

PHYSICIAN NUTRITION EDUCATION PROGRAM (PNEP): SURVEY AND
CONTINUING MEDICAL EDUCATION (CME) DEVELOPMENT TO INCREASE
NUTRITION KNOWLEDGE

A Dissertation

by

KRISTEN HICKS

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Peter Murano
Committee Members,	Jenna Anding
	Adam Barry
	William McIntosh
Head of Department,	Boon Chew

August 2017

Major Subject: Nutrition

Copyright 2017 Kristen Hicks

ABSTRACT

Physicians hold the most influence among healthcare providers, when it comes to providing guidance regarding the general health and well-being of patients. The contact between physicians and their patients during scheduled appointments serve as prime opportunities for providing nutrition and lifestyle counseling. For decades, nutritionists and health care experts have expressed the need to increase the number and availability of nutrition education programs for physicians. However, nationwide physicians lack the education in nutrition and lifestyle counseling, thus report limited counseling in practice settings. This dissertation seeks to address this challenge, and is in two parts: 1) develop a survey needs assessment (the PNEP survey) to determine interest in nutrition education opportunities and 2) perform an evaluation of online continuing medical education (CME) courses focused on nutrition topics.

The initial survey was administered online between May 2015 and August 2015 to Texas physicians to determine interest in nutrition education. The baseline needs assessment confirmed the demand for nutrition education courses, specifically an interest in online CME. This research is important because it confirms the supposition of limited opportunities for nutrition in medicine. Our findings indicate physicians recognize that nutrition focused CME courses will add value to their practices and are interested in enrolling in them.

For phase two of the study, online CME courses were developed based on the topics of interest identified from the PNEP survey. A total of three courses were developed by collaboration between a practicing physician and a practicing dietitian. These courses were then subsequently accredited and made available to physicians through state-level medical education platforms. Results from March 2017 showed one-hundred and twenty physicians participated in these courses, with ongoing participation beyond data collection for this dissertation. This phase was important because it fulfilled the current gap in the literature regarding nutrition focused continuing education course development for physicians in Texas. Unique to these courses was the development of the course structure. Structure utilizes the ARCS Model of Motivation and the IOM Core Competencies to develop nutrition knowledge and practical application tools to apply knowledge into patient care. This unique course design brings forth a concept that can be adapted for future nutrition CME course development.

Preliminary research showed a wide gap in educational offerings focused on nutrition concepts, this work contributed to filling this gap by demonstrating need in the survey and producing course offerings available to physicians. Future research is recommended to continue to develop online nutrition CME courses to determine if online delivery has clinical impact on patient health outcomes.

DEDICATION

This dissertation is dedicated to the entire Hicks Family who has pushed me along the way to complete my degree. I could not have finished this incredible feat without the emotional, mental and financial support of my family. Also, Mother Teresa, who has inspired me to help people and give back, she is my role model and I am happy to dedicate this dissertation to her.

ACKNOWLEDGEMENTS

I am so grateful for my parents who have pushed me to stretch the limits, overcoming obstacles that I never knew that I would be able to overcome. They have inspired me throughout my life to become greatness and I give thanks to them for this achievement of finishing my PhD.

I would also like to thank my committee chair, Dr. Peter Murano, who never gave up on me and always pushed me for more. Dr. Murano truly believes in me and the impact that I will make long term, I am forever grateful for his compassion and encouragement that he has given me over the past few years. My committee members, Dr. Adam Barry, Dr. Jenna Anding and Dr. Alex McIntosh have also been incredibly supportive through my venture of my doctoral degree.

Thanks also go to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience. I also want to extend my gratitude towards the many foundations and organizations that have provided me with scholarship money to help make my time at Texas A&M University affordable.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Professor Peter Murano and Professors Jenna Anding and William McIntosh of the Department of Nutrition and Food Science and Professor Adam Barry of the Department of Health and Kinesiology.

All work for the dissertation was completed in collaboration with Dr. Morgan Irion.

Funding Sources

Graduate study was supported by the Pathways to Doctorate fellowship from Texas A&M University and several scholarships. The scholarships that supported this work include: Jane Elizabeth Watkins Cohen Nutrition Education Endowed Scholarship, Helen Lane Nutrition Research Endowed Scholarship, Dr. Kate Adele Hill TAMU Academic Excellence Award Scholarship, Association of Former Students Scholarship and the U.S. Senator Phil Gramm Doctoral Fellowship.

NOMENCLATURE

CDC	Centers for Disease Control and Prevention
CME	Continuing Medical Education
IOM	Institute of Medicine
T2DM	Type 2 Diabetes Mellitus
MI	Motivational Interviewing
NFSC	Department of Nutrition and Food Science
RDN	Registered Dietitian Nutritionist
TAMU	Texas A&M University
TAMUCOM	Texas A&M University College of Medicine
TAMUHSC	Texas A&M University Health Science Center
TMA	Texas Medical Association
WHO	World Health Organization

TABLE OF CONTENTS

	Page
ABSTRACT.....	ii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
CONTRIBUTORS AND FUNDING SOURCES	vi
NOMENCLATURE	vii
TABLE OF CONTENTS	viii
LIST OF FIGURES.....	xi
LIST OF TABLES	xii
CHAPTER I INTRODUCTION.....	1
I.1. Background.....	1
I.2. Nutrition and Lifestyle Education and Counseling	6
I.3. Working with Healthcare Team.....	9
I.4. Purpose of this Study	10
I.5. Research Questions	11
I.6. Objective and Aims.....	13
I.6.1. Phase One.....	13
I.6.2 Phase Two.....	14
I.7. Methods and Design.....	15
I.7.1. Physician Nutrition Education Program: Phase One	15
I.7.2. Physician Nutrition Education Program: Phase Two	18
CHAPTER II PHYSICIAN PERSPECTIVES ON NUTRITION COUNSELING AND NUTRITION FOCUSED CONTINUING MEDICAL EDUCATION IN TEXAS	22
II.1. Overview	22
II.2. Introduction	23
II.3. Methods.....	25
II.3.1. Sample and Study Design.....	25

II.3.2. Procedure	25
II.3.3. Data Analysis	26
II.4. Results.....	27
II.4.1. Characteristics of Physician Participants.....	27
II.4.2. Characteristics of Practice	28
II.4.3. Incorporation of Nutrition into Physician Practices.....	29
II.4.4. Methods of Continuing Education.....	30
II.5. Discussion.....	32
CHAPTER III ONLINE NUTRITION CONTINUING MEDICAL EDUCATION (CME) FOCUSED TYPE 2 DIABETES PREVENTION AND MANAGEMENT LAUNCHED ON STATE-LEVEL MEDICAL ASSOCIATION.....	36
III.1. Overview	36
III.2. Introduction	37
III.3. Methods.....	40
III.3.1. Study Setting.....	40
III.3.2. Data Collection and Analysis.....	42
III.4. Results.....	43
III.4.1. Participant Demographics.....	43
III.4.2. Pre-test and Post-test Scores	45
III.4.3. Ratings	46
III.5. Discussion.....	46
III.5.1. Limitations	48
III.6. Conclusion	48
III.7. Practice Implications	49
CHAPTER IV DEVELOPMENT OF ONLINE NUTRITION CME COURSES: VALIDATION OF AN EFFECTIVE COURSE STRUCTURE.....	50
IV.1. Overview.....	50
IV.2. Problem.....	51
IV.3. Approach	52
IV.4. Outcomes	58
IV.5. Next Steps.....	61
CHAPTER V CONCLUSIONS.....	64
V.1. Survey of Physicians.....	64
V.2. Online CME Course	65
V.3. Future Research Directions	66
REFERENCES.....	71

APPENDIX.....83

LIST OF FIGURES

	Page
Figure 1: Phases of the Research.	12
Figure 2: Various Areas of Practice Specialties	43
Figure 3: Pre-test versus Post-test Evaluation	46
Figure 4: Flowchart on Development of CME	54
Figure 5: Data Analysis Comparing Pre- Versus Post-Tests.	59
Figure 6: Texas Medical Association Online Library Screen Capture.....	84
Figure 7: PNEP Logic Model	85
Figure 8: GANNT Chart	86

LIST OF TABLES

	Page
Table 1: Texas Physicians Self-Reported Demographic Data	28
Table 2: Texas Physicians Self-Reported Nutrition Education Interests	30
Table 3: Physician Demographics	44
Table 4: CME Core Competencies	55
Table 5: Descriptive Assessment of Participants.	60
Table 6: Future Course Development	69

CHAPTER I

INTRODUCTION

I.1. Background

Over one-third of the total population in the United States is considered to be obese, a contributor to many of the leading causes of death, raising a national health concern.^{1,2} It is estimated that obesity costs between \$147 and \$210 billion dollars annually to the United States health care system and has a global impact of nearly \$2.0 trillion.³ This exponential increase in obesity has created a financial as well as mortality burden to the U.S. population. The World Health Organization (WHO) has demonstrated that overweight and obesity have doubled since the 1980's; obesity now ranks as the fifth leading cause of death.⁴ Moreover, seven of the ten leading causes of death can be partially attributed to lifestyle factors, including poor dietary habits and lack of physical activity.

In the U.S., unhealthy behaviors contribute at a rate of nearly 15% due to poor diet and limited physical activity as compared to nearly 20% related to tobacco use.^{5,6} Obesity is highly associated with and considered a risk factor for numerous chronic health complications (e.g. diabetes, hypertension, cardiovascular disease, renal disease).⁷ There is substantial evidence that these conditions are often preventable and manageable with incorporation of nutrition and lifestyle changes. The impact of adequate dietary intake upon nutrition status is universally recognized as a contributing factor in achieving optimal

health.⁸ In fact, a recent report identified dietary factors as the single most significant risk factor for premature death.⁹ In order to prevent and/or manage chronic conditions, it is therefore imperative that physicians develop positive and influential patient-physician relationships to assist with behavior change that emphasizes the diet and lifestyle behaviors.¹⁰

According to the CDC (Centers for Disease Control and Prevention), 83.2% of all patients in the U.S. had contact with their healthcare providers on an annual basis.¹¹ This aspect of physician-patient contact hours is when intervention opportunities present themselves. Several objectives of 'Healthy People 2020' call for an increase in the proportion of consultations (counseling or education on nutrition or weight control) particularly for those with chronic disease.¹² The United States Preventive Services Task Force recommends that patients who are obese should be referred to intensive, multicomponent behavioral interventions¹³ Despite these guidelines, the number of physicians actually integrating behavioral, lifestyle counseling concepts into practice is limited.^{7,14,15} A recent systematic review recognized the disparity between lifestyle education and counseling delivery to patients and potential value (e.g. cost, morbidity) for preventing disease.¹⁶

Physicians could be at the forefront to provide diet and lifestyle counseling to patients, yet such counseling sessions rarely occur. Researchers have concluded that this failure by physicians to participate in counseling

represents a key missed opportunity to improve the health outcomes of their patients.¹⁷

There are many barriers faced by physicians in providing counseling to patients about health and lifestyle related behaviors, including a lack of knowledge, training and self-efficacy. Several questionnaires have been created to assess these measures for both physicians as well as medical students.¹⁸⁻²³ The latter feel that they are not studying enough nutrition in their medical education, and lack nutrition knowledge. A longitudinal study of U.S. medical students showed that from the freshman to senior year, perceptions in nutrition counseling relevancy in practice actually decreased from 72% to 46% respectively.¹⁸ Thus, while inadequate experience and education is a problem; however, so is the perceived importance of nutrition counseling-

A survey conducted by The Association of American Medical Colleges found that 57% of medical students perceived the time spent learning medical nutrition was inadequate.²⁴ Nutrition education is lacking throughout medical school and extends to practicing physicians. Half of all accredited medical schools in the United States teach 17 hours of nutrition related education and 9% require zero nutrition education.²⁵ Of those minimal hours of “nutrition education”, only 18% of those medical schools reported to have a dedicated nutrition course.²⁶ Any nutrition training is typically obtained through basic

science courses such as biochemistry, thus not via dedicated nutrition education course hours.

From 1998 to 2005, the National Heart, Lung, and Blood Institute granted the Nutrition Academic Award to medical schools whose students demonstrated improvements in knowledge and awareness of nutrition related concepts and the implementation of nutrition counseling in practice.²⁷ Yet the American Dietetic Association released results from a nationwide survey showing that a disappointing 64% of Americans believe doctors to be “very credible” sources of nutrition information.²⁸ The root issue is that physicians are not adequately educated nor trained in lifestyle counseling and incorporating nutrition concepts into practice. Survey data in Washington State showed that perceived quality of nutrition training was positively associated with self-reported proficiency in nutrition.²¹

Ideally, improvements in nutrition focused offerings would benefit medical students. However, the nature of the medical curriculum limits the chance to easily incorporate nutrition courses. Since opportunities post-medical school are even more limited, increased emphasis should be placed on providing nutrition education opportunities via continuing medical education (CME) courses.²¹ Physicians who have taken a standard nutrition and lifestyle focused course report a more positive attitude along with increased knowledge and ability to incorporate nutrition with patients.²⁹⁻³¹ A similar result has been observed with

CME type nutrition education delivery. Short term CME (<30h) has been shown to result in positive nutrition and lifestyle behavior changes in patients and increased implementation of learning into practice by physicians.^{32,33} In-person workshops, seminars, conferences and online webinars all provide ample opportunities for nutrition centered CME delivery.

In 2000, a two-day immersion course in Latin America entitled 'Total Nutrition Therapy' was offered to physicians. Participating physicians demonstrated an increase in nutrition knowledge and subsequent increase in implementation of nutrition therapy into practice.³⁴ The University of North Carolina Chapel Hill has developed free modules titled 'Nutrition in Medicine', available worldwide. Today, they offer numerous accredited CME courses for medical students and physicians at their distance site.²⁷ Even so, overall CME opportunities are minimal. The pressing need for physicians to acquire more nutrition knowledge is not being met.

Online delivery of continuing education is a potent strategy to implement nutrition focused CME courses to physicians nationwide and frankly, worldwide. The worldwide web has expanded opportunities for CME delivery through flexibility, convenience and ease of access. Online continuing education courses have resulted in a positive educational experience for participants, with a demand for additional opportunities for all healthcare professionals.^{35,36} A recent analysis of continuing education highlights online (i.e. slides with audio or

recorded lectures) as one of the more effective methods of education delivery.³⁷ Survey research has shown that self-paced home computer nutrition learning programs were of interest to physicians as a means to increase nutrition knowledge.²³ In addition, novel continuing education, not always accredited for CME credit, include massive open online courses (MOOC), available worldwide on the web. Research examining 98 international health and medicine courses, showed MOOC as a successful way to provide CME's.³⁸

Whether evaluating a one hour, two hour, two week or multi month course, findings are consistent in demonstrating that any education benefits physicians by improving knowledge and self-efficacy. Considering the positive effect when physicians enroll in courses and the fact that nutrition plays a vital role in prevention of many chronic diseases, nutrition and lifestyle education represent critically important opportunities for intervention.

