed to complete the survey. Consequently, the overall response rate was 99% (i.e. 256 - 151 = 105; 104/105 = 99%). Out of the 104 respondents who qualified and proceeded to complete the survey, only 16 met the criteria for being a member of Group A. Out of the remaining 88, only 28 could be allowed to remain in the sample since the contractual limit for Group B had been reached. The remaining survey respondents (i.e. 60) were automatically terminated as over quota for this research study. Thus, the ending sample obtained for the two groups was: 16 (Group A) and 28 (Group B). While the original plan for this research was to secure a total of 57 responses, the incidence of physicians who satisfied screening criteria for Group A was much lower than expected. Consequently, total sample size obtained was 77% (44) of what was planned.

Sample Characteristics

One hundred percent of the participants (n=44) selected to participate in this study were physicians who recommend and direct, or direct and manage treatment for type 2 diabetic patients. The distribution on the proportion of physicians' practices focused on

patient care to diabetic patients is provided in Table 1 of Appendix A. Most of the 44 physician practices have a considerable amount of their practice treating patients with diabetes. The areas of medicine within which responding physicians (n=44) practice were mostly Family Practice. Table 2 of Appendix A provides the complete distribution of these physicians in Endocrinology, Family Practice, General Practice and Internal Medicine.

Most of the 44 responding physicians had suburban and urban practices (84%) and were based mainly in New York and Pennsylvania (82%). Table 3 of Appendix A provides the detailed distribution of the states and areas of physician practices.

The majority of the 44 responding physicians were Caucasian American (71%) and Table 4 of the Appendix A provides the detailed composition of ethnic origin for these physicians. Distribution of the 44 responding physicians by age and gender is provided in Table 5 of Appendix A. In general, 66% were between 36 and 55 years of age, and 61% were male.

Data Collection

Data collection procedures were conducted in accordance with MSU IRB approved protocol. Research Now sent an email to their physician medical panel and all responding physicians were given a unique identifying link that provided online access to the survey for this study. Once responding physicians clicked on their uniquely identifying survey link, they were then presented with an online "Implied Consent" where physicians were given an opportunity to agree or not to the conditions of this research study. All responding physicians who did agree, were then presented with screening questions to qualify to answer the specific closed-ended and open-ended study questions.

The purpose of using both closed-ended and open-ended survey questions was to employ a quasi mixed-methods data collection process. While it is generally understood there are some typical qualitative data collection formats such as focus groups, in-depth interviews, observation or document analysis, data collected through open-ended survey questions are also considered qualitative by definition - responses are free-flowing, unscripted, concerned with the nature of a phenomena and considered subjective (Labushcagne, 2003; Brace, 2005; Hughes, 2006; Trochim, 2006; Pew Research Center, 2013; Liana, 2013). Alternatively, closed-ended questions are not free-flowing, instead they are designed to elicit responses to pre-determined, scripted questions and only a finite number of responses can be given (Labushcagne, 2003; Brace, 2005). In addition to the pros and cons associated with each approach used to elicit responses, both open-ended and close-ended questions can be quantified, but typically, the latter question format is considered quantitative (Labuschcagne, 2003; Reja, Manfreda, Hlebec & Vehovar, 2003; Brace, 2005; Trochim, 2006). The reason for the label "quasi mixed-methods" stems mainly from the small sample which rendered closed-ended data more challenging for quantitative analysis, and the absence of follow-up probing questions for open-ended responses to maintain anonymity. The reason for small sample was due to budget considerations and the need to maintain anonymity is in accordance with the approved MSU IRB study protocol.

The mode of data collection for both open-ended and closed-ended questions was an online survey. Online data collection allowed time-constrained physicians to provide responses during times they found most convenient. The online survey was tested to ensure all questions presented in the proposal were loaded, a physician respondent could

move seamlessly through the online version, and online instructions worked as designed. Among questions asked was a question having 13 attributes. Attributes for this question were randomized so that each answering physician received a different order of these attributes to avoid ordering bias.

Appendix B provides all survey questions designed for use in this study.

Measures

Quantitative

There were six closed-ended survey questions presented to all physicians responding to this study. Appendix B provides details on question wording, the intent of survey question, survey question number, and scales used to illicit responses. In some areas quantitative questions were designed to help quantify qualitative responses. For instance, questions regarding physician perceptions and attitudes were asked in a quantitative format following opportunities physicians had to provide open-ended responses. To illustrate, the question "*Overall, what is the likelihood of your practice using the Diabetes Prevention Program in the treatment of patients with type 2 diabetes using a scale of 1 (very unlikely) to 7 (very likely)*" followed the qualitative question "*Explain what you have heard or know about the Diabetes Prevention Program.*" In other areas, quantitative questions provided stand-alone information such as the location of responding physician practices or the area of medical specialty they focused on.

Qualitative

There were seven open-ended questions for which physicians gave their responses. These qualitative measures were designed to elicit physicians' attitudes towards lifestyle

intervention strategies as well as on strategies physicians are currently using. Also of interest were physicians' knowledge of nutrition-based lifestyle interventions, the Diabetes Prevention Program itself, along with barriers and limitations to using nutrition-based lifestyle interventions or the Diabetes Prevention Program. Appendix B provides a list of qualitative questions asked, the intent of each question, and the online survey question number.

V. Findings

SPSS was used to conduct analysis of all closed-ended quantitative questions and to compute new variables needed for analysis. For instance "Group" variable was created to evaluate the difference in intervention strategies used for diabetic patients. Descriptive analyses, plots, tests for normality, crosstabs and tests of proportionality were conducted before analyzing closed-ended responses. Histograms, Boxplots, P-P Plots and Q-Q Plots were produced to visually inspect the distribution of each variable measure because the best estimate of a measure is the center of a distribution according to central limit theory (Moore & Cabe, 1999; Green, 2011; Field, 2009).

Statistical Analysis

Histograms suggested distributions were non normal in each of the variables and boxplots gave information on the degree of spread and skewness and also identified outliers present in the closed-ended variables. P-P and Q-Q plots were inspected to examine deviations from the normal distribution.

The distribution of all referenced closed-ended questions were examined to better understand the data and test for normalcy to determine which procedure, parametric or nonparametric, was appropriate for analysis. While visual inspection of data provided evidence that the distribution of close-ended variable measures was not consistent with a normal distribution as confirmed by the Kolmogorov-Smirnov and Shapiro-Wilk tests, there was one instance where the close-ended variable measure might be considered normal - *lacking in social assistance-receives social assistance* (Q22g). Results for the one exception (i.e. Q22g) was ambiguous because the nonparametric Kolomogorov-Smirnov test for this variable was significant ($p=0.001$) and therefore could be

considered different from normal, but the Shapiro-Wilk test was not significant (p=0.097) and thus, not different from normal.

Through the production of crosstabs, both the X^2 and the Fishers Exact tests were examined to evaluate differences in proportions between Group A (patient base is 50% or more African American) and Group B (patient base is 50% or more Caucasian American) for responses on measures on treatment strategies (Q11), likelihood of using DPP (Q15), satisfaction with current strategies being used (Q17), value of nutrition-based interventions (Q19) and patient scores (Q22a-Q22m).

While X^2 is a nonparametric measure, its accuracy depends more on the size of frequencies in each cell. The rule of thumb is that cell counts should be no less than 5 and no less than 20% for large sample. However, in the data set for this study, this criteria was not met. In fact, between 60% and 79% of cells for these crosstabs had counts less than 5. Consequently, the Fishers Exact Test, which can be applied to small samples such as the sample of 44 responding physicians for this study, was employed. Use of X^2 on small sample can lead incorrectly to a type I error and falsely reject the null hypothesis: there is no association. Hence, both tests were examined to test the association between groups and the Fishers Exact Test confirms there is no significant difference between the column proportions of Group A and Group B.

Table 6 below provides a summary of results for the p-values of these tests for the measures discussed above.