I.2. Nutrition and Lifestyle Education and Counseling

Nutrition and lifestyle education and counseling are tools that can be used by practitioners to help change behaviors to promote patient health. Nutrition education has been formerly defined as “any combination of educational strategies accompanied by environmental supports, designed to facilitate voluntary adoption of food choices and other food and nutrition-related behaviors conducive to health and well-being and delivered through multiple venues, involving activities and the individual, institutional, community and policy

levels”.³⁹ By contrast, lifestyle medicine has been defined as the “evidence-based practice of assisting individuals and their families to adopt and sustain behaviors that can improve health and quality of life”.⁵ A combination of nutrition and lifestyle education and counseling incorporated into physician practices has shown to improve patient outcomes.^{29,30,40}

Furthermore, interventions conducted in primary care can help minimize risky behaviors of patients associated with chronic disease.⁴¹ A seven year study conducted by primary care physicians performing monthly face-to-face lifestyle counseling resulted in a reduced frequency of hyperlipidemic, hyperglycemic and hypertensive periods. Moreover, a higher frequency of counseling sessions resulted in a great number of patients who met lifestyle goals.⁴² The POWER-UP trial led by Vetter and colleagues randomly assigned obese patients to a usual care, brief lifestyle counseling or enhanced lifestyle counseling groups, with each counseling session delivered by a physician. It was found that weight counseling by a healthcare team approach resulted in significant weight loss and improvements in cardio metabolic risk factors.⁴³

A systematic review of education delivered by a healthcare provider to cardiac patients also supports this theme, in that positive benefits related to physical activity, dietary intake and smoking cessation were observed.⁴⁴ It has been established that there is a strong impact of integrated nutrition counseling regarding improved measurable patient health outcomes. A short-term study

looking at the incorporation by physicians of a brief nutrition counseling component in a routine cardiology visit showed improvements in cardiovascular markers.⁴⁵ A retrospective study of over 10,000 hyperglycemic adults with diabetes mellitus documented that intensive lifestyle counseling was associated with improved glycemic control.⁴⁶ Similarly, the Diabetes Prevention Program (DPP) demonstrated that lifestyle intervention reduced T2DM diagnosis among high risk patients by nearly 58%.^{47,48} Although the number of studies is limited, research studies that include physician delivered nutrition and lifestyle education are consistently reporting improvements in clinical outcomes.

One component of nutrition and lifestyle education often includes motivational interviewing (MI), used in conflict-ridden encounters (those in which critical medical information must be effectively communicated by healthcare and understood by patients so that important decisions can be jointly made). A psychologist, William R. Miller, studied the manner by which empathetic listening and self-motivating statements could initiate a change in behavioral response. A meta-analysis showed significant impact of motivational interviewing on measurable health outcomes including body mass index, total cholesterol levels and blood pressure.⁴⁹ A qualitative study randomly assigned patients to three groups (1: usual care, 2: provider delivered MI counseling, 3: provider and registered dietitian delivered MI counseling session). It was discovered that statistically significant reductions in BMI percentile in as a result of MI lifestyle

counseling delivered by a combination of providers and registered dietitians occurred.⁵⁰ Health professionals acknowledge an effect on measurable outcomes by instigating health related motivational interviewing. In order to be effective, the techniques and methods of delivery through MI, could be taught to physicians with a CME course.

I.3. Working with Healthcare Team

In an ideal world, physicians would be highly educated in nutrition and have optimal time to provide nutrition and lifestyle counseling. However, this is often not the case and therefore, collaboration among the healthcare team is an important concept in effective healthcare. Components of knowledge needed by physicians includes assessment and education of nutrition care, as well as referrals to Registered Dietitian Nutritionists (RDN).²⁵ Medical students in a focus group expressed limitations to referral rates due to concerns that they were unaware of how to refer to an RDN, what the role of an RDN is in practice and how often patients could see an RDN (Shroads, unpublished data, 2015).

A marketing study showed that delivery of brochures containing information about benefits of nutrition counseling, reimbursement of nutrition counseling and background of the dietetic profession resulted in a 30% increase in referral rates to RDNs from physicians.⁵¹ By increasing the awareness of the physician regarding the role of the RDN, it improves the opportunities for enhanced patient care through this under-utilized healthcare professional.

Practitioners relationships with dietitians have been shown to be one of the primary influencing factors for referrals.⁵² Additionally, providing referral forms and contact details for a dietitian was shown to be effective to make referrals easier for physicians. A critical component of referrals is that physicians acknowledge that their patients would benefit from nutrition counseling.

A survey of physicians demonstrated that there is a wide gap between acknowledging the need of nutrition counseling and the proportion of patients receiving counseling from the provider or via a referral to an RDN.⁵³ Physicians should aim to include a short nutrition and lifestyle recommendation as a component of each clinical visit in addition to a referral to a healthcare professional with expertise in nutrition and lifestyle counseling. Since follow-ups play an integral role in sustained behavior change, referrals to RDNs for multiple visits may add value to both the physician and patient.⁵⁴

I.4. Purpose of this Study

With several national guidelines emphasizing the importance and necessity of physicians to incorporate nutrition and lifestyle medicine into practice, studies are needed to examine if interventions of providing continuing medical education opportunities successfully improve nutrition knowledge. First, there have been no studies, to our knowledge, which determine characteristics of practice including nutrition counseling and use of an RDN in their practice. Second, there have been few studies looking at online continuing medical

education courses and effectiveness in improvements of subject matter specific nutrition knowledge. It is important to measure and document any increase in knowledge through participation in online programs for physicians, in addition, we are unaware of any studies incorporating a component regarding importance of referrals to a RDN and “how-to” refer in a CME course that also includes basic nutrition care.

I.5. Research Questions

1. What are the current nutrition practices and perceived confidence levels in nutrition knowledge and counseling?
2. Have physicians participated in any format of CME focused on nutrition?
3. Are there types of CME formats that are preferred? Specifically, is a nutrition focused CME of interest?
4. How likely is a physician working in a practice that promotes nutrition awareness; how often do they refer patients to a RDN?
5. Will a webinar or self-study module focused on nutrition education and counseling techniques improve subject-specific nutrition knowledge?

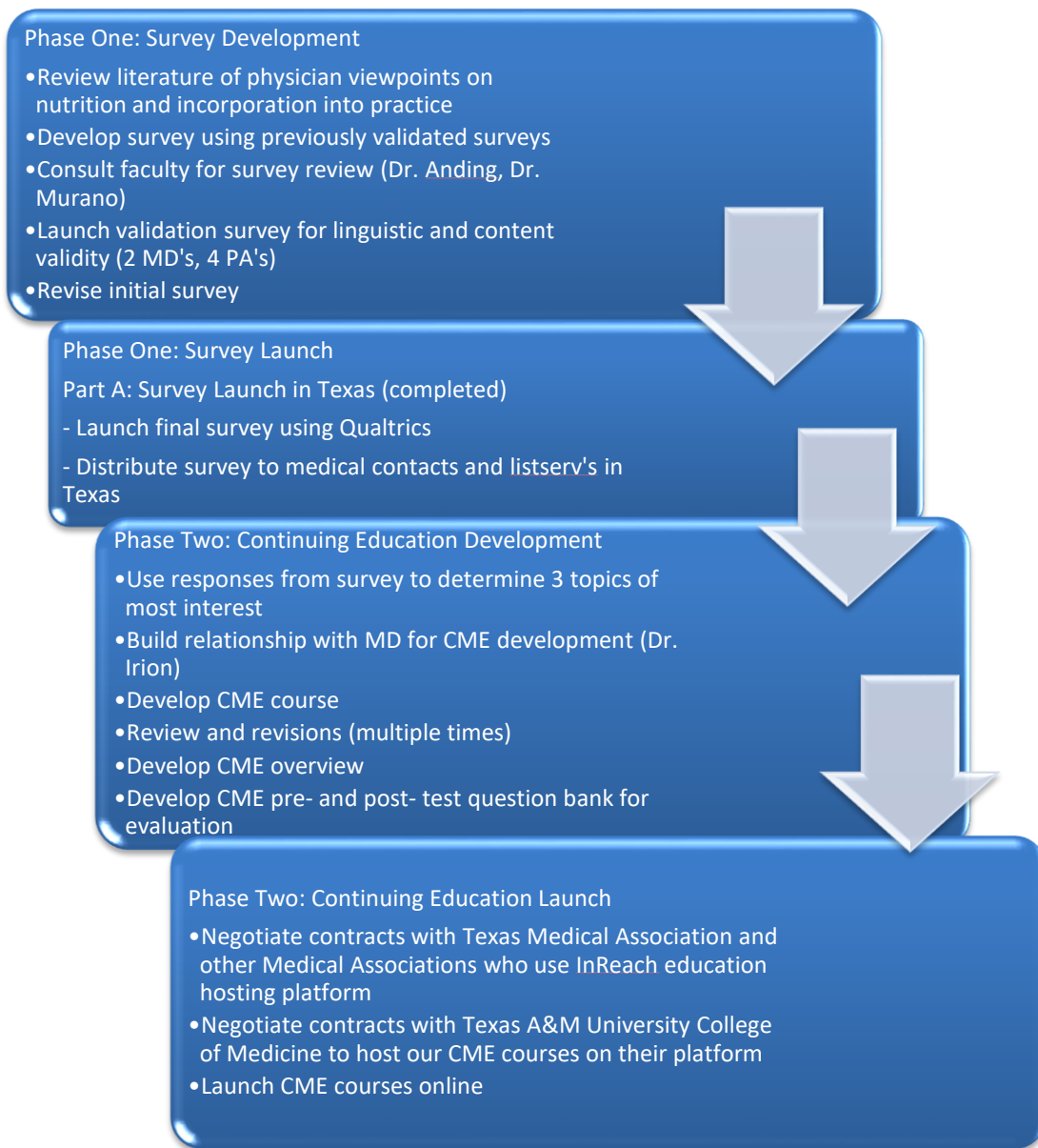


Figure 1: Phases of the Research.

I.6. Objective and Aims

I.6.1. Phase One

Objective: The purpose of this study was to survey a sample of Texas physicians to determine nutrition knowledge, confidence and methods of obtaining continuing medical education (CME) credits.

Research Questions:

1. What are the current nutrition practices and perceived confidence levels in nutrition knowledge and counseling?
2. Have physicians participated in any format of Continuing Medical Education (CME) focused on nutrition?
3. Are there types of Continuing Medical Education (CME) formats that are preferred? Specifically, is a nutrition focused CME of interest?
4. How likely is a physician working in a practice that promotes nutrition awareness; how often do they refer patients to a RDN?

Aim #1: Determine the need and interests of physician's nutrition counseling experiences and methods of obtaining continuing medical education. Our hypothesis is that we will be able to measure a difference between current nutrition confidence & counseling with their interest in improving nutrition knowledge. We will develop, distribute and analyze data from the survey to answer our objective.

Hypothesis #1: We hypothesize that physicians will acknowledge a lack in nutrition knowledge and confidence in communicating nutritional advice to patients.

Hypothesis #2: We hypothesize that physicians will report that they acquire Continuing Medical Education (CME) courses by enduring materials over other methods of obtaining CME.

1.6.2 Phase Two

Objective: The purpose of this study was to developing Continuing Medical Education (CME) courses on nutrition topics to determine if it is a viable way to increase education on nutrition topics.

Research Question:

1. Will a webinar or self-study module focused on nutrition education and counseling techniques improve subject-specific nutrition knowledge?

Aim #2: Determine the improvement in knowledge as quantified by changes in pre- versus post- test scores that are associated with the continuing medical education course. We will develop, distribute and analyze data from nutrition CME courses to answer our objective.

Hypothesis #1: A one-hour online nutrition education program will improve the targeted subject matter nutrition knowledge of physicians.

I.7. Methods and Design

I.7.1. Physician Nutrition Education Program: Phase One

I.7.1.1. Participants

Physicians across Texas were participants in this research project. In phase one, physicians were emailed via various physician contact listserv emails inviting participation in the Physician Opinion Survey. Sampling was a convenience sample due to inability to access and contact all physicians in Texas. Inclusion criteria: participants had to be 1) a licensed medical professional and 2) had to be practicing in the state of Texas. Exclusion criteria: anyone who was not a licensed medical professional.

I.7.1.2. Recruitment

The research team searched for willing participants to complete the online opinion survey by disseminating this instrument via the Texas Medical Association, Texas A&M College of Medicine and several hospitals based on known contacts. An email was sent from the principal investigator of the study Dr. Peter Murano, and the graduate student Kristen Hicks, to potential survey participants. There was no penalty to anyone who choose not to participate in the survey.

I.7.1.3. Survey Development

A “Physician Opinion” survey was developed with the intention of collecting a needs assessment of opinions from physicians regarding nutrition interest, nutrition practices and interest in nutrition related CME credits. A combination of questions from two previously validated surveys (Frank et al, Spencer et al), in addition to eight questions were created to support the study objective.^{55,56} Questions from Frank and colleagues included demographic and professional work place locations. Those from Spencer’s group included self-reported nutrition counseling behaviors and attitudes. The additional questions gathered further information regarding our aims: (1) to understand the physicians’ role in counseling, (2) to raise awareness regarding referrals to registered dietitians and (3) interest in nutrition focused continuing education opportunities. This survey was reviewed by a panel of experts, including 2 physicians and 4 physician assistants, for content and linguistic validity, and modified according to feedback obtained. Survey development, distribution and data collection was performed using Qualtrics™ Online Software (www.qualtrics.com). The finalized revised survey was distributed through several medical contact listservs. All Phase One survey research was approved by the Institutional Review Board (IRB) at Texas A&M University (IRB2015-0248D)

I.7.1.4. Measures

In phase one, our survey data was collected using Qualtrics™ Online Software. The administered survey consisted of 20 questions addressing the following information:

- 1) Demographic data including age, gender, credentials, practice geographical location and specialty area of practice
- 2) Nutrition practices and perceived confidence in nutrition knowledge
- 3) Community type of practice
- 4) Methods of obtaining continuing education

I.7.1.5. Anticipated Outcomes

The main outcome that was anticipated was that the survey provided relevant background information about practicing physicians in Texas and their current nutrition education practices.

I.7.1.6. Data Analysis

Measures of demographics, nutrition related practices and avenues for obtaining CME credits were used in this analysis. Data collected in our survey was analyzed using GraphPad Prism™ (version 5, GraphPad Software Inc, La Jolla, CA, 2007). We administered students t-tests among questions of interest to determine if there was a relationship between responses. Descriptive statistics was performed on all data.

I.7.2. Physician Nutrition Education Program: Phase Two

I.7.2.1. Participants

Physicians across Texas, along with other states using the InReach™ platform, were participants of this research project. In phase two, physicians were emailed via various physician contact listserv emails to participate in the continuing education opportunities. Sampling was a convenience sample due to inability to access and contact all physicians. Inclusion criteria: participants must be 1) a licensed medical professional and 2) must be practicing in the United States. Exclusion criteria: anyone who was not a licensed medical professional.

I.7.2.2. Recruitment

The research team will search for willing participants to complete the online continuing education opportunity by disseminating via Texas Medical Association, Texas A&M College of Medicine and several hospitals based on known contacts. An email was sent from the principal investigator of the study, Dr. Peter Murano and the graduate student, Kristen Hicks, to potential participants. Marketing emails will also be distributed via listservs within Texas Medical Association. There is no penalty to anyone who choose not to participate in the survey. One *AMA PRA Category 1™ credit* or 1 *Ethics™ credit* will be awarded to paid participants who completed the course along with the pre- and post- test.

I.7.2.3. Research Design and Methods

In phase two, a three webinars and similar self-study modules were developed with the intention of educating physicians about nutrition and the role of prevention and management of chronic disease.

I.7.2.4. Stages of Development

- i. Topic selection was completed based on the data collected from the PNEP survey. The top three most requested topics included: (1) the role of nutrition in type 2 diabetes, (2) nutrition counseling for weight loss and management and (3) nutrition in cardiovascular disease. Phase two course development research was approved by the Institutional Review Board (IRB) at Texas A&M University (IRB2015-0779D)
- ii. Objectives were developed to measure gain in knowledge by comparison between pre- and post-tests.
- iii. Literature searches were conducted for up-to-date research and guidelines specifically related to the topics selected. Sources of information were derived from credible organization, association or governmental websites. In addition, scholarly articles were obtained from PubMed, Google Scholar and Texas A&M University Libraries.
- iv. Incorporation of the FRAMES model (Miller and Sanchez, 1994) allowed integration of patient counseling into practice. This model focuses on

Feedback, Responsibility for change, Advice-giving, Menu of change options, Empathetic counseling statement and Self-efficacy.