Table 6: Pearson X^2 and Fisher's Exact

Measure	Pearson Chi-Square (2-sided)	Fisher's Exact Test (2-sided)
Q11 (Recommended treatment for diabetes)	.542	.614
Q15 (Likelihood of using DPP in practice)	.545	.663
Q17 (Satisfaction with current intervention strategy)	.991	1.000
Q19 (Value of nutrition-based lifestyle intervention strategy)	.229	.215
Physician scoring on diabetic patients on the following attributes:		
Q22a (intelligence)	.875	.977
Q22b (self-control)	.147	.185
Q22c (pleasant)	.152	.112
Q22d (educated)	.726	.837
Q22e (rational)	.772	.786
Q22f (responsible)	.981	1.000
Q22g (social assistance)	.539	.592
Q22h (comply with medical recommendations)	.794	.890
Q22i (likely to participate in nutrition-based lifestyle intervention)	.505	.588
Q22j (likely to engage in exercise)	.327	.316
Q22k (insured for nutrition-based lifestyle intervention)	.191	.189
Q22l (likely to afford nutrition-based lifestyle intervention without insurance)	.364	.330

Measure	Pearson Chi-Square (2-sided)	Fisher's Exact Test (2-sided)
Q22m (culturally like people I could be friends with)	.412	.374
Time estimate on the amount of time given to patients		
Q24a (Patients who have type 2 diabetes)	.355	.416
Q24b (Patients who are healthier)	.317	.314

The evidence in Table 6 shows there are no differences in proportions between Group A and Group B for any of the variables listed (i.e. if $p > 0.05$, then one can fail to reject the null hypothesis: there is no significant difference between column proportions)[1]

In summing up, interpretation of plots and diagnostic tests lead to the conclusion that distribution of all closed-ended variable measures can be considered different from normal and therefore nonparametric procedures were employed to compare the two groups. This direction was also appropriate due to the small sample size and outliers observed during diagnostic tests (i.e. plots of quantitative variables). Since nonparametric procedures are appropriate for this sample, mean values and standard deviations were not used (i.e. normal distribution of this data cannot be assumed).

Content Analysis (CA) was used to evaluate physician responses to open-ended questions and identify prevailing themes from their responses. CA is a method that can

[1] Mann-Whitney and Wilcoxon's rank tests were also conducted even though Fishers Exact is more appropriate for small sample. The former tests showed the null could not be rejected for attribute Q22k (insured or not for nutrition-based lifestyle intervention), and therefore is further discussed in the summary of findings.

be used to analyze data in various forms including print, verbal and electronic media. CA is also an appropriate method for analyzing open-ended survey responses because CA is one way to systematically turn qualitative information into quantitative data and create analytical themes from open-ended responses (Kondracki, Wellman & Amundson, 2002).

Furthermore, themes emerged from the use of CA without using literature, and instead open-coding was used to allow the data to speak for itself (Ruben & Ruben, 2005). Often individual responses to a question would fit more than one theme. Hence, there could be multiple coded responses for a single physician response.

Since open-ended questions for this survey were designed to add context and insights to closed-ended questions, findings and analysis of both closed-ended and open-ended responses are jointly presented.

A. Summary of Findings

1. Physician considerations regarding lifestyle interventions

All responding physicians were first asked to explain the lifestyle intervention they thought would best help treat their type 2 diabetic patients (Q10). The answers given were varied and resulted in four themes: factors that are External to Patients of these physicians, Patient-based Intervention Strategies patients could use, Supportive Functions and General Care. There were 135 coded responses for these themes.

External Factors: Themes that can be viewed as External Factors were composed of availability of nutritious food, variety in nutritious food options patients could choose from, culturally sensitive food options, and options that could be understood by patients. Four percent (5) of all coded responses for this theme were related to availability, variety, culture and understandability of options. For instance, some physicians were concerned with availability of nutritious foods, culturally sensitive food choices or diets that were understandable.

"Availability of nutritious foods..."

"... Diet choices using common ethnic foods"

"... Simple, understandable diet choices"

Patient-based: Six coded themes, 73% (98 coded responses), were related to Patient-based Intervention Strategies - specific responsibilities physicians believed patients have: healthy eating, losing weight, managing weight, modifying behavior, self-regulation and physical exercise. One physician for instance stated there needs to be

"Understanding from the patient that they need to take control of their diet."

Supportive Functions: The Supportive Functions theme includes the need for nutrition counseling and nutrition education, monitoring, maintaining food diaries, setting

goals, and receiving continuing support from a nutritionist/dietician. Coded responses for these supportive functions represented 17% (23) of the coded responses for which interventions best help type 2 diabetics. Physician comments in this area include:

" Dietary counseling and modifications. Also counseling on increased and consistent exercise to facilitate weight loss."

" Nutritional education"

" Food diaries, consults with dietician/nutritionist, regular weigh-ins."

General Self-care: The General Self-care theme included associations related to medical care, safety and overall care, representing 7% (10) of coded. One physician illustrated this theme succinctly with a comment that included:

"... smoking cessation... "

2. Physician Treatment Recommendations

All responding physicians were next given a closed-ended question that asked what treatments they generally recommended (Q11) and 91% (40) said they recommended both lifestyle intervention and drug treatment for their type 2 diabetic patients.

3. Physician Perspectives on Specific Nutrition-based Intervention Strategies

The perspectives of responding physicians regarding specific nutrition-based lifestyle intervention strategies they were most familiar (Q13) fell into six theme groups: Diet Strategies, Behavior Modification, Nutrition Education and Counseling, Monitoring and Support, Physical Activity and Self-Care. A total of 74 coded responses emerged for this question and two of the coded responses (3%) represented a lack of awareness on the part of the responding physicians regarding nutrition-based lifestyle intervention

strategies. For instance, one physician said *"I am not aware of a specific program" in* feedback provided.

Diet Strategies: 43% (32) of coded responses represented the diet strategies theme including interventions available through institutions or organizations, widely recognized diet approaches and general, non-specific diet and exercise recommendations. The general understanding about specific nutrition-based interventions among physicians surveyed is evidenced by comments such as these.

"low fat, low carb(ohydrate) diet, DASH diet"

"ADA1500 recommendations"

"Weight Watchers, Jenny Craig"

Behavior Modification: 7% (5) of coded responses reflected physicians' awareness that behavior modification is necessary in nutrition-based lifestyle intervention strategies. For instance, a few physicians cited awareness that portion control and avoiding processed foods was necessary.

"Portion control..."

"Avoidance of processed carbohydrates... "

Nutrition Education and Counseling: Nutrition education and counseling in nutrition-based lifestyle intervention strategies were also acknowledged by physicians as reflected in 24% (18) of the coded responses.

"Nutritional counseling with certified diabetes educator..."

Monitoring and Support: 5% (4) of coded responses represent physician awareness of monitoring and supportive activities in nutrition-based lifestyle interventions. For instance, one physician cited *"... and support group (such as weight watchers)"*

Physical Activity: Physical activity as part of nutrition-based lifestyle interventions was acknowledged by physicians and represented 11% (8) of coded responses for the question on nutrition-based strategies they were most familiar. Sentiments can be observed for instance in feedback from one physician who was particularly specific regarding the need for physical activity.

" .... at least 150 min(ute)s of cardio workout a week"

Self-care: Lastly, 7% (5) of the coded responses reflected awareness of self-care in nutrition-based lifestyle interventions. For instance, one physician expressed the need for patients to *" Stop alcohol intake"* as an area of self-care in a nutrition-based intervention.

4. Physician Awareness of Diabetes Prevention Program

Physicians were asked about the Diabetes Prevention Program (Q14) and in the absence of any information presented on DPP, physician responses fell into four themes: Informed, Somewhat Informed, Misinformed and Unaware/Uninformed.

Informed: Of the total 45 coded responses for this question, only 16% (7) could be considered reflective of physicians being informed about DPP and is illustrated by this comment.

" A program using education on diet and exercise to prevent diabetes"

Somewhat Informed: Another 16% (7) of coded responses were appropriate for the category of Somewhat Informed about DPP. For example, one physician said *" dietary, and disease education"* illustrating awareness of the dietary component but lack of clarity by citing disease education.

Misinformed: 4% (2) of coded responses for Q14 reflect misinformation among some of the responding physicians regarding DPP. One physician in particular has a false understanding because DPP aims to prevent diabetes.

"... They don't see prediabetes"

Unaware/Uninformed: An overwhelming 64% (29) of responses from responding physicians regarding DPP was appropriate for the Unaware/Uninformed theme as evidenced by some physician comments. This lack of awareness is captured in feedback from one physician.

" I've heard and know nothing"

When asked a closed-end question on the likelihood of using DPP in their practice (Q15), on a scale of 1(very unlikely) to 7 (very likely), 34% (15) of all responding physicians were a 6 or 7 on this 7-point scale. Additionally, 18% (8) of responding physicians gave a rating of 5 and only 9% (4) could be considered as very unlikely (1 or 2 rating) to use DPP to treat type 2 diabetes patients.