- v. Explanation of RDN credentials and “how-to” referral to an RDN were a component of the continuing education piece to underscore the importance of working as a healthcare team to give the best care for patients.

The courses were developed and presented by Dr. Morgan Irion (physician) and Kristen Hicks (registered dietitian nutritionist). Webinar format was created using PowerPoint and voice recordings were created using Audacity™. Lastly, the self-study module, with similar content to the PowerPoint™ slide was created using Microsoft Word™.

The webinar and self-study modules (each 1 hour duration) were made available on Texas Medical Association’s “On-Demand” online platform. This provided convenience for physicians wishing to view our Continuing Medical Education courses. Courses were shared via the “sharing network” on InReach™ Continuing Education platform. The registration fee set by TMA per course was between \$29 (member) and 79 (non-member). Each was accredited for 1 Continuing Medical Education credit (1 *AMA PRA Category 1 Credit*™) and 1 Ethics credit. Courses have a lifespan availability on the “On-Demand” library for 3 years, once uploaded.

I.7.2.5. Measures

Each continuing education course accompanied a 10 question pre- and 10 question post- test randomly drawn from a 16-choice question bank created by the research team. Along with evaluation scores, data including: credentials, gender, specialty, years in practice and specialty of practice was collected.

I.7.2.6. Anticipated Outcomes

Three key outcomes are anticipated: 1) Physicians will register and complete the webinars and obtain knowledge in the field of nutrition and chronic disease prevention and treatment; 2) Texas Medical Association will continue to allow Texas A&M Department of Nutrition and Food Science to contribute research based webinars to be available on the On-demand library. Lastly 3) Physicians who complete nutrition courses will demonstrate a gain in knowledge as compared between pre- and post- test scores.

I.7.2.7. Data Analysis

Data collected in our survey was analyzed using GraphPad Prism™ (version 5, GraphPad Software Inc, La Jolla, CA, 2007). Students t-tests between pre- and post- test scores were performed to determine if there was a statistically significant change in knowledge following the course intervention. Descriptive analysis will be performed on all questions and comparing demographic data.

CHAPTER II

PHYSICIAN PERSPECTIVES ON NUTRITION COUNSELING AND NUTRITION FOCUSED CONTINUING MEDICAL EDUCATION IN TEXAS*

II.1. Overview

To assess Texas physician nutrition counseling practices and interest in nutrition Continuing Medical Education (CME) opportunities that would enhance patient care. A convenience sampling method used to evaluate a brief validated online survey to physicians across Texas between May 2015 and August 2015. Participants (n=54) completed the survey regarding demographics, incorporation of nutrition with patient care, and nutrition-related continuing education opportunities. Texas physicians overwhelmingly reported insufficient incorporation of nutrition counseling into their practice and were in favor of additional CME opportunities focused on nutrition. Our results showed 89% of physicians' care for patients who require nutrition counseling "Sometimes" or "Usually/Always". However only 15% feel "Highly" confident when discussing nutrition with patients. A majority (81%) of physicians reported increased likelihood to participate in webinars delivering research-based nutrition information due to their lack of nutrition training. Nutrition CME opportunities post-medical school are limited. To address this shortcoming, and to enhance

*Reprinted with permission from Hicks, K., Murano, P., "Physician perspectives on nutrition counseling and nutrition focused continuing medical education in Texas" *Social Medicine* (2016): 10(3), 1-7. Creative Commons License

physician confidence and ability to incorporate nutrition information when interacting with patients, CME courses focused on nutrition must be more readily available. Our findings indicate that Texas physicians recognize the need for nutrition CME opportunities to add value to their practices, and seek such learning opportunities.

II.2. Introduction

Medical nutrition education and training has been insufficient despite much research supporting the positive impact of proper dietary and lifestyle habits on overall patient health. Although nutrition-related coursework during medical school would address this shortcoming, the majority of physicians report little or no such nutrition training, thus are ill-equipped to provide research-based nutrition counseling. In 2010, a national survey found that half of all accredited medical schools across the United States teach 17 hours at most and 9% require no nutrition focused courses throughout the 4 year duration.⁵⁷ In those medical schools with dedicated nutrition coursework, such courses are often taught by non-physician health professionals.⁵⁸ In 2013, the Accreditation Committee of Graduate Medical Education released program requirements for trainees in medical disciplines including Internal Medicine, Preventive Medicine and Cardiovascular Disease. Among each of these documents, the words “nutrition”, “diet” and “lifestyle” are all absent.⁵⁹ Beyond medical school lies opportunities for post-graduation training such as Continuing Medical Education

(CME). CME courses have been shown to be effective in educating various healthcare providers about specific topics in nutrition and lifestyle. Given the poor emphasis of nutrition for physicians during and post-medical school, there is a critical need for CME courses focused on nutrition and incorporation into practice.

In recent years, there have been considerable advances in the science of nutrition regarding the impact that diet and lifestyle choices have on health. Proper nutrition has the potential to positively impact various chronic conditions. Conversely, suboptimal nutrition has been shown to have adverse effects on clinical conditions including acute illnesses and chronic diseases.²⁵ Seven of the ten leading causes of death are chronic diseases that possess a critical nutrition component (e.g. heart disease, cancer, diabetes) (CDC). In 2011, a survey distributed by the American Dietetic Association found that 64% of the American public considers doctors to be “very credible” sources of nutrition information.²⁸ Thus, there is a need for physician nutrition understanding and expertise in order to match patients’ needs and expectations. Moreover, primary care physicians see a majority of the population annually which makes their interactions prime opportunities to advise patients about nutrition and lifestyle practices. Physician-to-patient interactions that include nutrition discussions and information transfer are in great need. Studies that examined barriers to nutrition counseling in primary practice report that physician feel inadequately trained and have poor

self-efficacy to counsel on weight management among other nutrition related complications.⁶⁰ Currently there is a wide gap regarding what is needed versus what is being achieved.^{23,61} The value of this caregiver-to-client relationship cannot be underestimated.

The purpose of this study was to determine the current status of incorporating nutrition counseling (providing nutrition information to patients) into physician practices, and methods of obtaining CME credits. We hypothesize that physicians are lacking sufficient nutrition knowledge and desire more nutrition related CME opportunities to help to improve their understanding and ability to incorporate nutrition counseling to improve patient health outcomes.

II.3. Methods

II.3.1. Sample and Study Design

The current study was part of a larger study designed to provide nutrition education webinars to physicians as Continuing Medical Education (CME) credits. Physicians across Texas were recruited through convenience sampling by email contact. Only one inclusion criteria in place for survey participation, that participants had to possess either MD or DO credentials. This study was approved by the Institutional Review Board of Texas A&M University.

II.3.2. Procedure

Our survey was developed using a combination of questions from two previously validated surveys and then supplemented with additional

questions.^{18,56} Then eight additional questions we created were added that addressed nutrition awareness, nutrition education interests and current methods of obtaining CME credit to support our outcome objective. The survey was then reviewed by a panel of experts including two physicians and four physician assistants for content and linguistic validity, several recommendations being incorporated. The self-administered survey consisted of 20 questions addressing the following information:

- 1) Demographic data including age, gender, credentials, practice geographical location and specialty area of practice
- 2) Nutrition practices and perceived confidence in nutrition knowledge
- 3) Community type of practice
- 4) Methods of obtaining continuing education

Participants completed the survey online between May and June, 2015. Administration was achieved using Qualtrics™ Online Software links to the survey (www.qualtrics.com), distributed to a convenience sample via administrative contacts. Participation in the survey by physicians was entirely optional, and at the discretion of each individual receiving the survey.

II.3.3. Data Analysis

Measures of demographics, nutrition education practices and methods of obtaining continuing education credits were used in this analysis. Data analysis was conducted with Qualtrics™ and GraphPad Prism™ (version 5, GraphPad

Software Inc, La Jolla, CA, 2007). We performed descriptive analyses for all questions.

II.4. Results

II.4.1. Characteristics of Physician Participants

A total of 58 participants completed our survey; however, one individual did not identify with any credentials and three individuals did not identify themselves as MD or DO, which excluded them from all analyses. The sample included more males than females (57% vs. 41% respectively) and one physician who selected “Prefer Not to Answer”. Table 1 summarizes all demographic and practicing data of our total sample of 54 physicians. The majority of physicians (n=44, 82%) were credentialed “MD” (Doctor of Medicine), whereas (n=6, 11%) were credentialed “DO” (Doctor of Osteopathic Medicine) and (n=4, 7%) indicated dual credentials “MD & PhD”. Nearly 30% of physicians focused their practice in Family Medicine; however, various “other” focus specialties numbered thirteen. Age distributions split into groupings included ages 25-35 yrs. (42%), 36-45 yrs. (14%), 46-55 yrs. (12%) and 56+ (29%). Ages of physicians ranged from 27-68 years old, the mean age was 44 years old. There was an observed distribution of participants based on numbers of years in practice ranging from 0-2 years to 10+ years (30% and 44% respectively).

II.4.2. Characteristics of Practice

The majority of physicians (96%) reported that they practice in either urban or suburban areas; only two participants practiced in rural areas. Over half of physicians (52%) reported that they do not work in a practice that promotes nutrition to all patients. Fifty-six percent reported awareness of a registered dietitian in their work facility. Only 17% of all physicians “Usually/Always” refer patients to a registered dietitian for follow-up consultation. (Table 1)

Table 1: Texas Physicians Self-Reported Demographic Data

Current Credentials	# of Participants (% total)
MD	44 (82%)
DO	6 (11%)
MD/PhD	4 (7%)
Gender	
Male	31 (57%)
Female	22 (41%)
Prefer Not to Answer	1 (2%)
Current area of practice	
Family Practice	15 (28%)
Emergency Medicine	5 (9%)
Internal Medicine	6 (11%)
Obstetrics-Gynecology	4 (7%)
Pediatrics	7 (13%)
Oncology	0 (0%)
Cardiology	1 (2%)
Endocrinology	3 (6%)
Other	13 (24%)
Age, years	
25-35	23 (42%)
36-45	8 (14%)
46-55	7 (12%)
55+	16 (29%)

Table 1 Continued

Current Credentials	# of Participants (% total)
Years as a practicing physician	
0-2 years	16 (30%)
2-5 years	6 (11%)
5-10 years	8 (15%)
10+ years	24 (44%)
Current location of practice	
Rural	2 (4%)
Suburban	24 (44%)
Urban	28 (52%)
Online	0 (0%)

II.4.3. Incorporation of Nutrition into Physician Practices

The self-reported proficiency of physicians' nutrition knowledge and practice was low. Table 2 summarizes all nutrition related practices and methods of obtaining CME credits of our total sample of 54 physicians. Only 15% of physicians felt "Highly" confident integrating nutrition information during patient interactions. Among all physicians, 70% reported that they "Usually/Always" see patients who require nutrition counseling; whereas only 11% reported that they "Never" do. A follow up question inquired about frequency of physicians providing nutrition counseling to their patients. It was found that only 46% of participants reported that they "Usually/Always" and 35% "Sometimes" provide nutrition information and advice to their patients. Correlation analysis between how often physicians see patients who require nutrition versus how often they perform nutrition education showed significance ($p < 0.0001$). Additionally,

confidence correlated with frequency of nutrition education consults ($p=0.02$) and frequency of nutrition education discussions with patients ($p=0.0001$).

II.4.4. Methods of Continuing Education

Only twenty-four physicians (44%) identified that they had ever participated in a seminar, webinar or conference that focused on nutrition. A majority of physicians, 67%, did however report that they would be interested in a webinar on nutrition. The top two rated methods of obtaining continuing education included self-study programs (56%) and in-person courses (33%). Moreover, 65% of physicians reported utilizing webinars as a preferred self-study method. Additionally, online interactive modules were selected by 68% of physicians as self-study programs. Findings indicated that 81% of physicians were “Highly” or “Somewhat” likely to participate in a nutrition education webinar for CME credits.

Table 2: Texas Physicians Self-Reported Nutrition Education Interests

Question	# of Participants (% Total)
How often do you see patients who require nutrition education?	
Never/Rarely	6 (11%)
Sometimes	10 (19%)
Usually/Always	38 (70%)
How often do you talk to your patients about nutrition?	
Never/Rarely	10 (19%)
Sometimes	19 (35%)
Usually/Always	25 (46%)

Table 2 Continued.

Question	# of Participants (% Total)
What is your confidence level in performing nutrition counseling?	
Not at all	6 (11%)
Somewhat	40 (74%)
Highly	8 (15%)
Are you in a practice that promotes nutrition awareness to all patients?	
Yes	26 (48%)
No	28 (52%)
Is there currently a Registered Dietitian working at your facility/hospital/practice?	
Yes	30 (56%)
No	24 (44%)
With a typical patient, how often would you refer them to a Registered Dietitian?	
Never/Rarely	19 (35%)
Sometimes	26 (48%)
Usually/Always	9 (17%)
Have you ever attended a seminar/webinar/conference about nutrition?	
Yes	24 (44%)
No	30 (56%)
Would you be interested in a webinar on research-based nutrition education?	
Yes	36 (67%)
No	18 (33%)
What method best describes your method of obtaining Continuing Education credits?	
Self-Study Programs	30 (56%)
In Person Course	18 (33%)
Internet Point of Care	9 (17%)
Manuscript Review	2 (4%)
Faculty Teaching	15 (30%)

Table 2 Continued.

Question	# of Participants (% Total)
If you selected "Self-Study Programs", which programs do you participate in? (Select all that apply)	
Paid Online Webinars	5 (15%)
Free Online Webinars	17 (50%)
Podcasts	9 (26%)
Online Interactive Education Modules	23 (68%)
Printed Monographs	12 (35%)
How likely are you to participate in a nutrition education webinar for Continuing Medical Education credits?	
Not at all	10 (19%)
Somewhat	31 (57%)
Highly	13 (24%)

II.5. Discussion

The present study constituted a needs-assessment regarding the importance of addressing the degree of nutrition competence among Texas physicians. A key finding was the current lack of confidence reported by primary care physicians in discussing nutrition concepts with patients, yet high appeal to participate in nutrition education activities. There is ample documentation of the lack of patient directed nutrition counseling by physicians. One of the nutrition objectives in Healthy People 2020 was to “increase the proportion of physician office visits that include counseling or education related to nutrition or weight” (Healthy People 2020). Survey research has shown that physicians have positive attitudes about nutrition and believe that over half of their patients would benefit from nutrition counseling.⁵³ Yet results from a survey found that 68% of

physicians spend five minutes or less discussing diet and nutrition with their patients, a number likely on the decline since.²³ In 2014, Kris-Etherton and colleagues reported that physicians play key roles in the health care system both individually and as a team with other healthcare professionals. The importance of nutrition has been acknowledged, yet both nutrition education and training are needed to effectively influence patient care.⁶² There is an opportunity, as well as a pressing need to provide for continuing medication education to physician in nutrition.

Vetter and colleagues found that only 14% of physicians felt adequately trained to provide nutrition counseling to their patients.⁶³ Specific barriers exist in addition to lack of formal nutrition training to provide nutrition counseling including time limitations, poor reimbursement and lack of skills, self-efficacy and confidence to educate on lifestyle counseling.⁶³⁻⁶⁵ Results from our survey found infrequent nutrition related counseling by physicians, with similar findings reported by others.^{56,66} Brief education and training, such as CME courses, have been documented to assist in improving physician knowledge, self-efficacy and frequency of nutrition and lifestyle counseling.^{29-31,67,68} After brief review among the state level medical associations across the country, less than 20% of the medical education platforms listed a nutrition focused CME course. A novel study using multi-platform CME approach (live and online programs)

demonstrated that CME courses may be an effective tool to fill knowledge gaps to potentially positively impact patient health.⁶⁹

Beyond simply the physician being responsible to provide nutrition education to patients, a 1995 report published by the American Society for Clinical Nutrition recommended that major medical centers employ a full time employee with nutrition expertise as a role model for nutrition education in medical school and residency curricula.⁷⁰ The majority of physicians who completed our survey reported often seeing patients requiring nutrition counseling, yet less than half regularly communicated with or referred patients to a registered dietitian. A patient-centered medical home healthcare model recognizes the role of the dietitian and emphasizes involving a healthcare team. Relationships between physicians and dietitians is a strong influencing factor with referrals, a critical component to the healthcare team.⁵² Further studies are needed to identify barriers and discover alternative approaches to educate physicians about nutrition and tactics to incorporate nutrition into practice, in part by utilizing a healthcare team approach.

Our study has several limitations that should be considered. First, our participants were limited to Texas and mostly from suburban/urban practice locations. Due to our limited sample, the findings cannot be generalized to all of Texas let alone nationwide. We chose a convenience sample by sending emails to select representatives who have access to listservs of physicians, this may

have introduced selection bias and did not reach all 43,000 Texas physicians. Although our survey did not specifically address the nutrition background of physicians, it obtained feedback from physicians related to their interest in future nutrition education opportunities. Since our survey was voluntary, we believe physicians who responded were highly motivated with respect to the issue of importance of integrating nutrition counseling in their practice.

Despite these limitations, our study supports the contention that physicians indeed lack but desire to incorporate nutrition counseling into their practice. Physicians perceive their potential role as nutrition educators to improve the health of their patients. We found that physicians do acknowledge a lack of confidence in being able to provide nutrition counseling. Interestingly, referral rates to professionals with an expertise in nutrition (i.e. registered dietitians) is infrequent. Further studies are needed to determine effective and efficient mechanisms to educate physicians on nutrition topics. For example, the possibility of nutrition education via online or in-person delivery made available as CME credits might be considered. Providing nutrition education opportunities to physicians will add value to their practices. In addition to improving their confidence and self-efficacy in providing patient nutrition counseling, interactions and referrals to registered dietitians may increase. These are positive outcomes, which may ultimately decrease recurring visits from patients by incorporating nutrition and lifestyle-responsive approaches to patient care.

CHAPTER III

ONLINE NUTRITION CONTINUING MEDICAL EDUCATION (CME) FOCUSED TYPE 2 DIABETES PREVENTION AND MANAGEMENT LAUNCHED ON STATE-LEVEL MEDICAL ASSOCIATION*

III.1. Overview

Objective: The purpose of this research study was to determine if a one-hour online Continuing Medical Education (CME) course focused on nutrition for type 2 diabetes would result in a gain in nutrition knowledge by practicing physicians.

Methods: A practicing physician and dietitian collaborated to develop an online CME course (both webinar and self-study versions) on type 2 diabetes. This one-hour accredited course was launched through state-level medical association's education library, available to all physicians.

Results: Physicians (n=43) registered for the course, and of those, 31 completed the course in its entirety. A gain in knowledge was found when comparing pre- vs. post-test scores related to the online nutrition CME ($p < 0.0001$).

*Reprinted with permission from Hicks, K., Murano, P., "Online nutrition and T2DM continuing medical education course launched on state-level medical association." *Advances in Medical Education and Practice*. 2017:8, 1-6. Copyright 2017 Dove Medical Press Ltd.

Conclusions: Online CME courses launched via state-level medical associations offer convenient continuing education to assist practicing physicians in addressing patient nutrition and lifestyle concerns related to chronic disease. The present diabetes CME one credit course allowed physicians to develop basic nutrition care concepts on this topic to better assist patients.

Practice Implications: Increasing nutrition offerings for physicians will allow them to become more proficient on nutrition assessment and practical application tools to implement into practice.

III.2. Introduction

The United States healthcare system is transitioning to a more preventive based approach, of which healthy eating and lifestyle approaches are at the forefront, since nutrition and health behaviors are implicated to impact chronic disease development and progression. The literature has highlighted that poor nutrition contributes to chronic disease, ultimately contributing to morbidity and mortality.⁷¹⁻⁷³ A landmark study, EPIC-Norfolk, discovered that individuals with poor health behaviors (low fruit and vegetable intake, lack of physical activity, tobacco alcohol use) had over four times greater risk of mortality.⁷⁴ Specific to type 2 diabetes (T2DM), dietary intake plays a critical role in management of the disease. Providing dietary and lifestyle education focused on T2DM has resulted in improved self-management, and a reduction in both hemoglobin A1c (HgA1c)

and 2-hour blood glucose levels.⁷⁵⁻⁷⁷

Primary care physicians can benefit from incorporating nutrition and lifestyle focused counseling with patients. However, nutrition education in medical school is lacking. Physicians acknowledge limited nutrition knowledge and are seeking opportunities for nutrition education.^{53,78} Development of nutrition-related continuing medical education (CME) courses has been proposed as a feasible strategy to enhance physician education. Lifestyle focused CME programs have been shown to have a positive impact on physician knowledge, confidence and overall counseling behaviors.^{68,79} Various formats, length of CME's and accompanying credits provide versatile offerings for physicians to obtain CME credits. Multi-course CME programs have been shown to be successful in knowledge gain and practical application of material into practice.^{30,80} The American College of Lifestyle Medicine has a basic and advanced 30 CME Lifestyle Medicine Training Curriculum which encompasses several key competencies to integrate lifestyle medicine into practice. The "Healthy Kitchens, Healthy Lives" CME conference is a live four-day program including medical and culinary education.⁶⁷ Programs that encompass several CME credits, as part of a comprehensive program, are becoming more prevalent. Although multi-course CME programs focused on nutrition and lifestyle are important, other practical course topics often take precedence such as billing, risk management, compliance and practice operations.

Due to a variety of factors including physician request, concise, focused CME courses have been suggested. Regarding education focused specifically on nutrition care for T2DM, there are unfortunately limited independent one-credit CME courses available. A recent publication described the need for CMEs focused on T2DM, with inclusion of practical application tips to implement into practice.⁸¹ There is a documented need and corresponding positive impact when nutrition and lifestyle counseling are delivered to patients with T2DM.^{76,82-85} To begin to address this need, a few CME courses focused on nutrition and treatment of T2DM have been implemented. An independent multi-platform CME course (live and online) focused on T2DM resulted in physicians improve knowledge and assisted with reducing patient HbA1c.⁶⁹ Preliminary analysis from video-based education CME courses on diabetes care showed improvements in knowledge and competence for diabetes management.⁸⁶ These independent programs, provided through independent websites, represent a beginning. It remains to be seen whether nationwide interest in such independent courses by physicians will be generated.

Due to the limited single course offerings regarding nutrition and T2DM, the authors created an online CME focused on T2DM. It was hypothesized that providing a diabetes focused CME course, launched in collaboration with state-level medical associations, and would have a positive impact on physicians' knowledge regarding diabetic patient care.

III.3. Methods

III.3.1. Study Setting

An online continuing medical education (CME) course was jointly developed by a physician, a dietitian and a researcher focused on nutrition education delivery to physicians. This collaborative effort allowed practicing clinicians to work together, as they would in healthcare practice, to develop a course that could be utilized as a learning tool to apply care to patients. Each creator has extensive nutrition backgrounds and all focus on nutrition for prevention medicine whether it be in research or clinical practice. For the course “Frontiers in Type 2 Diabetes: The Role of Nutrition in Health”, the target learning audience was Texas physicians, of all practice specialties. The course was launched by the Texas Medical Association in January 2016 and was disseminated via the InReach© sharing network, and was subsequently accessed by the Oregon Medical Association and South Carolina Medical Association.

The educational activity was designed to measure the amount of knowledge gained based on information provided through the course. Physicians who participated were billed accordingly to the state level medical association for CME credits. Courses were accredited by ACCME for 1 *AMA PRA Category 1 Credit™* or 1 Ethics Credit. Course development was purposely created to be different than any current nutrition focused CME offerings that the

authors were aware of. The goal was to offer the most relevant and up-to-date content on the topic of T2DM and disseminate applied approaches to provide nutrition counseling. The CME curriculum was designed using the ARCS Model of Motivation, an eLearning technique used in online course development, shown to improve knowledge.⁸⁷ This model was selected due to the emphasis on practical application of nutrition care to patients, a core concept in the course.

Unlike other CME courses this had four main objectives including:

- 1) Highlight national nutrition recommendations
- 2) Introduce and discuss basic nutrition concepts
- 3) “How-to” provide nutrition care for patients including practical approaches and MI techniques
- 4) Utilizing a collaborative healthcare approach with billing codes for reimbursement

The webinar and self-study module included the following: background information on T2DM and specific learning objectives; complications associated with T2DM; recommendations for interventions according to professional health associations; the role of the physician in screening, diagnosis, treatment, and prevention of T2DM; two case studies for practice; lifestyle recommendations and medical nutrition therapy; implementing best practice techniques (motivational interviewing techniques; nutrition awareness in the office setting); SMART goal setting (goals that are Specific, Measurable, Attainable, Relevant

and Time Bound); working with patients in collaboration with RDs (registered dietitians); and overview of billing codes according to new ICD-10 billing system.

III.3.2. Data Collection and Analysis

Course participants accessed course content that included demographic disclosure, pre-test, T2DM course content, and post-test. Demographic characteristics included gender, zip code of practice, credentials, practice specialty and years in practicing medicine. The online activity was accompanied with a 16 multiple choice question test bank in which 10 questions at random were generated for the pre-test and post-test. Questions focused on basic nutrition knowledge, nutrition related terms and current nutrition recommendations, relative to T2DM; all content that was emphasized in the course. Test bank was created by the healthcare professionals whom created the course, to address the competencies of the learning objectives. From January 2016 to December 2016, physicians had options of selecting either a 42 minute online webinar, or a 9 page self-study PDF module, as means of participating in the study.

This study was approved by the Texas A&M University Institutional Review Board (IRB # IRB2015-0779D).

III.4. Results

III.4.1. Participant Demographics

Physicians who participated in our study provided select demographic information including credentials, gender, years in practice, zip code of practice and practice specialty. (Table 3; Figure 2)

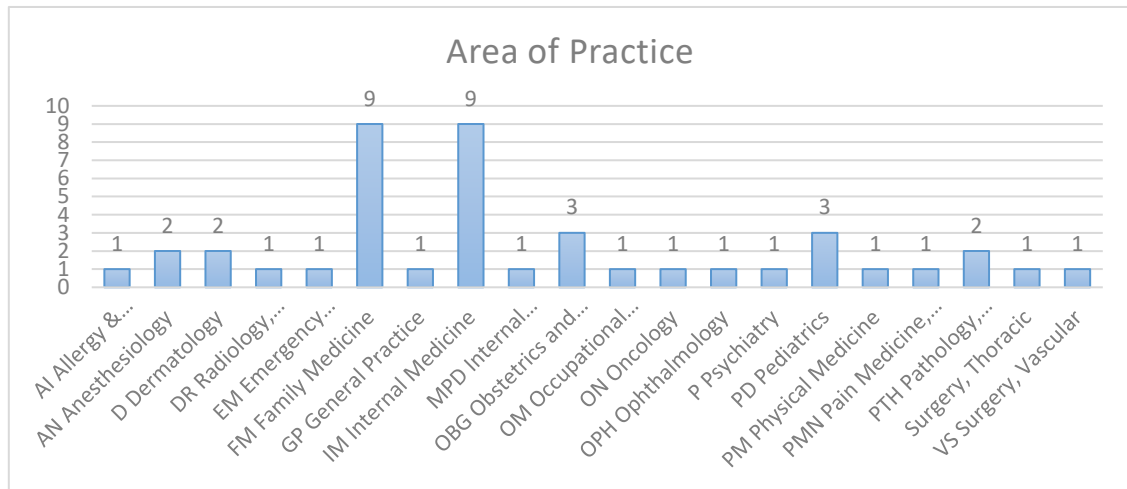


Figure 2: Various Areas of Practice Specialties

Table 3: Physician Demographics

Category	Description (#; % participants)
Credentials	MD (40; 93%)
	DO (3, 7%)
Gender	Male (24; 56%)
	Female (19; 44%)
Years in Practice	1-5 years (8; 19%)
	6-10 years (4; 9%)
	11-15 years (6; 14%)
	16-20 years (5; 12%)
	21-25 years (7; 16%)
	26+ years (13; 30%)
State of Residence	Texas (38; 88%)
	New Mexico (2; 5%)
	Missouri (1; 2%)
	Alabama (1; 2%)
	Wisconsin (1; 2%)

III.4.2. Pre-test and Post-test Scores

A score of 70% or better was required to “pass” our CME for credit, of which 93% of physicians achieved. Two physicians showed no increase in test scores comparing pre- and post-test and also did not achieve a passing score of 70% on the post-test to obtain credit. Using a paired t-test among pre- and post-test scores per user, there was a significant gain of knowledge ($p < 0.0001$). (Figure 3) No data to distinctly separate self-study vs. webinar associated test scores were available to us to analyze any differences.

Comparing pre- versus post-test scores, recognition of the prevalence of T2DM nationwide increased from 21% to 96% respectively. After the course, a majority (92%) of physicians were able to accurately recognize that carbohydrates were an important macronutrient to monitor for a patient with T2DM. The overall goal of medical nutrition therapy was correctly answered by all physicians in the post-test.

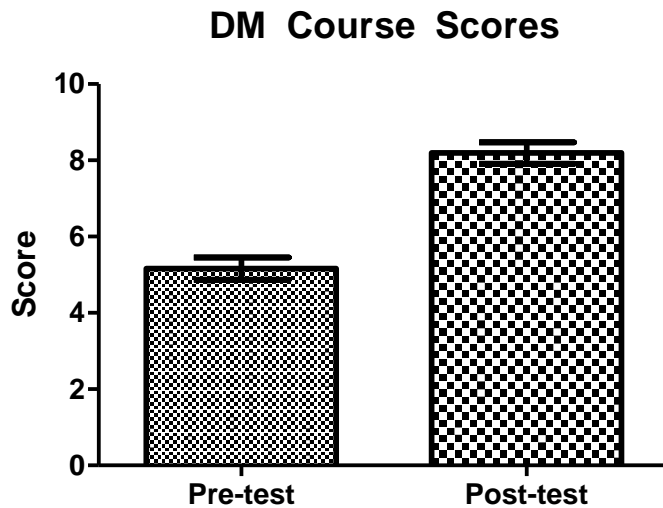


Figure 3: Pre-test versus Post-test Evaluation

III.4.3. Ratings

Physicians who completed the course were required to provide a rating of the course out of five stars. The 31 participants who completed all components to the course provided a rating of overall course content and delivery. Rating breakdown included: 5 stars (19), 4 stars (11) and 3 stars (1) with no ratings of a 2 or 1 star. In addition, brief feedback was provided as a comment such as “will incorporate into my practice”, “good content” and “it has lots of useful information”.