5. Physician Satisfaction with Current Intervention Strategies

Physicians were asked in an open-ended question to explain what makes them satisfied or not satisfied with their current intervention strategies (Q16). Forty-six coded responses for this question were grouped into three themes: Satisfied, Somewhat Satisfied and Unsatisfied.

Satisfied: 17% (8) of responses coded from responding physicians provided evidence of satisfaction with current intervention strategies as they explained what makes them satisfied. For instance, one physician's views were: *"Have seen several patients control DM II completely with weight loss and dietary changes. Many of them were surprised to find they had DM II, actively made changes, and have been rewarded medically for these changes."*

Somewhat Satisfied: One-third (15) of coded responses from responding physicians evidenced levels that seemed physicians were somewhat satisfied evidenced by reasons that include the following.

"I am satisfied with the options available for patients. I am not satisfied with non compliant patients who do not try to help themselves"

"good results with medications, poor results with lifestyle modifications"

Unsatisfied: 50% (23) of the coded responses were deemed evidence of physicians being unsatisfied with the current strategies being used. Responding physicians generously expressed the reasons for their frustrations. Responses from a few of these physicians are provided to illustrate this point.

" Understand and agree with clinical findings regarding diet and exercise but find developing programs and participation in current patient population difficult. Patient resistance to lifestyle changes is high."

" Usually patient non-compliance makes me very unsatisfied and frustrated. I feel like I try to help some people who do not want to or are not ready to change."

How can you help people in this area?"

Following their explanation on what makes them satisfied or not with current intervention strategies, responding physicians were asked in a closed-ended question to consider their overall satisfaction levels with current intervention strategies used in their practice to obtain desired patient outcomes for type 2 diabetic patients (Q17). Responding physicians rated this question using a scale of 1 (lowest) to 7 (highest). Less than 20% (8) gave a high rating of 6 or 7 but 30% (13) seemed satisfied enough as evidenced through a rating of 5 on this 7-point scale. Only a small 7% (3) of these

responding physicians evidenced very low satisfaction levels by giving a rating of 2 on this 7-point scale. Another 9% (4) of responding physicians gave a low satisfaction rating of 3, but 36% of responding physicians appeared in the middle of being satisfied and not satisfied by giving a rating of 4 on this 7-point scale

6. Physician Perceptions on the Value of Nutrition-based Lifestyle Interventions

When physicians responded to the open-ended question *"Overall, in your opinion, what is the value of nutrition-based lifestyle intervention strategies"* (Q18), their opinions seemed appropriate for three coded themes: Highly Valued, Somewhat Valued and Conditionally Valued.

Highly Valued: Approximately two-thirds (66%) of all 59 coded responses for this question suited the Highly Valued theme for this question. One physician said: *"It is huge...a healthy diet is key for a diabetic patient"*

Somewhat Valued: Only five percent (3) of the coded responses seemed applicable to the theme of Somewhat Valued. For instance, one physician said it is *"Valuable and effective up to a certain degree, especially initially and for prediabetes"*

Conditionally Valued: Close to one-third (29%) of the coded responses fit the theme of Conditionally Valued because of the opinions offered by responding physicians.

"Extremely high if followed"

"If done properly, over time a new lifestyle may emerge that is healthier with hopefully lifelong benefits"

"When there is good patient compliance, patients will often do well with less or no medication."

When asked to rate the value of nutrition-based intervention strategies (Q19) using a scale of 1 (lowest) to 7 (highest), 41% (18) of all responding physicians gave a highly valued rating with a score of 6 or 7. An additional 30% (13) of responding physicians gave a moderately good score of 5 for the value of nutrition-based intervention strategies. Only 5% (2) of the responding physicians found very low value for nutrition-based strategies as evidenced by their score of 2.

7. Physician Perceived Barriers to Nutrition-based Interventions

Following the closed-end question on the value of nutrition-based interventions, physicians were then asked to *"Explain what specific barriers would (has) your practice experience(d) in using nutrition-based lifestyle interventions in your treatment plans for type 2 diabetes patients"* (Q20). Physician responses to this question were coded into six themes: External Environment, Physician-based Barriers, Patient-based Barriers, Patient Characteristics, Patient Behavior and Nutrition Education. There were a total of 65 coded responses for this question.

External Environment: 8% (5) of the coded responses for this question fit the External Environment theme. Issues related to the external environment included ethnic options, food costs, ability to prepare foods, and impacts of food manufacturers via large scale marketing campaigns. For instance, one physician cited *"Food plans do not address ethnic food preferences, or attempt to find close alternatives"* while another said *"Our patients have nowhere to prepare their own food as they live in shelters and have to eat the food prepared by shelter."*

Physician-based Barriers: 6% (4) of coded responses seemed appropriate for the Physician-based Barriers theme. These barriers relate to constraints of time, resources,

the lack of nutrition-based education and the number of people having the condition of diabetes. These sentiments are evidenced by the following physician feedback.

"Time constraints, staff restraints"

"Not having enough education to teach about nutrition"

"Too many patients with diabetes in my area to have all their needs met"

Patient-based Barriers: 15% (10) of the coded responses were most suited for the theme of Patient-based Barriers. Physicians viewed patient-based barriers as limited financial resources, access to healthy foods, cultural lifestyles, and time constraints. Examples of these views are evidenced by:

"... Patient barriers to healthy food choices"

"Limited financial resources..."

"... ethnic barriers to healthy lifestyle..."

"Working patients..."

An additional 15% (10) of coded responses define the theme of Patient Characteristics. Physicians cited language, comprehension and habits as defining characteristic-based barriers.

"... reading and language are also barriers"

"Eating habits are very difficult to change the older you get"

Patient Behavior: More than half (57%) of the 65 coded responses are quite suited for the theme of Patient Behavior as vigorously noted by responding physicians. Their sentiments - patient adherence, motivation, resistance, beliefs, intentions - are captured in the comments of a few.

"Adherence..."

"... (patient) attrition"

"Patient compliance - some do (not) want to change their eating habits AT ALL"

"... Many believe the 'rules' don't apply to them"

8. Physician Perceptions Regarding Diabetic Patients

Following completion of the close-ended and open-ended questions discussed above, responding physicians were asked to score their diabetic patients on the following 13 attributes based on a 7-point scale (Q22a-Q22m). The Top 2-box (score = 6 and 7) and Bottom 2-box (score = 1 and 2) scores were created and evaluated for this analysis. Top/Bottom-2-box are a common analytic approach in research, is indicative of very and somewhat, and is viewed as an alternative to a mean score (Sauro, 2010; Timpany, 2011). Appendix C provides a complete listing of scores for each attribute.

Intelligence (Q22a):15% of all responding physicians (n=42) perceived their diabetic patients as very intelligent as evidence by the Top 2-box rating of 6 or 7. Only 5% of these responding physicians perceived their diabetic patients as being on the lower spectrum of intelligence through a Bottom 2-box score.

Self-control (Q22b): 7% of all responding physicians (n=44) perceive their patients have a high level of self-control as evidenced by physicians Top 2-box score. However, 21% of physicians perceive patients of having low-self control evidenced by a Bottom 2-box score.

Pleasant (Q22c): 44% of all responding physicians (n=43) perceive their diabetic patients as pleasant illustrated by their Top 2-box scores and just 2% of responding physicians considered their diabetic patients as unpleasant evidenced through a Bottom 2-box score.

Educated (Q22d): 21% of all responding physicians (n=43) view diabetic patients under their care as educated, while 7% consider their diabetic patients as uneducated.

Rational (Q22e): 24% of the physicians (n=42) who scored patients on this attribute perceive diabetic patients as rational, and only 7% perceive these patients as irrational.

Responsible (Q22f): 17% of responding physicians (n=42) view their diabetic patients as responsible while 5% do not.

Social Assistance (Q22g):14% of responding physicians (n=42) scored their diabetic patients with a Top 2-box rating evidencing these physicians view their patients having some form of social assistance. 12% of the physicians who responded perceive their diabetic patients to lack social assistance illustrated through a Bottom 2-box score.

Compliance (Q22h): Only 2% of responding physicians (n=42) perceive their diabetic patients to be compliant when given medical recommendations and 14% of physicians feel their patients are noncompliant.