III.5. Discussion

We believe that this research study is the first to report an increase in nutrition knowledge of physicians by completing a single online nutrition focused CME on T2DM launched on the state-level education platform. Physicians who

completed the course improved scores significantly, indicating a gain in knowledge based on learning from course materials. These results are consistent with previous research that has demonstrated the overall efficacy of CME courses on course outcomes.^{29,67,69,86,88} An article assessed over 600 CME programs to find that online activities were more effective to simple enduring materials, multimedia inclusion was comparable to live activities.³⁷ These findings have important implications for CME developers as they develop and launch new CME courses. A unique feature in our online course was incorporation of a multimedia-based component as two separate case studies. Published research demonstrates that online CME courses that include multimedia activities are effective.⁸⁹

It is suggested that through course content delivery such as we have demonstrated, enhanced physician-to-patient interactions may occur that more successfully address T2DM. This is important because patients diagnosed with T2DM are at increased risk for co-morbidities and mortality. Integration of lifestyle counseling with T2DM patients has resulted in improvements in weight, HgA1c and overall lifestyle patterns.^{69,84,90,91} Non-communicable disease can be prevented and/or managed with improvements in physician-patient interactions focused on diet and lifestyle.

III.5.1. Limitations

This research study has several limitations. This course was only available through a few state-level medical associations, limiting physician participant awareness and access. Secondly, since this course was fee-based (\$29 member; \$79 non-member) within Texas, it is likely that the physicians who registered for the course had higher inherent interest in learning nutrition care related to diabetes. We also could not report what the overall response rate was among physicians since we did not have access to that data. The fact that the number of participants was limited, and that they were mainly Texas physicians, suggests that there was not true representativeness in our participant sample. This study did not obtain data regarding actual implementation of course content into practice. There is a need for CME evaluations to include long term follow up as part of studies. It may be considered a limitation the brevity of the course is inadequate to truly be considered a comprehensive course. This course is to instill basic concepts of nutrition and simplistic methods to integrate nutrition into counseling; this is not a replacement for a multi-course nutrition education program that would provide a more comprehensive outlook on nutrition and T2DM.

III.6. Conclusion

Results from this pilot study indicate that nutrition focused CME courses at the state-level medical association offer a feasible option for physicians to

learn and incorporate nutrition topics into their practices. There is a need for physicians to increase nutrition knowledge related to chronic disease prevention and development, and the inclusion of a one hour course can begin address this need. A call for CME's which include a practical component, such as interactive case studies, will support physicians seeking to integrate new knowledge into their practices.⁹²

This research study demonstrated that online CME courses launched on state-level medical association platforms improved subject matter knowledge. Ultimately, physicians who couple knowledge basics with practical application tools may more successfully integrate these into their practices. Since the rate of T2DM prevalence is increasing, there is no better time to create targeted nutrition offerings to enhance physician knowledge and effectiveness.

III.7. Practice Implications

Nutrition focused CME courses available on the state-level medical association platform is a viable opportunity to disseminate nutrition and improve content-specific nutrition knowledge of practicing physicians. An increase in knowledge and confidence on subject matter nutrition topics may assist to improve nutrition care and counseling with patients.

CHAPTER IV

DEVELOPMENT OF ONLINE NUTRITION CME COURSES: VALIDATION OF AN EFFECTIVE COURSE STRUCTURE

IV.1. Overview

Problem: Nutrition focused Continuing Medical Education (CME) for physicians is lacking a rigorous and reliable course structure to improve competency and ultimately medical practice behaviors.

Approach: Healthcare education has been lacking structure in development of nutrition CME courses for physicians. A series (n=3) of nutrition CME courses were created adhering to a course outline and structure, utilizing Institute of Medicine guidelines regarding the optimal approach for learning and ultimately patient care. These courses were launched on the Texas state medical association's education platform (TMA), available to all physicians.

Outcomes: Over 100 physicians from diverse professional specialties, practice locations and years of experience completed a nutrition course between January 2016 and March 2017. Evaluation of the data showed that this innovative online educational activity can be utilized as a powerful learning opportunity to increase nutrition specific knowledge, comparing pre- and post-test evaluations with each course.

Next Steps: Utilizing the course structure developed and tested, additional nutrition CME courses in critical nutrition topical areas should be

developed and employed to determine if physician knowledge and counseling in practice would improve.

IV.2. Problem

It is estimated that by 2020 two-thirds of diseases worldwide will stem from unhealthy diet and lifestyle habits.⁹³ Several studies focused on the inclusion of diet and lifestyle counseling into primary care have noted improvements in laboratory indices (lipids, HgA1c) and weight.^{42,43,82} Diet and lifestyle counseling can be used for both prevention and treatment of chronic disease, a clear target for healthcare professionals. Despite potential positive benefits, many physicians do not routinely provide lifestyle counseling to patients due to barriers including physician knowledge, confidence, time and reimbursement.⁹⁴ It has long been acknowledged that nutrition education during medical school is sparse, and frankly has been on the decline since early 2000. Most states require physicians to complete annual Continuing Medical Education (CME) credits to continue to the learning process as they practice medicine throughout their careers. CME courses are brief education sessions aimed to enhance professional development, ultimately to enhance physicians' clinical performance to improve patient health outcomes.

CME courses discussed in this paper focus on online materials. To date, there are minimal offerings of CME courses focused on nutrition topics, although nutrition and lifestyle have been shown to be a modifiable risk factor for chronic

disease. The two central websites for online offerings available for nutrition CME's include: Nutrition in Medicine (<http://nutritioninmedicine.org/>) and Nutrition CME (<https://www.nutritioncme.org/>). These courses, while of significance, are lacking in several capacities including: accreditation, practical application tools such as case study approach and MI techniques and discussion of collaborative healthcare. It has been acknowledged that there are no requirements for CME design and quality standards, thus leaving an open-ended development, a fault in the CME system.⁹⁵⁻⁹⁷

Here, we describe an innovative course design and development that provides basic knowledge, practical nutrition care MI application and emphasis on collaborative healthcare, all which have shown to improve practicing physician knowledge and patient nutrition care.^{31,50,98} With limited data on e-learning design and effectiveness, we aim to set a structural guideline for future course development to enhance learning and applied clinical skills by physicians.

IV.3. Approach

The course development and implementation in this case provided the groundwork for continued development CME's for healthcare professionals. To develop the courses, we used the Keller's ARCS Model of Motivation, a problem-solving approach to enhance learning by engaging participants in eLearning activities. This instructional design model embodies the four main

principles (Attention, Relevance, Confidence and Satisfaction). In order to grasp attention from the audience, each course had areas for active participation to allow physicians to practice what they learned. Additionally, providing real-world case studies and different presentation formats were to embody the Attention aspect. Relevance was determined based on other published courses and the literature, modeling several capacities that physicians could integrate nutrition care into practice. Course objectives were highlighted and reinforced throughout the courses to demonstrate a gain in confidence that the material had practical application for their medical practice. A format of webinar or self-study was offered to provide freedom of choice from the learners, to select a format best suited for their learning capabilities. Lastly, satisfaction was received due to these being accredited educational offerings, 1 *AMA PRA Category 1*[™] or 1 Ethics credit were awarded for physicians who passed the post-test. This model, shown in other courses, was embodied step-by-step to produce the strongest, most impactful course for physicians.

For course development, we employed a flow chart adapted from a previously published continuing education course.⁹⁹ (Figure 4) A step-by-step process was taken to ensure fluidity in development and dissemination.

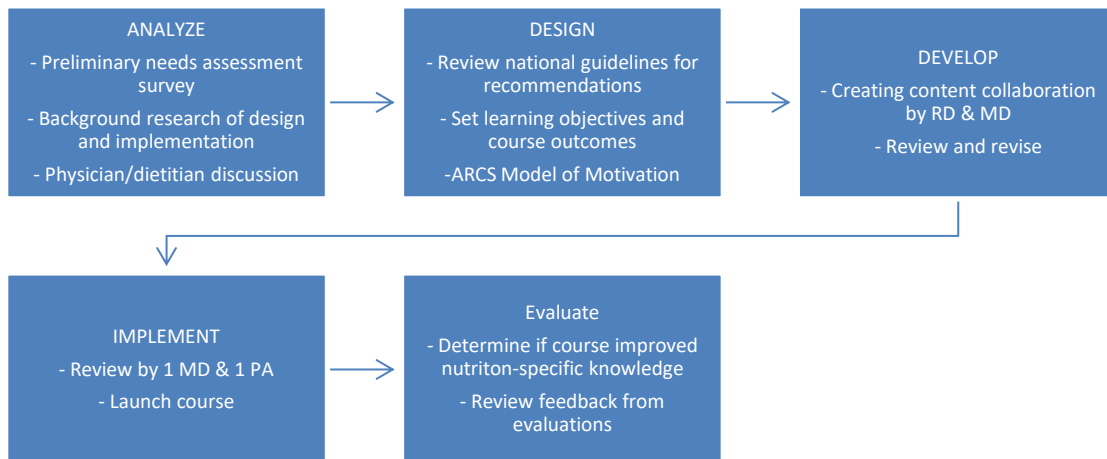


Figure 4: Flowchart on Development of CME

This design was constructed based on the Institute of Medicine core competencies for health professional education to promote optimal patient based care (Table 4).¹⁰⁰ These competencies were addressed in the course to meet the foundational guidelines for optimal education while facilitating a gain in knowledge regarding nutrition focused topics.

Table 4: CME Core Competencies

Core Competency	Description
Patient-centered care	Identify, respect and demonstrate compassion regarding patients' values, preferences and expressed needs. Advocate for disease prevention, wellness and promotion of healthy lifestyles.
Interdisciplinary approach	Collaborate, communicate and integrate care as a healthcare team to ensure that continued care is provided.
Evidence-based practice	Integrate valid and reliable research and clinical expertise for optimal patient care. Participate in learning to be provide evidence-based medicine.
Applying Quality Improvement	Measure quality of care by the care structure, process, and outcomes for patient and community needs.
Utilize Informatics	Support decision making using technology for communication and management of care.

Adapted from Balmer, J.T., The transformation of continuing medical education (CME) in the United States. *Adv Med Educ Pract*, 2013. **4**: p. 171-82.

The aim was to increase nutrition CME offerings while providing a practical approach to integrating nutrition into practice as a collaborative healthcare team. Healthcare is transitioning to a collaborative healthcare model and nutrition stands as a critical component to patient care, providing cohesion for the healthcare team. The courses, which were developed by a physician and dietitian, encompassed many components needed to implement nutrition care with patients.

Strategic planning went into content development, as robust planning was essential in order to identify a structure and course outline to be utilized for

future nutrition focused CME courses. The courses were organized in sequence of previously published courses on the Nutrition and Medicine website, including new instructional elements shown to be effective for application.^{27,101} The sequence included 1) highlighted recommendations 2) basic nutrition concepts 3) nutrition care for patients including practical approaches and MI techniques and lastly 4) collaborative healthcare approach and billing codes for reimbursement. This design was selected to satisfy Institute of Medicine competencies along with pilot feedback from various physicians on topics and sequencing to improve learners experience.

First, the course delved into national nutrition recommendations including Healthy People 2020, United States Preventive Services Task Force and the Academy of Nutrition and Dietetics. Each recommendation emphasized the role of the provider in patient care. Following on a section on physician responsibilities, a focus on prevalence and screening of the health issue at hand (e.g. HgA1c with a diabetic or LDL/HDL with a cardiovascular disease patient) was inserted. The course then transitioned into basic nutrition knowledge and care for patients suffering from chronic disease. Here is where macronutrient recommendations and specific dietary modifications expected for proper nutrition guidance for patients were made. Following this section, several case studies were integrated to simulate how a physician should approach and initiate

nutrition counseling with their patients. The physicians were then encouraged to compile assessment notes based on the case study, which was then reviewed.

The course next transitioned into discussing the healthcare team and how patients benefit when they are the center of a team-based approach to medicine. The role of the Registered Dietitian Nutritionist was discussed at length, along with how to increase provider referrals to this specialty healthcare professional. It was continuously emphasized throughout the course that working as a healthcare team will lighten the burden on any single provider and improve overall patient care. The course comes to completion with a brief discussion of ICD-10 billing codes that can be utilized for payment and reimbursement for both provider delivered counseling and collaborative billing.

Innovative in their design, the three courses (Frontiers in Type 2 Diabetes: The Role of Nutrition in Health; Stimulating Nutrition and Lifestyle Focused Counseling with the Overweight Patient; Innovation in Education for Cardiovascular Risk Patients: Heart Healthy Diet and Lifestyle) were launched at the Texas Medical Association, a state-level medical association, in order to attract participants. Course delivery to participants was via the education library (<http://texmed.inreachce.com/>). Accompanied with each course included a ten question pre- and post- test focused on the course outline. Online courses with associated tests have been utilized in various aspects of CME education, all

shown to demonstrate outcomes in learning.³⁵ The study was approved by the Texas A&M University Institutional Review Board (IRB# 2015-0779D).

IV.4. Outcomes

The online nutrition courses engaged participants in learning nutrition concepts which ultimately resulted in an increased knowledge about each specific nutrition topic. Aside from providing TMA with the new nutrition courses, the structure of the courses is the first of its kind to highlight an impactful design of content, known to be a challenge in online education. This innovative pilot study reports preliminary findings. Additional data collection is ongoing as the writing of this dissertation. It is hoped that our design can serve as the foundation for future nutrition focused courses offered through TMA, in which the inclusion of national recommendations, basic nutrition concepts, practical tips to implement nutrition counseling into practice and emphasizing importance of collaborative healthcare are all key features.

Data reports has shown a nearly 700% increase in online CME activities from the late 1990's to early 2000's. Online CME courses with interactive case components have been effective to enhance learning, and have been very favorably reviewed by participants.^{96,102} Validation that online CME activities can help to improve knowledge and confidence, is essential as more online courses begin to be developed.

The three courses had staggered launch dates (1: January 2016, 2: June 2016; 3: January 2017), based upon the time required to develop each. Data collected from January 2016 to March 2017 are reported in this innovative report. To date, these courses have enrolled 120 participants across all three courses: course 1 (n=47), course 2 (n=61) and course 3 (n=12). The post-intervention results demonstrated that participants who took any one of the three nutrition courses increased nutrition specific knowledge, as compared among pre- and post-tests using a paired t-test ($p < 0.0001$) (Figure 5). The mean score for the pre-test was 5.4, a score considered to be “not passing”; whereas, the post-test had a mean score of 8.7. Every participant who took one of the courses received a passing score of 7 or more.

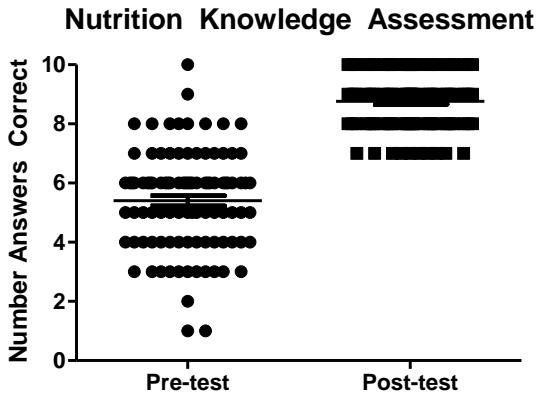


Figure 5: Data Analysis Comparing Pre- Versus Post-Tests.

For each course, two questions were intentionally focused on the same subject content 1) ways to create a healthy office atmosphere and 2) recognizing the health professional for nutrition. Comparing pre- versus post- test scores, participants correctly identified a method to promote a healthy office 94% and 100% respectively. Recognition of the nutrition health care professional scores increased from 46% to 87.5% respectively.

A series of descriptive statistics were compiled and presented, demonstrating a representative sample of physicians completed the courses (Table 5). Within our sample population, there were participants from six states and 123 different zip codes.

Table 5: Descriptive Assessment of Participants.

Description	Number
Gender	Male = 65
	Female = 55
Years in Practice	1-5 years = 10
	6-10 years = 10
	11-15 years = 31
	16-20 years = 17
	21+ years = 52
Practice Specialty	Family Medicine = 23
	Internal Medicine = 19
	Obstetrics and Gynecology = 8
	Anesthesiology = 7
	Pediatrics = 6
	Pathology = 5
	Psychiatry = 5
	Other Specialties (30 different) = 46

IV.5. Next Steps

There are many important next steps to consider, including the development of a standardized format for delivering nutrition focused CME courses, based on practical application. Currently no standard requirements are set for CME course development and course structure varies upon each different CME, leaving a disjointed system. The courses created through this pilot study succeeded in that physicians learned basic nutrition concepts with practical nutrition tools in order to assimilate nutrition counseling into practice, and also gained insight into the benefits of working as part of a healthcare team. Based upon the results of this pilot study, the following messages became apparent:

1. Online education delivery can reach a wide audience due to the ease of online access and availability.
2. Since nutrition focused CME courses are vital but lacking, there is an urgent need to create and make these available to physicians.
3. A structured nutrition CME course which integrates national recommendations, basic nutrition concepts, practical nutrition application tips and describes the healthcare team approach must be consistent components for these online learning courses.

The critical task going forward is to address a consistent course structure, such as what we presented, that will improve knowledge and meet guidelines of

online learning objectives. The ARCS model for e-learning course development is a viable model to follow which has been shown to help improve knowledge and confidence on content subject matter. This development, presented in a set of three courses, can be used as a guideline when discussing online nutrition CME development in the future. We believe this is an ideal course structure and outline that can facilitate nutrition focused knowledge and application of nutrition care. Other course frameworks lack several components such as case study scenarios, healthcare team approach discussion and inclusion of MI concepts and application. Additionally, many CME courses have narrow topics which lacks generalizability and popular nutrition concerns in patient-physician encounters. From evaluation comments received, these courses assisted physicians to incorporate nutrition counseling into practice and collectively showed a gain in subject specific nutrition knowledge according to pre-and post-test data.

Future research envisioned will utilize this structured design as a helpful tool when designing online nutrition CME courses for physicians and other healthcare professionals. Demonstrating that physicians play a critical role in patient health related to nutrition behaviors, the interactive case study allowed each participant to practice and learn how to incorporate key skills into a real-life scenario. Other studies including case studies and other problem based learning techniques into CME courses result in improvements in knowledge on subject

matter.⁹² Additionally, case studies embody the concept of active learning which has been shown to be effective at improving knowledge.

In a perfect world, this course design will not only aid to improve knowledge of healthcare professionals, but also guarantee that evidence-based nutrition therapy would be implemented into practice with each patient. Future research investigating this course outline as a basis for nutrition course development, with follow up data to determine if counseling practices change, is an important next step.

CHAPTER V

CONCLUSIONS

Physician nutrition education has been called upon for years as an area needed for improvement. There are limited educational opportunities that exist within the medical curriculum and beyond graduation. With a majority of physician-patient interactions that lack a nutrition component, this educational program described was an opportunity to improve nutrition knowledge for an array of practicing physicians. There continues to be an increase in medical nutrition research within the United States and abroad, it is imperative to assemble and disseminate these research findings to practitioners.

V.1. Survey of Physicians

This research endeavor began with an initial assessment, in order to determine topics of interest and demonstrate need of nutrition focused CME. It is well established that physicians acknowledge a lack in nutrition education background, confidence and face barriers with having time to incorporate nutrition into practice.^{23,94,103} Due to these perceived barriers, there is little to no nutrition counseling integrated into physician-patient interactions.⁵³ Based on preliminary data from our Physician Opinion Survey, we found that physicians recognized their limited nutrition background and knowledge. With limited attention given to nutrition in medical school, it is clear that educational offerings post-graduation is imperative. There has been a decline in nutrition coursework

found in the medical school curriculum nationwide since the early 2000's.¹⁰³ It was found that physicians seek out nutrition education opportunities and are interested in participating in nutrition focused CME programs. These findings presented confirmed the hypothesis that was expected, physicians are interested in developing a stronger base knowledge of nutrition related concepts and application into practice. The next stage in the research proposal was to develop and disseminate online nutrition courses to improve physician knowledge.

V.2. Online CME Course

Once survey results were completed, our second phase was initiated which focused on developing and implementing nutrition education CME courses at the state-level medical association. Course development adhered to a structure based on the ARCS Model of motivation and FRAMES Model of motivational interviewing, which provided practical application tools to use knowledge in counseling patients in practice. These courses were launched on Texas Medical Association, focused on availability to Texas physicians, yet available nationwide. All participants who took any of these courses demonstrated a gain in knowledge as determined by pre- versus post-test scores ($p < 0.0001$).

Several conclusions can be drawn from this research, mainly that online CME courses are effective methods of content delivery to improve content-

specific nutrition knowledge. In addition, these online versatile offerings overcome barriers such as lack of time, limited local availability and content specific course focus (e.g. diabetes, cardiovascular disease). Additionally, physicians across various specialties enrolled in these courses indicating that nutrition knowledge is being sought across disciplines.

Nutrition and lifestyle counseling are imperative to the transitioning healthcare system of using a preventive medicine approach. With a mere seven of ten leading causes of death attributed to diet and lifestyle, the inclusion of lifestyle counseling is needed within every physician-patient interaction. Lifestyle counseling can encompass an array of topics including dietary modification, stress management, sleep tracking, smoking cessation, self-management and so much more. Each of these lifestyle practices, with emphasis on diet and nutrition, are topics that can be addressed in healthcare with primary care providers. It is well documented that lifestyle counseling can have positive impact on patient outcome measures (e.g. weight, BMI, lipids, HgA1c).^{40,42,43,45}

V.3. Future Research Directions

This research filled a need that has been addressed in the literature for decades, with no answers from other researchers. The PNEP program focused on delivering high-impact educational offerings at the state-level medical associations, an opportunity that was visible to all physicians practicing in the state of Texas and across the nation. Shown in Table 6 are future courses that

should be developed based on preliminary survey feedback and research support for the need. It is expected with an increase in knowledge equivocally will result in improvements in the competency of nutrition care for patients from physicians.

Future research is needed to address this competency, do online CME modules result in increased nutrition care and counseling in the clinical setting? With education and nutrition research in a constantly changing context, the concept of addressing competency is critical.¹⁰⁴ If this competency were addressed, what would be the measurable patient outcomes that can be attributed to providing nutrition counseling to patients with chronic disease. Several methods are available to document care in practice settings including collecting data from a follow up survey post education, perform chart audits and/or monitor billing codes used by practitioners to determine if they billed for nutrition related and preventive medicine services.

Additionally, the question remains if physicians are the only provider of concern that needs to enhance nutrition knowledge for patient care. It is equally essential for other healthcare professionals to be competent on nutrition if collaborative healthcare practices are being utilized. There is a need and duty for educators to provide nutrition education for physician assistants, nurses, pharmacists, technicians, physical therapists and speech therapists, among the many other health disciplines.¹⁰⁵⁻¹⁰⁷ In changing healthcare models, an urge for

interprofessional patient care is on the rise, thus creating a demand for interprofessional education. It is essential to describe the role of nutrition and how each healthcare professional can address a nutrition concern in their practice, a need for future researchers to delve into.

In conclusion, this research contributed to what otherwise limited efforts to increase physician knowledge on nutrition related chronic disease, with a practical aspect of “how-to” include nutrition counseling in practice. It filled the otherwise empty space of nutrition education post-medical school, in an innovative online capacity that is accessible at convenience across the country. Based on pilot program data, courses with this unique structural design and content outline should be made and launched to contribute to the overall efforts of improving physician knowledge, ultimately with the outcome of improving patient health.

Table 6: Future Course Development

Course Title	Research Support for Need	Course Outline
Translating the Dietary Guidelines for Americans (DGA): From Recommendations to Patient Education	<ul style="list-style-type: none">• The DGA are created based on sufficient scientific evidence to support claims, all resources are available within the guidelines¹⁰⁸• Preliminary data report a relationship among individuals who use tools such as MyPlate and their related understanding of the DGA recommendations¹⁰⁹	<ul style="list-style-type: none">• Overview of changes in the DGA over the past 20 years• Detail each of the DGA components and provide research support for these recommendations• Provide MI tools to discuss lifestyle education with patient population• Tools and tips to counseling and billing
Pregnancy Nutrition: Conception to Birth	<ul style="list-style-type: none">• Prenatal programming has been shown to link poor nutrition during pregnancy to increased risk for offspring disease (i.e. DM, CVD) ¹¹⁰• Maternal diet has impact on fetal macrosomia and neonatal anthropometrics¹¹¹	<ul style="list-style-type: none">• Discuss the national recommendations for physicians to counsel pregnant women• Signs and symptoms for adverse pregnancy outcomes• Overview of nutrition and lifestyle components for healthy pregnancy• Provide MI tools to discuss lifestyle education with patient population• Tools and tips to counseling and billing

Table 6 Continued.

Course Title	Research Support for Need	Course Outline
<p>Nutrition and Cancer: Summation of Research to Practice Translations</p>	<ul style="list-style-type: none"> • Nutrition and lifestyle have been shown to have impact on preventing several cancer types including during remission (e.g. colon, breast, lung, prostate)^{105,112} • Phytochemicals in fruits and vegetables have preliminary data to support anti-cancer properties¹¹³ 	<ul style="list-style-type: none"> • Discuss the national recommendations for physicians to counsel individuals at risk for cancer • Clinical signs and apparent symptoms for early diagnosis of cancer • Overview of nutrition and lifestyle components during various cancer stages (diagnosis, treatment, remission) • Provide MI tools to discuss lifestyle education with patient population • Tools and tips to counseling and billing

REFERENCES

1. Ogden, C.L., Carroll M.D., Kit B.K., Flegal K.M. Prevalence of Childhood and Adult Obesity in the United States, 2011-2012. *J Am Med Assoc.* 2014;311(8):806-814.
2. CDC. FastStats - Leading Causes of Death. 2014; <https://www.cdc.gov/nchs/fastats/leading-causes-of-death.htm>, 2016.
3. Cawley, J., Meyerhoefer C. The Medical Care Costs of Obesity: An Instrumental Variables Approach. *J Health Econ.* 2012;31(1):219-230.
4. WHO. Obesity and Overweight. 2016; <http://www.who.int/mediacentre/factsheets/fs311/en/>.
5. Polak, R., Pojednic, R., Phillips, E. Lifestyle Medicine Education. *Am J Lifestyle Med.* 2015;9(5):361-367.
6. Mokdad, A.H., Marks, J.S., Stroup, D.F. et al. Actual Causes of Death in the United States, 2000. *J Am Med Assoc.* 2004;291(10):1238-1245.
7. Berning, J. The Role of Physicians in Promoting Weight Loss. *Econ Hum Biol.* 2015;17:104-115.
8. Daley, B.J., Cherry-Bukowiec J., Van Way, C.W., Collier, B., Gramlich, L., McMahon, M.M., McClave, S.A. Current Status of Nutrition Training in Graduate Medical Education From a Survey of Residency Program Directors: A Formal Nutrition Education Course Is Necessary. *J Parenter Enteral Nutr.* 2016;40(1):95-99.
9. Murray, C.J.L., Abraham, J., Ali, M.K., Alvarado, M., Atkinson, C., Baddour, L.M. et al. The State of US Health, 1990-2010: Burden of Diseases, Injuries, and Risk Factors. *J Am Med Assoc.* 2013;310(6):591-608.
10. Alexander, J.A., Hearld, L.R., Mittler, J.N., Harvey, J. Patient-Physician Role Relationships and Patient Activation Among Individuals with Chronic Illness. *Health Serv Res.* 2012;47(3):1201-1223.
11. CDC. FastStats - Physician Office Visits.; <http://www.cdc.gov/nchs/fastats/physician-visits.htm>.

12. Nutrition and Weight Status | Healthy People 2020.; <https://www.healthypeople.gov/2020/topics-objectives/topic/nutrition-and-weight-status/objectives>.
13. Moyer, V.A. Screening for and Management of Obesity in Adults: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med.* 2012;157(5):373-378.
14. Bleich, S., Pickett-Blakely, O., Cooper, L.A. Physician Practice Patterns of Obesity Diagnosis and Weight-Related Counseling. *Patient Educ Couns.* 2011;82(1):123-129.
15. King, M., Nkoy, F.L., Maloney, C.G., Mihalopoulos, N.L. Physicians and Physician Trainees Rarely Identify or Address Overweight/Obesity in Hospitalized Children. *J Pediatr.* 2015;167:816-820.
16. Bock, C., Diehl, K., Schneider, S., Diehm, C., Litaker, D. Behavioral Counseling for Cardiovascular Disease Prevention in Primary Care settings: A Systematic Review of Practice and Associated Factors. *Med Care Res Rev.* 2012;69(5):495-518.
17. Fontil, V., Gupta, R., Bibbins-Domingo, K. Missed Opportunities: Young Adults with Hypertension and Lifestyle Counseling in Clinical Practice. *J Gen Intern Med.* 2015;30(5):536-538.
18. Spencer, E.H., Frank, E., Elon, L.K., Herzberg, V.S., Serdula, M.K., Galuska, D.A. Predictors of Nutrition Counseling Behaviors and Attitudes in US Medical Students. *Am J Clin Nutr.* 2006;84(3):655-662.
19. Connor, R., Cialdella-Kam, L., Harris, S.R. . A Survey of Medical Students' Use of Nutrition Resources and Perceived Competency in Providing Basic Nutrition Education. *J Biomed Educ.* 2015;2015:1-7.
20. Conroy, M.B., Delichatsios, H.K., Hafler, J.P., Rigotti, N.A. Impact of a Preventive Medicine and Nutrition Curriculum for Medical Students. *Am J Prev Med.* 2004;27(1):77-80.
21. Mihalynuk, T.V., Scott, C.S., Coombs, J.B. Self-Reported Nutrition Proficiency is Positively Correlated with the Perceived Quality of Nutrition Training of Family Physicians in Washington State. *Am J Clin Nutr.* 2003;77:1330-1336.

22. Jay, M., Gillespie, C., Ark, T., Richter, R., McMacken, M., Zabar, S., Paik, S., Messito, M.J., Lee, J., Kalet, A. Do Internists, Pediatricians, and Psychiatrists Feel Competent in Obesity Care?: Using a Needs Assessment to Drive Curriculum Design. *J Gen Intern Med*. 2008;23(7):1066-1070.
23. Kushner, R.F. Barriers to Providing Nutrition Counseling by Physicians: A Survey of Primary Care Practitioners. *Prev Med*. 1995;24(6):546-552.
24. Patel, S., Taylor, K.H., Berlin, K.L., Geib, R.W., Danek, R., Waite, G.N. Nutrition Education in U.S. Medical Schools: An Assessment of Nutrition Content in USMLE STEP Preparation Materials. *Journal of Curriculum and Teaching*. 2015;4(1):108-113.
25. Kris-Etherton, P.M., Akabas, S.R., Douglas, P., Kohlmeier, M., Laur, C., Lenders, C.M., Levy, D., Nowson, C., Ray, S., Pratt, C.A., Seidner, D.L., Saltzman, E. Nutrition Competencies in Health Professionals' Education and Training: A New Paradigm. *Adv Nutr*. 2015;6:83-87.
26. Adams, K.M., Butsch, W.S., Kohlmeier, M. The State of Nutrition Education at US Medical Schools. *J Biomed Educ*. 2015.
27. Kohlmeier, M., Adams, K.M., Powell, M. Nutrition in Medicine - Online Medical Nutrition Education. 2016; <http://nutritioninmedicine.org/>.
28. *Nutrition and You: Trends 2011*. Academy of Nutrition and Dietetics.
29. Dacey, M., Arnstein, F., Kennedy, M.A., Wolfe, J., Phillips, E.M. The Impact of Lifestyle Medicine Continuing Education on Provider Knowledge, Attitudes, and Counseling Behaviors. *Med Teach*. 2013;35(5):1149-1156.
30. Polak, R., Shani, M., Dacey, M., Tzuk-Onn, A., Dagan, I., Malatskey, L. Family Physicians Prescribing Lifestyle Medicine: Feasibility of a National Training Programme. *Postgrad Med J*. 2016;0:1-6.
31. Welsh, J.A., Nelson, J.M., Walsh, S., Sealer, H., Palmer, W., Vos, M.B. Brief Training in Patient-Centered Counseling for Healthy Weight Management Increases Counseling Self-Efficacy and Goal Setting Among Pediatric Primary Care Providers: Results of a Pilot Program. *Clin Pediatr*. 2015;54(5):425-429.