Likely to participate in a Nutrition-based lifestyle intervention (Q22i): 11% of the physicians (n=44) who scored this attribute have the perception that their diabetic patients are likely to participate in a nutrition-based intervention that includes nutrition, exercise and counseling, but 7% have a different perception. The latter group of physicians believe their patients are unlikely to participate.

Likely to engage in exercise (Q22j): Only 2% of responding physicians (n=42) have the perception that their type 2 diabetic patients are likely to engage in exercise. 19% of responding physicians believe patients are unlikely to do so.

Insured for nutrition-based lifestyle intervention (Q22k): Just 7% of all responding physicians (n=44) perceive their patients to have insurance for a nutrition-based lifestyle

intervention. 23% of the physicians perceive their diabetic patients are not insured. Furthermore, since the Mann Whitney test on this attribute revealed a significant difference between groups, the Top 2-box and Bottom 2-box proportions by group are provided:

	Group A	Group B
Top 2-box	6%	7%
Bottom 2-box	38%	14%

Hence, there are proportionately more physicians among Group A (physicians with a patient base of at least 50% or more who are African Americans) that perceive their patients are uninsured for nutrition-based lifestyle interventions based on the Bottom 2-box ratings for both groups (see Appendices D and D2 for details).

Likely to afford nutrition-based lifestyle intervention without insurance (Q22l): Barely 9% of all responding physicians (n=44) perceive diabetic patients under their care are likely to afford nutrition-based intervention if they do not have insurance. Just slightly more than one-third (34%) of the physicians perceive type 2 diabetic patients cannot afford nutrition-based intervention if they are not insured for this intervention.

Culturally like friends (Q22m): Only 10% of responding physicians (n=43) perceive their diabetic patients as being culturally unlike people they could be friends with. More than double (23%) of the responding physicians perceive diabetic patients as culturally like people they could be friends with.

9. Physician Reactions to Diabetes Prevention Program Defined

The last open-ended question for physicians sought their reaction to the Diabetes Prevention Program. For this open-ended question, physicians were given information on the DPP and then asked *"Based on this description and any information you may already have on this program, please explain how easy or difficult it would be (is) to*

integrate the Diabetes Prevention Program in your practice?" (Q23). Physician responses were coded into four themes: Easy, Challenging but Possible, Challenging and Unlikely, Difficult.

Easy: 30% (13) of the total 44 coded responses were considered fit for the Easy theme. For instance, one physician said *"It would not be as difficult as more patients request such programs and information, when drugs and self-help fails."*

Challenging but Possible: 43% (19) of the coded responses provided the content for the Challenging but Possible theme. In the words of a few physicians, there are real and tangible reasons why the program would be challenging.

" I think it would be a great program and resource for my patients if it was affordable for them. Some of them would definitely be motivated to attend and utilize the gym resources."

"It would be easy if it is covered by insurance or free. There is not a YMCA in our neighborhood."

Challenging and Unlikely: 14% (6) of all coded responses for the question about DPP were best suited for the Challenging and Unlikely theme. For instance, one physician summed the issues up quite well. *"Would not be easy for many patients. Lack of transportation to YMCA, lack of ability to afford YMCA, lack of motivation would all make it difficult to integrate. If insurance paid or offered other motivation, might be easier."*

Difficult: Lastly, 14% (6) of coded responses for the DPP question belong to the theme Difficult as illustrated by a two physician comments.

"Difficult. Many patients state they do not have the time or resources to attend such programs."

"People don't like structure "

10. Physician Estimates of Time Spent on Diabetic Patient Care

The remaining closed-ended question addressed the perception of time spent with diabetic patients relative to healthier patients. (Q24a-Q24b)). Intuitively and based on the high cost of healthcare, it would be expected that physicians treating patients diagnosed with type 2 diabetes would spend a far greater amount of time with these patients relative to the amount of time spent with patients who are healthier.

Evidence obtained in this study confirms this expectation. Two-thirds (67%) of all responding physicians (n=43) reported spending approximately 5 to 15 minutes with healthier patients, which is less than three times the amount of time being spent with type 2 diabetic patients. Specifically, only 19% of the physicians reported spending 5 to 15 minutes with type 2 diabetic patients - 58% of these responding physicians instead reported spending 20 to 30 minutes with diabetic patients. Some (23%) reported spending 35 or more minutes where only 12% of responding physicians evidenced spending 35 or more minutes with healthier patients.

VI. Analysis and Discussion

Along with the research objectives, the interest of this study is the question *"Can we bridge the physician practices to produce results achieved in evidence-based lifestyle intervention research?"* Consequently, this analysis will review each research objective and provide evidence on how the study has met the objective. Next, a summary analysis of key findings will be presented based on physician responses to both open-ended and closed-ended questions earlier presented. Following this analysis, a discussion will argue how nutrition educators can assist physician practices in bridging the gap between evidence and practice.

Objective 1: Explore the perceptions of physicians on the effectiveness of nutrition-based lifestyle interventions.

Evidence that emerged in this study strongly suggests that responding physicians highly valued nutrition-based strategies for their effectiveness in treating or preventing type 2 diabetes. Given that nutrition intervention is viewed as an essential ingredient in treating and preventing diabetes and other chronic disease by many investigators (e.g. NIH, 2011; Shaik et al., 2011; Mathers, 2008; Contento, 2007; Pelto & Freake, 2003), this finding is not surprising. In fact, as reported in this research, evidence-based research has shown nutrition-based lifestyle interventions to be highly effective in reducing the incidence and impact of type 2 diabetes (Diabetes Prevention Program Research Group, 2002, 2003, 2009, 2012; Herman et al., 2005).

Objective 2: Compare and contrast intervention strategies delivered to non-Hispanic blacks and non-Hispanic whites.

Responding physicians who treat at least 50% or more African American diabetic patients (Group A) as compared to responding physicians who treat 50% or more Caucasian Americans (Group B) do not differ in strategies recommended to their type 2 diabetic patients according to findings in this study. In fact, the only evidence that emerged to suggest a difference exists is associated with insurance for nutrition-based lifestyle interventions - relatively more Group A diabetic patients were perceived to be uninsured for these interventions than were diabetic patients of Group B. Yet, disparities in incidence rates and health outcomes related to type 2 diabetes prevail and the lack of insurance for nutrition-based interventions is unlikely to be the only factor.

Various factors that may contribute to differences in diabetes incidence and diabetes related outcomes among African American diabetic patients relative to Caucasian American diabetics was suggested in open-ended feedback from some responding physicians and also in research conducted by other investigators interested in disparities related to diabetes and other chronic diseases (van Ryn & Burke, 2000; van Ryn, 2002; Heisler, Smith, Hayward, Krein & Kerr, 2003, Jenkins et al., 2004, 2011; Betancourt et al., 2003). A case in point includes external factors such as the fact that locally available healthy food that is both affordable, accessible and ethnically viable are problematic. In other words, it wouldn't matter how motivated a given person would be to changing dietary behavior if nutritious foods are not readily available, affordable or would satisfy ethnic tastes.

Another factor could be the high level of frustration evidenced among responding physicians attempting to secure better outcomes for their type 2 diabetic patients. If African Americans, have relatively fewer resources, particularly with respect to time,

budget constraints and support, then African Americans may be less able to comply with physician recommendations and hence more likely to increase physician frustration. In other words, if physicians perceive patients differently and patients through their own behavior, can modify physician beliefs, as van Ryn (2002) argues, then it seems possible that African American patients contribute to disparate outcomes by influencing physicians' attitudes, perceptions and beliefs as suggested by van Ryn and Burke (2000) when complying with physician recommendations are perceived or experienced as too difficult a task. Additionally, van Ryn and Burke argue that bias in physician perceptions is compounded when less time is given with minorities to include information such as treatment discussions and follow-up medical services. As a final point, it is important to note that van Ryn (2002) suggests that providers, through their interaction with patients, can affect: patients" self-efficacy or confidence in their ability to perform a given behavior such as buying and eating more vegetables; behavioral intentions, their likelihood of performing this behavior; and trust. It seems probable that relative reductions in confidence, intentions and trust between ethnic groups are all likely to contribute to disparities in diabetes-related outcomes.

If best practices are important in ensuring evenness in outcomes between ethnic groups as argued by Jenkins et al. (2011), then the argument can be made, that protocols are needed to ensure physician practices are being followed as evidenced by the Diabetes Prevention Program. Additionally, Heisler et al. (2003) suggested that health processes need attention, and according to Betancourt (2003), culturally-based interventions must be employed if disparities are to be addressed.