32. Giri, K., Frankel, N., Tulenko, K., Puckett, A., Bailey, R., Ross, H. *Keeping Up to Date: Continuing Professional Development for Health Workers in Developing Countries*. 2012; www.capacityplus.org/.
33. Lauer, P.A., Christopher, D.E., Firpo-Triplett, R., Buchting, F. . The Impact of Short-Term Professional Development on Participant Outcomes: A Review of the Literature. *Prof Develop Educ*. 2013;40(2):207-227.
34. Van Horn, L. The Nutrition Academic Award: Brief History, Overview, and Legacy. *Am J Clin Nutr*. 2006;83(4):936S-940S.
35. Williams, J.G. Are Online Learning Modules an Effective Way to Deliver Hand Trauma Management Continuing Medical Education to Emergency Physicians? *Plas Surg*. 2014;22(2):75-78.
36. Curran, V.R., Fleet, L. A Review of Evaluation Outcomes of Web-Based Continuing Medical Education. *Med Educ*. 2005;39(6):561-567.
37. Salinas, G.D. CME Effectiveness: Utilizing Outcomes Assessments of 600+ CME Programs to Evaluate the Association Between Format and Effectiveness. *J Contin Educ Health Prof*. 2015;35(S1):S38-39S.
38. Liyanagunawardena, T.R., Williams, S.A. Massive Open Online Courses on Health and Medicine: Review. *J Med Internet Res*. 2014;16(8):e191.
39. Contento, I.R. *Nutrition Education: Linking Research, Theory, and Practice*. 2 ed. Sudbury, MA: Jones & Bartlett; 2011.
40. Dod, H.S., Bhardwaj, R., Sajja, V., Weidner, G., Hobbs, G.R., Konat, G.W., Manivannan, S., Gharib, W., Warden, B.E., Nanda, N.C., Beto, R.J., Ornish, D., Jain, A.C. Effect of Intensive Lifestyle Changes on Endothelial Function and on Inflammatory Markers of Atherosclerosis. *Am J Cardio*. 2010;105(3):362-367.
41. Lin, J.S., O'Connor, E., Evans, C.V., Senger, C.A., Rowland, M.G., Groom, H.C. . Behavioral Counseling to Promote a Healthy Lifestyle in Persons With Cardiovascular Risk Factors: A Systematic Review for the U.S. Preventive Services Task Force. *Ann Intern Med*. 2014;161(8):1-12.

42. Morrison, F., Shubina, M., Turchin, A. Lifestyle Counseling in Routine Care and Long-Term Glucose, Blood Pressure, and Cholesterol Control in Patients With Diabetes. *Diab Care*. 2012;35:334–341.
43. Vetter, M.L., Wadden, T.A., Chittams, J., Diewald, L.K., Panigrahi, E., Volger, S., Sarwer, D.B., Moore, R.H., et al. Effect of Lifestyle Intervention on Cardiometabolic Risk Factors: Results of the POWER-UP Trial. *Int J Obes* 2013;37 (Suppl 1):S19-S24.
44. Ghisi, G.L., Abdallah, F., Grace, S.L., Thomas, S., Oh, P. A Systematic Review of Patient Education in Cardiac Patients: Do They Increase Knowledge and Promote Health Behavior Change? *Patient Educ Couns*. 2014;95(2):160-174.
45. Schleifer, W.J., Mookadam, F., Scales, R., Hurst, R., Cornella, K., Alegria, J. . Short-Term Effect of Physician Nutrition Counseling during a Routine Cardiology Visit. *Adv Nutr*. 2016;7:18A.
46. Hosomura, N., Goldberg, S.I., Shubina, M., Zhang, M., Turchin, A. Electronic Documentation of Lifestyle Counseling and Glycemic Control in Patients With Diabetes. *Diab Care*. 2015;38:1326–1332.
47. Ma, J., Yank V., Xiao L., Lavori, P.W., Wilson, S.R., Rosas, L.G., Stafford, R.S. Translating the Diabetes Prevention Program Lifestyle Intervention for Weight Loss Into Primary Care A Randomized Trial. *J Am Med Assoc Intern Med*. 2013;173(2):113-121.
48. Knowler, W.C. Fowler, S.E., Hamman, R.F., et al. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. *N Engl J Med*. 2002;346(6):393-403.
49. Rubak, S., Sandbaek, A., Lauritzen, T., Christensen, B. Motivational Interviewing: A Systematic Review and Meta-Analysis. *Br J Gen Pract*. 2005;55(513):305-312.
50. Resnicow, K., McMaster F., Bocian A., Harris D., Zhou Y., Snetselaar L., Schwartz R., Myers E., Gotlieb J., Foster J., Hollinger D., Smith K., Woolford S., Mueller D., Wasserman R. C. Motivational Interviewing and Dietary Counseling for Obesity in Primary Care: An RCT. *Pediatrics*. 2015;135(4):649-657.

51. Dickson, L.J., Bianchi, P. An Exploratory Study of Physician Referrals to Dietitians Before and After Distribution of Materials Promoting Nutrition Care Services. *J Acad Nutr Diet.* 1998;98(9):A28.
52. Mitchell, L.J., Macdonald-Wicks, L., Capra, S. Increasing Dietetic Referrals: Perceptions of General Practitioners, Practice Nurses and Dietitians. *Nutrition & Dietetics.* 2012;69(1):32-38.
53. Wynn, K., Trudeau, J.D., Taunton, K., Gowans, M., Scott, I. Nutrition in Primary Care: Current Practices, Attitudes and Barriers. *Can Fam Physician.* 2010;26(3):e109-e116.
54. Arena, R., Williams, M., Forman, D.E., Cahalin, L.P., Coke, L., Myers, J., Hamm, L., Kris-Etherton, P., Humphrey, R., Bittner, V., Lavie, C.J. Increasing Referral and Participation Rates to Outpatient Cardiac Rehabilitation: The Valuable Role of Healthcare Professionals in the Inpatient and Home Health Settings. *Circulation.* 2012;125:1321-1329.
55. Spencer, E.H., Frank, E., Elon, L.K., Herzberg, V.S., Serdula, M.K., Galuska, D.A. . Predictors of Nutrition Counseling Behaviors and Attitudes in US Medical Students. *Am J Clin Nutr.* 2006;84(3):655-662.
56. Franks, E., Segura, C., Shen, H., Oberg, E. Predictors of Canadian Physicians' Prevention Counseling Practices. *Can J Public Health.* 2010;101(5):390-395.
57. Adams, K.M., Kohlmeier, M., Zeisel, S.H. Nutrition Education in U.S. Medical Schools: Latest Update of a National Survey. *Acad Med.* 2010;85(9):1537-1542.
58. Kiraly, L., McClave S.A., Neel D., Evans D.C., Martindale R.G., Hurt R.T. Physician Nutrition Education. *Nutr Clin Pract.* 2014;29(3):332-337.
59. ACGME. *ACGME Program Requirements for Graduate Medical Education in Gastroenterology (Internal Medicine).* 2016; https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/144_gastroenterology_int_med_2016.pdf.
60. Smith, S., Seeholzer, E.L., Gullett, H., Jackson, B., Antognoli, E., Krejci, S., Flocke, S.A. Primary Care Residents' Knowledge , Attitudes , Self-Efficacy , and Perceived Professional Norms Regarding Obesity,

Nutrition, and Physical Activity Counseling. *J Grad Med Educ.* 2015;7(3):388-394.

61. Dimaria-Ghalili, R.A., Edwards, M., Friedman, G., Jaferi, A., Kohlmeier, M., Kris-Etherton, P., Lenders, C., Palmer, C., Wylie-Rosett, J. Capacity Building in Nutrition Science: Revisiting the Curricula for Medical Professionals. *Ann NY Acad Sci.* 2013;1306(1):21-40.
62. Kris-Etherton, P.M., Akabas, S.R., Douglas, P., Kohlmeier, M., Laur, C., Lenders, C.M., Levy, D., Nowson, C., Ray, S., Pratt, C.A., Seidner, D.L., Saltzman, E., Seidner, D.L., Van Horn, L. The Need to Advance Nutrition Education in the Training of Health Care Professionals and Recommended Research to Evaluate Implementation and Effectiveness. *Am J Clin Nutr.* 2014;99(5):1153S-1166S.
63. Vetter, M.L., Herring, S.J., Sood, M., Shah, N.R., Kalet, A.L. What Do Resident Physicians Know About Nutrition? An Evaluation of Attitudes, Self-Perceived Proficiency and Knowledge. *J Am Coll Nutr.* 2008;27(2):287-298.
64. Foster, G.D., Wadden, T.A., Makris, A.P., Davidson, D., Sanderson, R.S., Allison, D.B., Kessler, A. Primary Care Physicians' Attitudes About Obesity and its Treatment. *Obes Res.* 2003;11(10):1168-1177.
65. Sussman, A.L., Williams, R.L., Leverence, R., Gloyd, P.W., Crabtree, B.F. Self Determination Theory and Preventive Care Delivery: A Research Involving Outpatient Settings Network (RIOS Net) study. *J Am Board Fam Pract.* 2008;21(4):282-292.
66. Bleich, S.N., Bennett, W.L., Gudzone, K.A., Cooper, L.A. National Survey of US Primary Care Physicians' Perspectives About Causes of Obesity and Solutions to Improve Care. *BMJ open.* 2012;2(6):1-9.
67. Eisenberg, D., Miller, A., McManus, K., Erickson, M., Drescher, G., Burgess, J., Bernstein, A., Rosner, B., Rimm, E., Willett, W. Altering Nutrition-Related Behaviors of Healthcare Professionals Through CME Involving Nutrition Experts and Chefs. *BMC Complement Altern Med.* 2012;12(Suppl 1):O17.
68. Kahn, R.F. Continuing Medical Education in Nutrition. *Am J Clin Nutr.* 2006(83 Suppl):981S-984S.

69. Lee, B., Trence, D., Inzucchi, S., Lin, J., Haimowitz, S., Wilkerseon, E., Williams, C., Mosier, M., Dex, T. Improving Type 2 Diabetes Patient Health Outcomes with Individualized Continuing Medical Education for Primary Care. *Diabetes Ther.* 2016;7:473–481.
70. Halsted, C.H. Clinical Nutrition Education-Relevance and Role Models. *Am J Clin Nutr.* 1998;67(2):192-196.
71. Morris, N.P. The Neglect of Nutrition in Medical Education: A Firsthand Look. *J Am Med Assoc Intern Med.* 2014;174(6):841-842.
72. Hivert, M.F., Arena, R., Forman, D.E., Kris-Etherton, P.M., McBride, P.E., Pate, R.R., Spring, B., Trilk, J., Van Horn, L.V., Kraus, W.E., et al. Medical Training to Achieve Competency in Lifestyle Counseling: An Essential Foundation for Prevention and Treatment of Cardiovascular Diseases and Other Chronic Medical Conditions: A Scientific Statement From the American Heart Association. *Circulation.* 2016;134(15):e308-e327.
73. Pronk, N.P., Remington, P.L. Combined Diet and Physical Activity Promotion Programs for Prevention of Diabetes: Community Preventive Services Task Force Recommendation Statement. *Ann Intern Med.* 2015;163(6):465-468.
74. Khaw, K.T., Wareham, N., Bingham, S., Welch, A., Luben, R.N., Day, N. Combined Impact of Health Behaviours and Mortality in Men and Women: The EPIC-Norfolk Prospective Population Study. *PLoS Med.* 2008;5(1):e12.
75. Breen, C., Ryan, M., Gibney, M. J., O'Shea, D. Diabetes-Related Nutrition Knowledge and Dietary Intake Among Adults with Type 2 Diabetes. *Br J Nutr.* 2015;114(3):439-447.
76. Baum, H.B., Cagliero, E., Berry, C.A., Mencia, W.A., Stowell, S.A., Miller, S.C. Continuing Improvement in Type 2 Diabetes Care Through Performance-Based Evaluations. *J Prim Care Community Health.* 2014;5(2):107-111.
77. Sun, Y., You, W., Almeida, F., Estabrooks, P., Davy, B. The Effectiveness and Cost of Lifestyle Interventions Including Nutrition Education for Diabetes Prevention: A Systematic Review and Meta-Analysis. *J Acad Nutr Diet.* 2017;117(3):404-421.e436.


78. Hicks, K.K., Murano, P.S. . Physician Perspectives on Nutrition Counseling and Nutrition Focused Continuing Medical Education in Texas. *Social Medicine*. 2016;10(3):1-7.
79. Beno, L., Hinchman, J., Trowbridge, F. Design and Implementation of Training to Improve Management of Pediatric Overweight. *J Contin Educ Health Prof* 2005;25(4):248-258.
80. Allison, J.J., Kiefe, C.I., Wall, T., Casebeer, L., Ray, M.N., Spettell, C.M., Hook Iii, E.W., Oh, M.K., Person, S.D., Weissman, N.W. Multicomponent Internet Continuing Medical Education to Promote Chlamydia Screening. *Am J Prev Med*. 2005;28(3):285-290.
81. Beaser, R.S., Brown, J.A. Preventive Intervention in Diabetes: A New Model for Continuing Medical Education. *Am J Prev Med*. 2013;44(4 Suppl 4):S394-S399.
82. Azar, K.M.J., Chung, S., Wang, E.J., Zhao, B., Linde, R.B., Lederer, J., Palaniappan, L.P. . Impact of Education on Weight in Newly Diagnosed Type 2 Diabetes: Every Little Bit Helps. *Plos One*. 2015;10(6):e0129348.
83. Aguiar, E.J., Morgan, P.J., Collins, C.E., Plotnikoff, R.C., Young, M.D., Callister, R. The PULSE (Prevention Using LifeStyle Education) Trial Protocol: A Randomised Controlled Trial of a Type 2 Diabetes Prevention Programme for Men. *Contemp Clin Trials*. 2014;39:132-144.
84. Linmans, J.J., Van Rossem, C., Knottnerus, J.A., Spigt, M. Exploring the Process When Developing a Lifestyle Intervention in Primary Care for Type 2 Diabetes: A Longitudinal Process Evaluation. *Public Health*. 2015;129:52-59.
85. Ball, L., Davmor, R., Leveritt, M., Desbrow, B., Ehrlich, C., Chaboyer, W. Understanding the Nutrition Care Needs of Patients Newly Diagnosed with Type 2 Diabetes: A Need for Open Communication and Patient-Focussed Consultations. *Aust J Prim Health*. 2015;22:416–422.
86. Larkin, A., Healy, C., Le, A. Type 2 Diabetes Quality Improvement CME: Impact on Physician Knowledge. *Medscape Education*. 2016:757.