Rounding this discussion out, future qualitative research with physicians and their diabetic patients that includes the ability to probe and submit follow-up questions, could add to the body of knowledge gained on this research objective.

Objective 3: Identify barriers and limitations of incorporating nutrition-based lifestyle interventions.

Responding physicians were tremendously forthcoming in identifying factors that can and do inhibit the ability to effectively use nutrition-based lifestyle interventions, even though these physicians expressed high regard for such interventions. Inhibiting factors in employing nutrition-based strategies in practice from the perspective of these treating physicians were many. Factors that neither patients nor physicians have control over included food costs, urban environments, and continuous marketing campaigns by food manufacturers. Physicians are constrained by time, staff and costs, and are not knowledgeable enough regarding nutrition-based strategies, nor are physicians capable of effectively providing nutrition counseling. Patients are also constrained by time and finances, some do not understand nutrition-based information provided to them because of reading levels and language barriers. Furthermore, patients are perceived by responding physicians as lacking in motivation, self-regulation, compliant behavior, and some as completely resistant to changing their lifestyle and instead *"doing whatever they want"*.

Studies conducted by other investigators (Beverly et al., 2011; Brown & LeRoith, 2010; Brown et al., 2002; Florence & Yeager, 1999) also identified challenges in treating and preventing diabetes. Challenges mentioned include poor control of diabetes, patients who are "not empowered to prevent or treat hyperglycemia" (Brown & LeRoith, 2010, p.

742), as well as the costs, support and literacy levels associated with addressing diabetes (Brown & LeRoith, 2010). Florence & Yeager (1999) confirm what responding physicians argued by acknowledging provider challenges with managed care and limited resources. Furthermore, Florence & Yeager argued that type 2 diabetes is common and is under-diagnosed which present challenges in treating patients.

Beverly et al (2011) provided evidence through a qualitative study that patients have social and emotional challenges that physicians are not trained to provide psychological support to patients. Furthermore, that treatment options are limited to referrals, recommendations for increased follow-up visits and providing individualized care. As a result, physicians' feel "frustrated, inadequate and overwhelmed" (Beverly et al., 2011, p.1088) because there is not enough time or know-how to provide this level of care.

The Brown et al (2002) investigative team found through qualitative research, three domains of barriers: patient-based factors, physician-based factors and what they called systemic factors. Patient factors related to the ability of patients to exercise responsibility and management of their diabetic condition. Brown et al referred to these factors as 'patient facilitators' that if exercised, would lead to better patient outcomes; else would contribute to adverse patient outcomes. Additionally, Brown et al found that barriers related specifically to patients were adherence, the need to make considerable modifications in their lifestyles, their overall attitudes towards the disease, cultural context, treatment costs, and time constraints. With respect to physician barriers, Brown et al. cited lack of skill, knowledge and comfort levels in managing patients with type 2 diabetes. Further physicians lacked systems to help track and follow up on diabetic patients, so if someone fails to show up for their appointment, it could be a long time

before it is noticed. Brown et al. also cited staff and time constraints within practices as well as reimbursement constraints. Finally, according to Brown et al., physicians acknowledged the intricacies of diabetes management because of multiple medical conditions likely needing attention when treating diabetic patients.

Objective 4: Investigate perceptions on patient affordability and provider costs of using nutrition-based interventions.

Literature that supports the investigation of patient affordability and provider costs of using nutrition-based lifestyle interventions is comprehensive. The introduction of this paper covered research conducted by investigators on health and societal costs associated with type 2 diabetes. Several of the investigators listed in this literature review section (NIH, Brown & LeRoith, Brown et al, Florence & Yeager) cited provider costs and patient costs of type 2 diabetes as a barrier in obtaining desired outcomes of treatment and prevention. Additionally, this study has shown that costs of treating diabetic patients are considerably high for responding physicians as inferenced by the amount of time spent with these patients relative to time on other patients considered less chronically ill.

Summary

This analysis and discussion has provided evidence that research objectives have been met by obtaining the voice of physicians in this research. The voice of responding physicians has provided their perspective on the value of nutrition-based lifestyle interventions: physicians have high regard for these interventions, are challenged in trying to employ them, and know that given the chance, nutrition-based interventions can go a long way towards solving problems associated with type 2 diabetes. Responding physicians also shared the substantial amount of time being spent with diabetic patients

relative to healthier patients and naturally, and this translates into higher costs for both physicians and their diabetic patients. Results from other studies provide supporting evidence for some of the feedback from physicians, but also contributed to enhance learning concerning real and perceived challenges physicians, diabetic patients and society encounters related to the overwhelming presence of type 2 diabetes.

Given the plethora of factors that pose barriers and limits on effectively utilizing nutrition-based interventions, along with the costs associated with epidemic levels of type 2 diabetes, this study argues for increased support for physicians so their patients can experience the overwhelming realization that nutrition is *"a necessary step for all diabetic patients"* and is needed *"in order to conquer diabetes."* Furthermore, the literature and findings in this study concerning barriers and limitations, provide compelling support that an expanded role for nutrition educators, as argued by Contento (2007), is most urgently needed to assist physicians in harnessing the value of nutrition-based intervention strategies.

Through the Diabetes Prevention Program (DPP), there are known protocols which emerged through evidence-based research, that can effectively address these barriers and limitations both patients and physicians are facing. Importantly, these DPP protocols mirror constructs of nutrition-based theories because their stated goal is changing behavior and the DPP mediators include: nutrition education and exercise, support in losing weight, addressing problems, identifying emotional/social cues, staying motivated and managing stress (Diabetes Prevention Program Web Site).

Most encouraging is that CDC is now encouraging participation in a "Centers for Disease Control and Prevention Diabetes Recognition Program - the PDRP" (Centers for

Disease Control, 2011). According to the CDC, the purpose of this program is recognizing those who have evidenced effectiveness in delivering an evidence-based (i.e. proven) type 2 diabetes prevention lifestyle intervention to make certain quality is present and curriculum standards developed for the DPP are followed. CDCs stated objectives for this recognition program include the assurance of program quality, adherence to scientific evidence and expansive use of effective type 2 diabetes prevention lifestyle interventions, and providing technical assistance in local area programs. The criteria for applying is "any organization with the capacity to deliver a lifestyle intervention meeting DPRP standards" (Centers for Disease Control, 2011, p.14). Consequently large physician practices or a consortium of physicians can be eligible to apply.

Nutrition educators are ideally suited to play a large role in this CDC process by assuming a leadership role in shepherding physicians treating type 2 diabetics and prediabetics through patient-physician designed protocols that will effectively bridge evidence into physician practices.

VII. Implications

Nutrition educators and counselors have a huge opportunity to emerge as change agents in translating evidence into practice with the goal of bridging the patient outcome gap for type 2 diabetes. The best opportunity is placing the focus on the many barriers and limitations noted. For instance, lack of patient compliance, motivation, self-regulation, support, and the inability to obtain results sustained overtime is a big part of physician frustration and why outcomes in practice are not matching evidence. It is possible, based on the public availability of the DPP protocols along with the PDRP criteria, nutritionists can hit the ground running because the constructs are readily available and have demonstrated their effectiveness in reducing the incidence of diabetes and diabetes-related outcomes.

Urgency is needed, and the argument here is that Nutrition educators and counselors have an opportunity to play a much, much bigger role in making the difference for both treating and preventing type 2 diabetes. Concentrating DPP in YMCAs is not realistic, practical, or especially desired by CDC. Instead, what is wanted is a way to broaden the distribution of proven DPP protocols with relies heavily on nutrition-based intervention strategies: nutrition, counseling and exercise - and people who are diabetic or prediabetic need these protocols, and physicians need the support.

VIII. Limitations

The following limitations exist within this research study. First, the sample of 44 physicians is small and would necessitate additional one-on-one in-depth interviews to further ensure the completeness of information gleaned from physicians in this study. In effect, these results cannot be generalized to physicians treating diabetic or prediabetic persons in the entire four-state region of Connecticut, New Jersey, New York and Pennsylvania. Second, the constraints of this study imposed by the need for anonymity prevented any probing or follow-up on qualitative questions. Furthermore, it would have been more instructive to have been able to ask qualitative questions of patients of these responding physicians to get a 360-viewpoint. In other words, while the perspective of treating physicians was obtained, information from type 2 diabetic patients would have added their patients' perspectives which could be supportive, illuminating or dissimilar to information obtained from these responding physicians. Hence, there could be social desirability bias since physicians were asked to reveal information about their perceptions and practices, the sample was small, and physician patients were not included in this survey.