87. Wongwiwatthanakit, S., Popovich, N.G. Applying the ARCS Model of Motivational Design to Pharmaceutical Education. *Am J Pharm Educ.* 2000;64(2):188.
88. Sargeant, J., Valli, M., Ferrier, S., MacLeod, H. Lifestyle Counseling in Primary Care: Opportunities and Challenges for Changing Practice. *Medical Teacher.* 2008;30(2):185-191.
89. McFadden, P., Crim, A. Comparison of the Effectiveness of Interactive Didactic Lecture Versus Online Simulation-Based CME Programs Directed at Improving the Diagnostic Capabilities of Primary Care Practitioners. *J Contin Educ Health Prof.* 2016;36(1):32-37.
90. Wing, RR, Bolin, P., Brancati, F.L., Bray, G.A., Clark, J.M., Coday, M., Crow, R.S., Curtis, J.M., Egan, C.M., Espeland, M.A., et al. Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes. *N Engl J Med.* 2013;369(2):145-154.
91. Galaviz, KI, Narayan, K.M.V., Lobelo, F., Weber, M.B. Lifestyle and the Prevention of Type 2 Diabetes: A Status Report. *Am J Lifestyle Med.* 2015:1-17.
92. Al-Azri, H., Ratnapalan, S. Problem-Based Learning in Continuing Medical Education. *Can Fam Physician.* 2014;60:157-165.
93. Chopra, M., Galbraith, S., Darnton-Hill, I. A Global Response to a Global Problem: The Epidemic of Overnutrition. *Bulletin of the World Health Organization.* 2002; 80:952-958
94. Kolasa, K.M., Rickett, K. Barriers to Providing Nutrition Counseling Cited by Physicians. *Nutr Clin Pract.* 2010;25(5):502-509.
95. Lewis, K.O., Cidon, M.J., Seto, T.L., Chen, H., Mahan, J.D. Leveraging E-Learning in Medical Education. *Curr Probl Pediatr Adolesc Health Care.* 2014;44(6):150-163.
96. Mojtahedzadeh, R., Ebrahimzadeh, I., Zandi, B., Sarmadi, M.R., Alipour, A. Instructional Design, Delivery, and Evaluation of Interactive Case-Based e-CME Contents. *J Med Educ.* 2015;14(1):33-38.
97. Walsh, K. E-learning in Medical Education: Problems with Research. *J Contemp Med Edu.* 2016;4(3).

98. Britt, E., Hudson, S.M., Blampied, N.M. Motivational Interviewing in Health Settings: A Review. *Patient Educ Couns.* 2004;53(2):147-155.
99. Karavetian, M., Rizk, R. Development and Evaluation of Continuing Education Course in Renal Nutrition. *Nutr Res Pract.* 2016;10(1):99-107.
100. Balmer, J.T. The Transformation of Continuing Medical Education (CME) in the United States. *Adv Med Educ Pract.* 2013;4:171-182.
101. Fordis, M., King, J.E., Ballantyne, C.M., Jones, P.H., Schneider, K.H., Spann, S.J., Greenberg, S.B., Greisinger, A.J. Comparison of the Instructional Efficacy of Internet-Based CME with Live Interactive CME Workshops: A Randomized Controlled Trial. *JAMA.* 2005;294(9):1043-1051.
102. Thepwongsa, I., Kirby, C., Schattner, P., Piterman, L. Online Continuing Medical Education (CME) for GPs: Does it Work? A Systematic Review. *Aust Fam Physician.* 2014;43(10):717-721.
103. Adams, K.M., Lindell, K.C., Kohlmeier, M., Zeisel, S.H. Status of Nutrition Education in Medical Schools. *Am J Clin Nutr.* 2006;83(4):941S-944S.
104. O'Connell, J., Gardner, G., Coyer, F. Beyond Competencies: Using a Capability Framework in Developing Practice Standards for Advanced Practice Nursing. *J Adv Nurs.* 2014;70(12):2729-2735.
105. Murphy, J.L., Girot, E.A. The Importance of Nutrition, Diet and Lifestyle Advice for Cancer Survivors - The Role of Nursing Staff and Interprofessional Workers. *J Clin Nurs.* 2013;22:1539-1549.
106. Thistlethwaite, J.E., Forman, D., Matthews, L.R., Rogers, G.D., Steketee, C., Yassine, T. Competencies and Frameworks in Interprofessional Education: A Comparative Analysis. *Acad Med.* 2014;89(6):869-875.
107. DiMaria-Ghalili, R.A., Mirtallo, J.M., Tobin, B.W., Hark, L., Van Horn, L., Palmer, C.A. Challenges and opportunities for nutrition education and training in the health care professions: Intraprofessional and interprofessional call to action. *Am J Clin Nutr.* 2014;99(5):1184--1193.


108. *Dietary Guidelines for Americans 2015-2020*. U.S. Department of Health and Human Services and U.S. Department of Agriculture. <https://health.gov/dietaryguidelines/2015/guidelines/>.
109. Schwartz, J., Vernarelli, J.A. Assessing the Public's Comprehension of Dietary Guidelines: Use of MyPlate / MyPyramid tools is Associated with Higher Diet Quality, Findings from the NHANES. *FASEB Journal*. 2017;31(1S):462.
110. Carolan-Olah, M., Duarte-Gardea, M., Lechuga, J. A Critical Review: Early Life Nutrition and Prenatal Programming for Adult Disease. *J Clin Nurs*. 2015;24:3716-3729.
111. Walsh, J.M., McAuliffe, F.M. Impact of Maternal Nutrition on Pregnancy Outcome- Does it Matter What Pregnant Women Eat? *Best Pract Res Clin Obstet Gynaecol*. 2015;29(1):63-78.
112. Deng, T., Lyon, C.J., Bergin, S., Caligiuri, M.A., Hsueh, W.A. Obesity, Inflammation, and Cancer. *Annu Rev Pathol*. 2016;11:421-449.
113. Wu, Q.J., Yang Y., Vogtman E., Wang J., Han L.H., Li H.L., Xiang Y.B. Cruciferous Vegetables Intake and the Risk of Colorectal Cancer: A Meta-Analysis of Observational Studies. *Annals of Oncol* 2013;24(4):1079-1087.

APPENDIX


TEXAS MEDICAL ASSOCIATION

[Find a Physician](#) | [Get Involved](#) | [Contact Us](#)

Browse by Delivery Type -

 Hello, **Guest** | [Sign in -](#) |  **0** Cart

[Home](#)

Registering for more than one person? A [TMA login](#) is required for each person you register.
 Need help? Contact the TMA Knowledge Center at (800) 880-7955.

Search Query ×

"nutrition"

Media Type

- On Demand Webinar 3
- Publication (PDF) 3

Category

- Clinical CME 3
- Communications 1
- Ethics 3
- Patient-Physician Relations 2
- Public Health 1

Credits

Minimum Credits

- AMA PRA Category 1 Credits™ (Enduring) 3
- ETHICS 3


Ratings

- ★★★★★ 3

Highest Price \$ 80

Sort By: Default

1.



Frontiers in Type 2 Diabetes: The Role of Nutrition in Health


Credits: 1 AMA PRA Category 1 Credits™ (Enduring); 1 ETHICS

Physicians are at the forefront of educating patients about metabolic disorders, and they have expressed a need for nutrition education. This course is designed to increase physicians' knowledge about nutrition and provide tools to help them educate and counsel their ... [Read More..](#)

Available As:
 Publication (PDF)
 On Demand Webinar

Starting at \$29.00 to \$79.00

★★★★★ (40)
2.




Stimulating Nutrition and Lifestyle-Focused Counseling With the Overweight Patient

Credits: 1 AMA PRA Category 1 Credits™ (Enduring); 1 ETHICS

Available As:
 Publication (PDF)
 On Demand Webinar

Starting at \$29.00 to \$79.00

★★★★★ (46)
3.



Innovation in Education for Cardiovascular Risk Patients: Heart Healthy Diet and Lifestyle

Credits: 1 AMA PRA Category 1 Credits™ (Enduring); 1 ETHICS

This activity educates participants about nutrition basics to prevent and manage

Starting at \$29.00 to \$79.00

★★★★★ (18)

Figure 6: Texas Medical Association Online Library Screen Capture



Physician Nutrition Education Program (PNEP) Logic Model

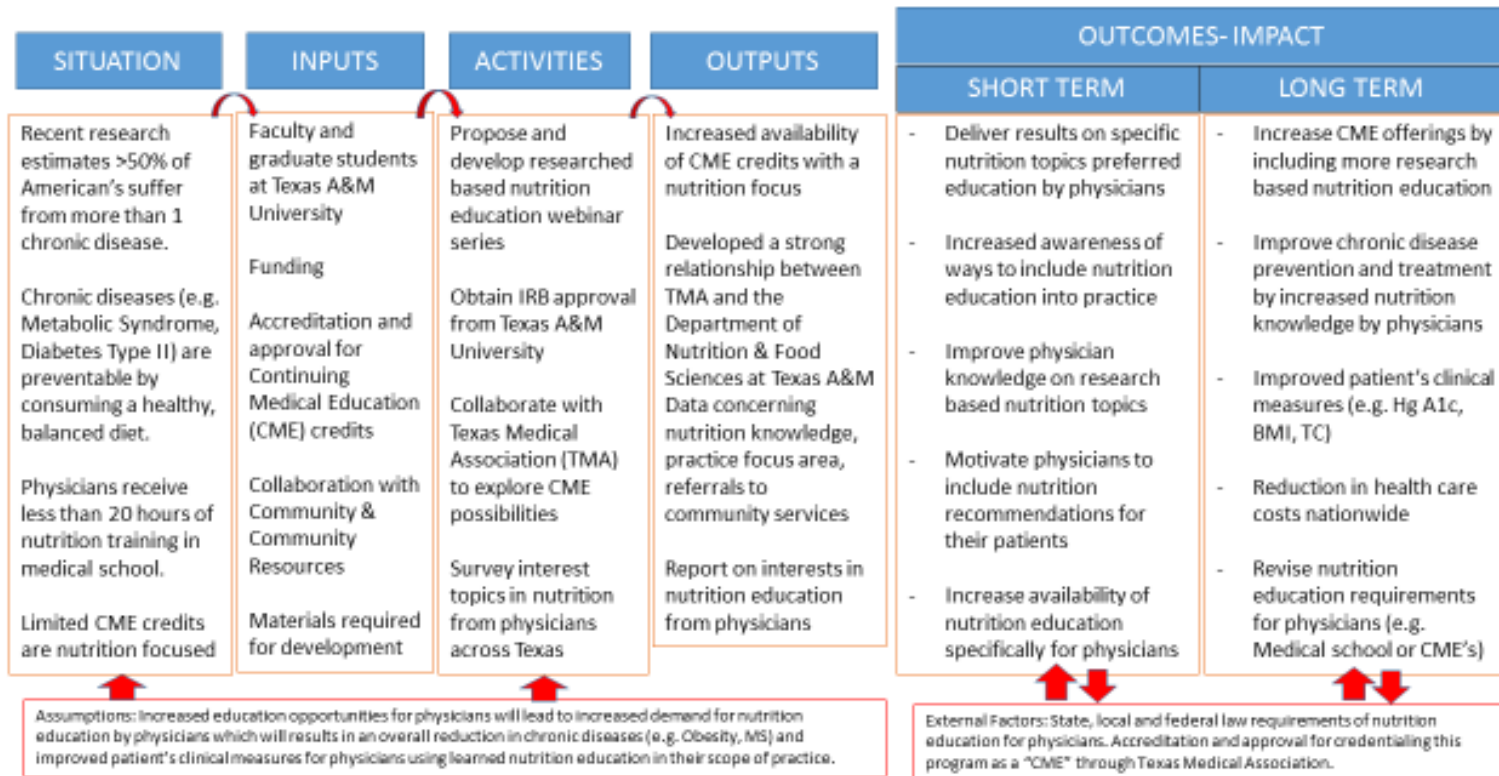


Figure 7: PNEP Logic Model

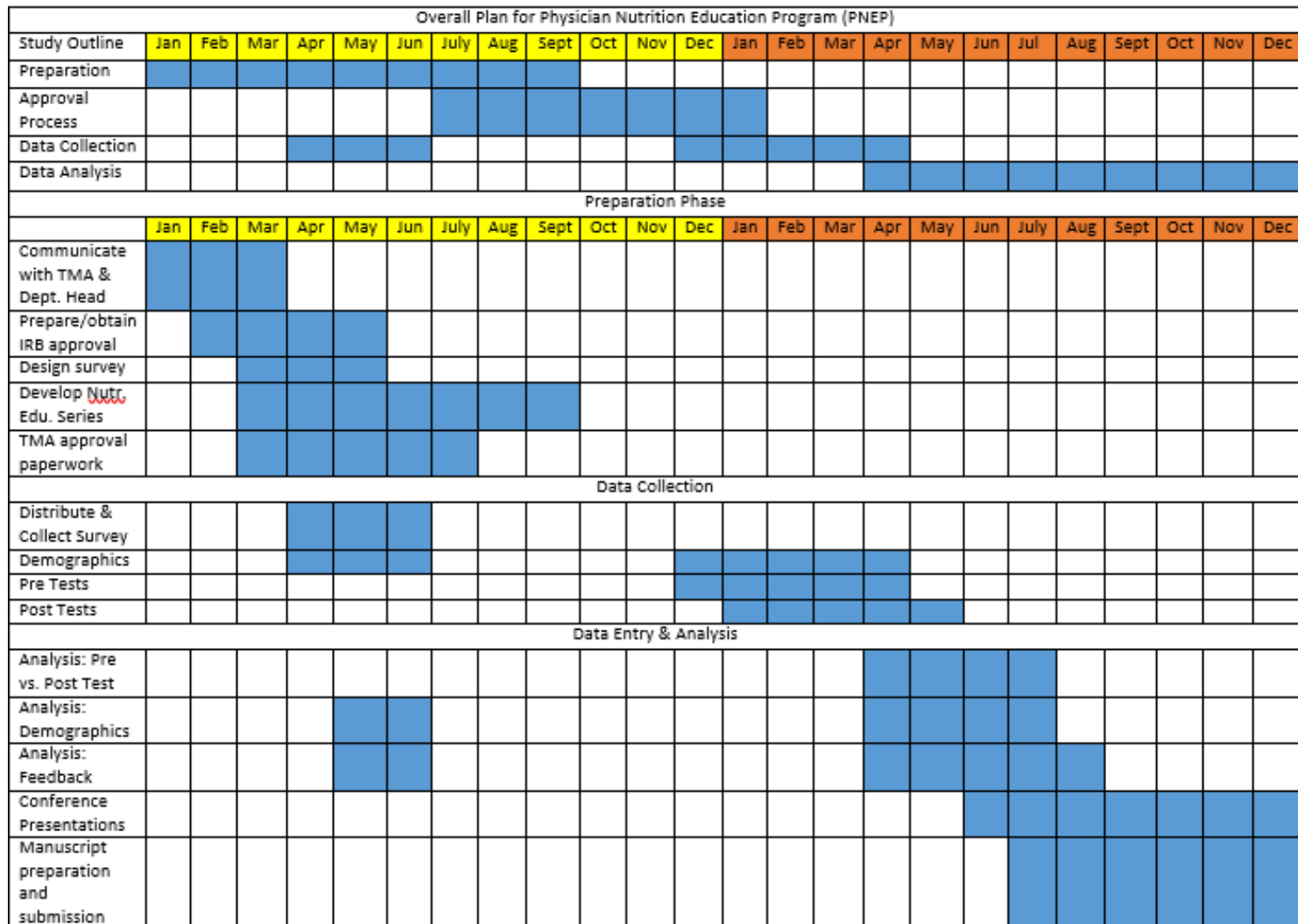


Figure 8: GANNT Chart