Future research should include one-on-one interviews with physicians and their patients with a large sample size for both physicians and type 2 diabetic patients under their care. The ability for follow-up probes should be used as well as solicitation of quantitative information for this larger sample.

The need for this expanded study is important since this study and other research identified has shown there are gaps that need to be filled in order to reduce the incidence, prevalence and outcome disparities of diabetes. Bringing evidence-based research on

lifestyle interventions into physician practices where type 2 diabetic patients are being treated is one way to bridge these gaps. Since the expanded study might reveal actionable, realistic steps that can be taken, from the perspectives of physicians and their type 2 diabetic patients, it seems a reasonable pursuit that could be undertaken. In this way, as NIH suggests, more treating physicians may use evidence-based strategies.

IX. List of Tables

X. List of Appendices

Appendix A - Tables 1 through Table 5

Appendix B - Survey Questions

Appendix C - Physician Ratings on Perceptions of Patient Attributes

XI. References

Ackerman, R. T., Marrero, D. G. (2007). Adapting the Diabetes Prevention Program lifestyle intervention for delivery in the community: The YMCA model. *The Diabetes Educator, 33*(69),69-78.

Ackermann, R.T., Marrero, D.G., Hicks, K.A., Hoerger, T.J., Sorensen, S., Zhang, P., Engelgau, M.m., Ratner, R.E. & Herman, W.H. (2006). An evaluation of cost sharing to finance a diet and physical activity intervention to prevent diabetes. *Diabetes Care, 29*,1237-1241).

Betancourt, J. R., Green, A.R. & Carrillo, J.E. (2003). Defining cultural competence: a practical framework for addressing racial/ethnic disparities in health and health care. *Public Health Reports 118*,293-302.

Beverly, E.A., Hultgren, B.A., Brooks, K.M., Ritholz, M.D., Abramson, M.J. & Weinger, K. (2011). Understanding physicians' challenges when treating type 2 diabetic patients' social and emotional difficulties. *Diabetes Care, 34*,1086-1088.

Brace, I. (2005). Questionnaire design: How to plan, structure and write survey material for effective market research. Philadelphia, PA: Kogan Page Ltd.

Brown, M.T. & LeRoith, D. (2010). Overcoming challenges in type 2 diabetes management to improve patient outcomes. *Expert Reviews Endocrinology & Metabolism, 5*(5),741-751.

Brown, J.B., Harris, S.B., Webster-Bogart, S., Wetmore, S., Faulds, C. & Stewart, M. (2002). The role of patient, physician and systemic factors in management of type 2 diabetes mellitus. *Family Practice, 19*(4),344-349.

Centers for Disease Control and Prevention Diabetes Prevention Recognition Program (2011) *Standards and Operating Procedures*. Retrieved from: www.cdc.gov/diabetes/prevention/recognition.

Contento, I.R. (2007). Nutrition education: linking research, theory and practice. *Asia Pacific Journal of Clinical Nutrition, 17*(1),176-179.

Contento, I.R. (2011). Nutrition Education: Linking Research, Theory, and Practice. Sudbury, MA. Jones and Barlet.

Diabetes Prevention Program Research Group (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or Metformin. *New England Journal of Medicine, 346*(6),393-403.

Diabetes Prevention Program Research Group (2003). Within-trial cost-effectiveness of lifestyle intervention or Metformin for the primary prevention of type 2 diabetes. *Diabetes Care, 26*(9),2518-2523.

Diabetes Prevention Program Research Group (2003). Costs associated with the primary prevention of type 2 diabetes mellitus in the Diabetes Prevention Program. *Diabetes Care, 26*(1),36-47.

Diabetes Prevention Program Research Group (2009). 10-year follow-up of diabetes incidence and weight loss in the Diabetes Prevention Program outcomes study. *Lancet, 374*, 1677-1686.

Diabetes Prevention Program Research Group (2012). 10-year cost-effectiveness of lifestyle intervention or metformin for the diabetes prevention - an intent-to-treat-analysis. *Diabetes Care, 35*,723-730.

Diabetes Prevention Program - Study Documents Web Site. Retrieved from: http://www.bsc.gwu.edu/dpp/lifestyle/dpp_part.html.

Duru, O.K., Mangione, C.M., Steers, N.W., Herman, W.H., Karter, A.J., Kountz, D., Marrero, D.G., Safford, M.M., Waitzfelder, B., Gerzoff, R.B., Huh, S., & Brown, A.F. (2006). The Association between clinical care strategies and the attenuation of racial/ethnic disparities in diabetes care. Translating research into action for diabetes study. *Medical Care, 44*(12),1121-1128.

Field, A. (2009). *Discovering Statistics Using SPSS.* California: SAGE Publications Ltd.

Finch, E.A., Kelly, M.S. & Ackermann, R.T. (2009). Training YMCA wellness instructors to deliver an adapted version of the Diabetes Prevention Program lifestyle intervention. *Diabetes Education, 35*(2),224-8, 232.

Florence, J. A. & Yeager, B. F. (1999). Treatment of type 2 diabetes mellitus. *American Family Physician, 59*(10),2835-2844.

Green. S.B. & Salkind, N.J. (2011). *Using SPSS for Windows and Macintosh:Analyzing and Understanding Data.* New York: Prentice Hall.

Heisler, M., Smith, D.M., Hayward, R.A., Krein, S. & Kerr, E.A. (2003). Racial disparities in diabetes care processes, outcomes, and treatment intensity. *Medical Care, 41*(11),1221-1232.

Henry Kaiser Family Foundation. (2010). New Jersey: number of diabetes deaths per 100,000 population by race/ethnicity, 2007. Retrieved from: www.StateHealthFacts.org

Herman, W.H. (1999). Economic analysis of diabetes interventions: rationale, principles, findings, and interpretation. *Endocrinologist. 9*(2),113-118.

Herman W.H., Hoerger, T.J., Brandle, M., Hicks, K., Sorenson, S., Zhang, P., Hamman, R.F., Ackermann, R.T., Engelgau, M.M. & Ratner, R.E. (2005). The cost-effectiveness of lifestyle modification or metformin in preventing type 2 diabetes in adults with impaired glucose tolerance. *Annals of Internal Medicine, 142*(5),323-332.

Hughes, C. (2006). Quantitative and qualitative approaches. The University of Warwick. Retrieved from: http://www2.warwick.ac.uk/fac/soc/sociology/staff/academicstaff/chughes/hughesc_index/teachingresearchprocess/quantitativequalitative/quantitativequalitative/

Jenkins, C., McNary, S., Carlson, B.A., Hossler, C.L., Zheng, D., Linnen, F., Thomas, V., Powell, S. & Ma, Imani. (2004). Reducing disparities for African Americans with diabetes: progress made by REACH 2010 Charleston and Georgetown Diabetes Coalition. *Public Health Reports, 119*,322-330.

Jenkins, C., Myers, P., Kelechi, T.J. & Buckner-Brown, J. (2011). Efforts to decrease diabetes-related amputations in African Americans by racial and ethnic approaches to community health Charleston and Georgetown Diabetes Coalition. *Family & Community Health,34*(15),S63-S78.

Kondracki, N.I., Wellman, N.S. & Amundson, D.R. (2002). *Journal of Nutrition Education Behavior, 34*,224-230.

Labuschagne, A. (2003). Qualitative research - airy fairy or fundamental? The Qualitative Report, 8(1). Retrieved from http://www.nova.edu/ssss/QR/QR8-1/labuschagne.html.

Liana E. (2013). Get better data and simplify analysis: qualitative vs. quantitative questions. *Survey Monkey Blog*. Retrieved from: http://blog.surveymonkey.com/blog/2013/04/10/qualitative-vs-quantitative/

Mathers, J.C. (2008). Symposium on 'the challenge of translating nutrition research into public health nutrition'. Session 2: personalized nutrition - Epigenomics: a basis for understanding individual differences? *Proceedings of the Nutrition Society, 67*,390-394.

Medline Plus. (2012). Retrieved from: http://www.nlm.nih.gov/medlineplus/druginfo/meds/a696005.html

Moore, D.S. & McCabe, G.P (1999). *Introduction to the Practice of Statistics*. New York, W.H. Freeman and Company.

National Institutes of Health (2006). Diabetes Prevention Program. Retrieved from: http://www.diabetesprevention.pitt.edu/dpp.aspx.

National Institutes of Health (2011). NIH launches training institute on dissemination and implementation research. *NIH News*. Retrieved from: http://www.nih.gov/news/health/apr2011/0d-04.htm.

Office of Minority Health (2010). Diabetes/Data Statistics. Retrieved from: http://minorityhealth.hhs.gov/templates/browse.aspx?lvl=3&lvlid=62

Pelto, G.H. & Freake, H.C. (2003). Social Research in an integrated science of nutrition: future directions. *American Society for Nutritional Sciences, 133*,1231-1234.

Pew Research Center. (2013). Open and closed-ended questions. Retrieved from: http://www.people-press.org/methodology/questionnaire-design/open-and-closed-ended-questions/.

Reja, U., Manfreda, K.L., Hlebec, V. & Vehovar, V. (2003). Open-ended vs. close-ended questions in web questionnaires. *Metodološki Zvezki Journal,19*,159-177.

Rubin, H.J. & Rubin, I.S. (2005). *Qualitative interviewing: The art of hearing data*. Thousand Oaks, California, Sage Publications.

Sauro, J. (2010). Top-box scoring of rating scale data. *Measuring Usability: Quantitative Usability, Statistics & Six Sigma*. Retrieved from: https://www.measuringusability.com/blog/top-box.php.

Serrano, E., Anderson, J. & Chapman-Novakofski, K. (2007). Not lost in translation: nutrition education, a critical component of translational research. *Journal of Nutrition Education and Behavior, 39*,164-170.

Shaik, A.R., Vinokur, A.D., Yaroch. A.L., Williams, G.C. & Resnlcow, K. (2011). Direct and mediated effects of two theoretically based interventions to increase consumption of fruits and vegetables in the Healthy Body Spirit Trial. *Health Education Behavior, 38*,492-501.

The Henry Kaiser Family Foundation. (2010). New Jersey: number of diabetes deaths per 100,000 population by race/ethnicity, 2007. Retrieved from: www.StateHealthFacts.org

The NIH Common Fund (2011). Retrieved from: http://commonfund.nih.gov/.

Timpany, G. (2011, June 30). Web Surveys. [Web log post]. Retrieved from: http://survey.cvent.com/blog/customer-insights-2/sins-of-the-top-two-box-score.

Trochim. W.M.K. (2006). The Qualitative Debate. Research Methods Knowledge Base. Retrieved from: http://www.socialresearchmethods.net/kb/qualdeb.php.

van Ryn, M. & Burke, J. (2000). The effect of patient race and socio-economic status on physicians' perceptions of patients. *Social Science & Medicine, 50*,813-828.

van Ryn, M. (2002). Research on the provider contribution to race/ethnicity disparities in medical care. *Medical Care, 40*(1),I-140-I-151.

Zerhouni, E.A.(2006). Clinical research at a crossroads: the NIH roadmap. *Journal of Investigative Medicine, 54*(4),171-173.

Appendix A[1]

Table 1: Proportion of Physician Practice Spent Caring for Diabetics (n = 44)

Less than 25%	23%
25% - 49%	57%
50% - 74%	11%
75% - 100%	9%

Table 2: Distribution of Physicians Across Health Disciplines (n=44)

Endocrinologist	5%
Family Practice	75%
General Practice	14%
Internal Medicine	7%

Table 3: Distribution of Physicians by State and Area (n=44)

Connecticut	7%
New Jersey	11%
New York	39%
Pennsylvania	43%
Area	
Suburban	50%
Rural	16%
Urban	34%

Table 4: Ethnic Composition of Responding Physicians (n=44)

African American	7%
Asian American	18%
Caucasian American	71%
Hispanic American	2%
Interracial	2%

Table 5: Age and Gender Distribution of Responding Physicians (n=44)

25 - 35 years of age	21%
36 - 55 years of age	66%
55 years or more	14%
Gender	
Male	61%
Female	39%

[1] Totals may not sum to 100 due to rounding.

Appendix B: Survey Questions

Qualifying Screening Questions

Please tell me something about yourself.

1. Are you directly responsible for directing **or** directing and managing the care of patients with diabetes or pre-diabetes? ***Physician Note***: Definition for research purposes of this study: If you alone, ***or*** in collaboration with another physician, recommend ***and*** direct, ***or*** direct and manage treatment for your type 2 diabetic patients, then your answer would be yes; else no. (Q1)
2. Please indicate your geographic professional location (urban, rural, suburban) in (state). (Q4)
3. What is your professional title? (Q6)
4. What is the ethnic composition of your patient base? ((Q7)
5. What percent of your practice is focused on patient care to persons diagnosed as diabetic? (Q8)

Specific Survey Questions

1. Explain what lifestyle intervention strategies can ***best help*** you treat your patients diagnosed with type 2 diabetes. (Q10)
2. ***In general***, would you say your treatment recommendations for patients presenting with type 2 diabetes are: drug treatment? lifestyle intervention? both drug treatment and lifestyle intervention? other (explain)? (Select only one) (Q11)
3. What nutrition-based lifestyle intervention strategies available to treat patients with type 2 diabetes are you ***most familiar*** with? **Physician Note**: nutrition-based lifestyle intervention is defined as a program that includes nutrition education, exercise, and individual or group counseling.(Q13)
4. Explain what you have ***heard or know*** about the Diabetes Prevention Program? (Q14)
5. ***Overall***, what is the likelihood of your practice using the Diabetes Prevention Program in the treatment of patients with type 2 diabetes using a scale of 1 (very unlikely) to 7 (very likely)? (Q15)
6. ***Overall***, based on whichever intervention strategy you are using, explain ***what makes you satisfied or not*** with being able to ***achieve desired patient outcomes*** for your patients with type 2 diabetes. (Q16)
7. ***How would you rate*** your level of satisfaction with the intervention strategy you are using on a scale of 1 (lowest) to 7 (highest)? (Q17)
8. ***Overall***, in your opinion, what is the ***value of nutrition-based lifestyle intervention*** strategies? (Q18)
9. ***How would you rate*** the value of nutrition-based lifestyle intervention strategies on a scale of 1 (lowest) to 7 (highest) in treating type 2 diabetes patients in your practice? (Q19)

10. Explain what ***specific barriers*** would(has) your practice experience(d) in using nutrition-based lifestyle interventions in your treatment plans for type 2 diabetes patients? (Q20)

11. Now I am going to review some specific areas where your response is needed, so let's review each one[1]. ***On average***, how would you score patients under your care who have a physician diagnosis of type 2 diabetes on the following using a scale from 1 to 7? (Q22a-Q22m)

i. (unintelligent) 1 2 3 4 5 6 7 (intelligent)
ii. (lacking self-control) 1 2 3 4 5 6 7 (self-controlled)
iii. (unpleasant) 1 2 3 4 5 6 7 (pleasant)
iv. (uneducated) 1 2 3 4 5 6 7 (educated)
v. (irrational) 1 2 3 4 5 6 7 (rational)
vi. (irresponsible) 1 2 3 4 5 6 7 (responsible)
vii. (lacking in social assistance) 1 2 3 4 5 6 7 (receives social assistance)
viii. (fails to comply with medical recommendations) 1 2 3 4 5 6 7 (complies with medical recommendations)
ix. (unlikely to participate in a nutrition-based lifestyle intervention: nutrition, exercise, counseling) 1 2 3 4 5 6 7 (likely to participate in a nutrition-based lifestyle intervention: nutrition, exercise, counseling)
x. (unlikely to engage in exercise) 1 2 3 4 5 6 7 (likely to engage in exercise)
xi. (uninsured for nutrition-based lifestyle intervention) 1 2 3 4 5 6 7 (insured for nutrition-based lifestyle intervention)
xii. (unlikely to afford nutrition-based lifestyle intervention without insurance) 1 2 3 4 5 6 7 (likely to afford nutrition-based lifestyle intervention without insurance)
xiii. (culturally unlike people I could be friends with) 1 2 3 4 5 6 7 (culturally like people I could be friends with)

12. Now I'd like your ***specific reaction on the Diabetes Prevention Program*** described as: "A structured diet and physical activity intervention that includes group counseling, delivered through the YMCA to achieve and maintain modest weight loss for overweight adults with impaired glucose tolerance." (Finch et al., 2009). Based on this description and any information you may already have on this program, ***please explain*** how easy or difficult it would be (is) to integrate the Diabetes Prevention Program in your practice? (Q23)

13. ***On average***, what is your ***best estimate on the amount of time*** usually given in your practice to patients who have type 2 diabetes compared to time given to healthier patients? (Q24a-Q24b)

i. Patients who have type 2 diabetes: 5 10 15 20 25 30 35 40 45 50 55 60 or more minutes
ii. Patients who are healthier patients: 5 10 15 20 25 30 35 40 45 50 55 60 or more minutes

Demographic questions.
Please tell us a little more about yourself.

---

[1] These questions are modified versions of some of the questions used by van Ryn & Burke (2000).

14. Are you: 25 to 35; 36 to 55; 56 or over; (Q26)
15. Are you: African-American, Asian-American, Caucasian American, Hispanic American, (Q27) Other (please specify (Q28));
16. Are you: Male; Female (Q29)

Request for Summary of Research

Thank you for your help in this important research! Your time and attention is very much appreciated. Please let us know if you would like a copy of the "Summary of Research Findings" which will become available through Research Now. (Q30)

17. Yes, I would like a copy. ____ No, I do not want a copy. _____

Appendix B.1

Quantitative Questions

The question *"In general, would you say your treatment recommendations for patients presenting with type 2 diabetes are: drug treatment, lifestyle intervention, both drug treatment and lifestyle, other"* (Q11) is a measure for treatment strategies recommended by physicians for type 2 diabetes. A 7-point Likert scale was provided as answer choices to obtain physician perceptions and attitudes regarding their diabetic patients using the next series of questions.

"Overall, what is the likelihood of your practice using the Diabetes Prevention Program in the treatment of patients with type 2 diabetes using a scale of 1 (very unlikely) to 7 (very likely)" (Q15).

" How would you rate your level satisfaction with the intervention strategy you are using on a scale of 1 (lowest) to 7 (highest)"(Q17).

"How would you rate the value of nutrition-based lifestyle intervention strategies on a scale of 1 (lowest) to7 (highest) in treating type 2 diabetes in your practice" (Q19).

"On average, how would you score patients under your care who have a physician diagnosis of type 2 diabetes on the following using a scale from 1 to 7?" (Q22a-Q22m):

unintelligent 1 2 3 4 5 6 7 intelligent(Q22a);

lacking in self 1 2 3 4 5 6 7 control-self-controlled (Q22b);

unpleasant 1 2 3 4 5 6 7 pleasant (Q22c);

uneducated 1 2 3 4 5 6 7 educated (Q22d);

irrational 1 2 3 4 5 6 7 rational (Q22e);

irresponsible 1 2 3 4 5 6 7 responsible (Q22f);

lacking in social assistance 1 2 3 4 5 6 7 receives social assistance (Q22g);

Qualitative Questions

All responding physicians were asked the following questions.

"Explain what lifestyle intervention strategies can best help you treat your patients diagnosed with type 2 diabetes" (Q10).

"What nutrition-based lifestyle intervention strategies available to treat patients with type 2 diabetes are you most familiar with" (Q13).

"Explain what you heard or know about the Diabetes Prevention Program" (Q14).

"Overall, based on whichever intervention strategy you are using, explain what makes you satisfied or not with being able to achieve desired patient outcomes for your patients with type 2 diabetes" (Q18).

"Explain what specific barriers would (has) your practice experience(d) in using nutrition-based lifestyle interventions in your treatment plans for type 2 diabetic patients" (Q20).

This study was also interested in understanding physicians' sense on the feasibility of integrating the DPP within their practices based on aided awareness and therefore asked the following question.

"Now I'd like your specific reaction on the Diabetes Prevention Program described as: A structured diet and physical activity intervention that includes group counseling, delivered through the YMCA to achieve and maintain modest weight loss for overweight adults with impaired glucose tolerance. Based on this description and any information you may already have on this program, please explain how easy or difficult it would be (is) to integrate Diabetes Prevention Program in your practice" (Q23).

fails to comply with medical recommendations 1 2 3 4 5 6 7 complies with medical recommendations-complies with medical recommendations (Q22h);

unlikely to participate in a nutrition-based lifestyle intervention: nutrition, exercise, counseling 1 2 3 4 5 6 7 likely to participate in a nutrition-based lifestyle intervention: nutrition, exercise, counseling (Q22i);

unlikely to engage in exercise 1 2 3 4 5 6 7 likely to engage in exercise (Q22j);

uninsured for nutrition-based lifestyle intervention 1 2 3 4 5 6 7 insured for nutrition-based lifestyle intervention (Q22k);

unlikely to afford nutrition-based lifestyle intervention without insurance 1 2 3 4 5 6 7 likely to afford nutrition-based lifestyle intervention without insurance (Q22l); and

culturally unlike people I could be friends with 1 2 3 4 5 6 7 culturally like people I could be friends with (Q22m).

The last closed-ended question *"On average, what is your best estimate on the amount of time usually given in your practice to patients who have type 2 diabetes compared to time given to healthier patients"* (Q24a-Q24b) was designed to estimate the amount of time physicians perceive they spend with diabetic patients as compared to healthier patients. The determination of 'healthier' patients was left up to the judgment of physicians.

Appendix C - Physician Ratings on Attribute Scores

Appendix C: Patient Attributes

Q22a-Q22m: On average, how would you score patients under your care who have a physician diagnosis of type 2 diabetes on the following using a scale from 1 to 7 [1] [2]	Total /%	Total /%	Total /%	Total /%	Total /%	Total /%	Total /%	N
Attribute	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**n =**
a: (unintelligent) 1 2 3 4 5 6 7 (intelligent)	0/0	2/5	5/12	13/31	16/39	5/12	1/3	42
b: (lacking self-control) 1 2 3 4 5 6 7 (self-controlled)	0/0	9/21	11/25	11/25	10/23	3/7	0/0	44
c: (unpleasant) 1 2 3 4 5 6 7 (pleasant)	0/0	1/2	6/14	5/12	12/28	15/35	4/9	43
d: (uneducated) 1 2 3 4 5 6 7 (educated)	1/2	2/5	8/19	11/26	12/28	7/16	2/5	43
e: (irrational) 1 2 3 4 5 6 7 (rational)	0/0	3/7	6/14	12/29	11/26	10/24	0/0	42
f: (irresponsible) 1 2 3 4 5 6 7 (responsible)	0/0	2/5	10/24	11/26	12/29	7/17	0/0	42
g: (lacking in social assistance) 1 2 3 4 5 6 7 (receives social assistance)	1/2	4/10	6/14	15/36	10/24	5/12	1/2	42
h: (fails to comply with medical recommendations) 1 2 3 4 5 6 7 (complies with medical recommendations)	0/0	6/14	6/14	15/36	14/33	1/2	0/0	42
i: (unlikely to participate in a nutrition-based lifestyle intervention: nutrition, exercise, counseling) 1 2 3 4 5 6 7 (likely to participate in a nutrition-based lifestyle intervention:nutrition, exercise, counseling)	1/2	2/5	13/30	14/32	9/21	5/11	0/0	44
j: (unlikely to engage in exercise) 1 2 3 4 5 6 7 (likely to engage in exercise)	1/2	7/17	11/26	16/38	6/14	1/2	0/0	42
k: (uninsured for nutrition-based lifestyle intervention) 1 2 3 4 5 6 7 (insured for nutrition-based lifestyle	2/5	8/18	11/25	11/25	9/21	3/7	0/0	44

intervention)

l: (unlikely to afford nutrition-based lifestyle intervention without insurance) 1 2 3 4 5 6 7 (likely to afford nutrition-based lifestyle intervention without insurance)	4/9	11/25	5/11	11/25	9/21	3/7	1/2	44
m: (culturally unlike people I could be friends with) 1 2 3 4 5 6 7 (culturally like people I could be friends with)	2/5	2/5	8/19	9/21	12/28	7/16	3/7	43

(1) Due to rounding, total may not sum to 100
(2) Table is read as follows: the left end of the scale "1" represents either the lowest or unlikely event, the right end of the scale "7" represents the highest or likely event. Basically the scale is to ***provide the degree to which*** *physicians view patients on/near one end of the scale of the other.*
Ex: either patient is viewed as unlikely to afford insurance or likely can afford insurance.
Ex: either patient can be perceived as unintelligent or intelligent.