Cooking Up Health: A Novel Culinary Medicine and Service Learning Elective for Health Professional Students

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Abstract

Purpose: The current investigation assessed the feasibility, acceptability, and efficacy of the Cooking Up Health (CUH) culinary medicine elective that was offered to medical students at Northwestern University’s Feinberg School of Medicine. The elective included a combination of didactics, plant-based culinary sessions, and service learning, in which students translated nutrition and health connections to elementary school children in at-risk communities.

Method: Nine medical students enrolled in cohort 1 and 12 in cohort 2. Students completed assessments before and after the course measuring confidence in nutrition and obesity counseling, attitudes toward nutrition counseling, personal dietary intake, and cooking confidence and behaviors.

Results: The elective showed high feasibility and acceptability with strong class attendance (96%–99%) and retention (89%–100%). Over the course of the elective, students across both cohorts showed increased confidence in nutrition and obesity counseling ($p < 0.001$), cooking abilities ($p < 0.01$), and food preparation practices ($p < 0.04$). Cohort 1 reported decreased meat consumption ($p=0.045$), and cohort 2 showed increased fruit and vegetable intake ($p=0.04$). Finally, cohort 2 showed increased knowledge and confidence regarding consuming a plant-based diet ($p < 0.002$). Students reported an increased appreciation for the role of nutrition in health promotion and disease prevention and an intention to incorporate nutrition into patient care.

Conclusion: This study provided preliminary evidence demonstrating feasibility, acceptability, and efficacy of the CUH culinary medicine elective for increasing medical students’ confidence in nutrition and obesity counseling of patients and in their ability to use nutrition and cooking for personal self-care. Ultimately, this program of research may provide evidence to support widespread integration of CUH into medical education and has the potential to prepare medical students to properly advise patients on nutrition to combat the rising rates of obesity, diabetes, and preventable diseases related to nutrition.

Keywords: culinary medicine, nutrition education, obesity, behavior change, medical student well-being

Obesity is one of the most critical and challenging public issues and has been predicted to lead to a decline in life expectancy in the United States.1 A 2013 analysis of childhood obesity in Chicago revealed an overweight/obesity prevalence of 43.3% among public school students, which presents a tremendous opportunity to improve public health, since an estimated 90% of cardiovascular disease and diabetes and 70% of all cancers could be prevented with lifestyle
measures. There is growing recognition that solving the obesity epidemic and its downstream health consequences depends on preventative efforts at the individual, community, and public health level. Physicians are at the frontline of advising patients on nutrition; however, healthcare professionals report feeling ill-prepared to counsel patients on nutrition, and patients often lack the basic skills and confidence in making changes to their and their families’ diet. Only 29% of medical schools teach the recommended 25 h of nutrition, and fewer than 14% of practicing physicians feel adequately trained.

Food is being increasingly recognized as a core component of preventive and ameliorative healthcare. These findings highlight a need for attention to nutrition in medical school curriculum.

Nutrition education that includes culinary instruction is an emerging modality for health promotion in both adults and children. Awareness of the importance of culinary knowledge is reflected in the finding that a majority of the U.S. public supports requiring cooking education in schools. Consequently, leaders in dietetics have called for additional investment in cooking education to address the obesity crisis.

A specialized field of cooking education, culinary medicine, has been defined as the utilization of a unique combination of nutrition and culinary knowledge to assist patients in achieving and maintaining optimal health. At least 10 independent culinary medicine courses have been developed that include instruction for medical students. Several of these courses have been evaluated and found to increase medical students’ nutrition knowledge, healthy behaviors, and self-confidence in counseling patients. In addition, several culinary medicine courses have been offered to adults with nutrition-related chronic disease such as type 2 diabetes mellitus and hypertension. There is some evidence that the courses may improve nutritional and clinical outcomes in these patients. These data, while preliminary, are driving increasing interest in culinary medicine as a valuable adjunct to more conventional modalities of noncommunicable disease management.

Culinary medicine electives for medical students transmit both scientific knowledge and practical cooking skills. In addition, these courses may offer opportunities for medical students to participate in service learning, which combines service and learning in real-world situations. This is important because service learning and community service are identified as a standard for program accreditation by the Liaison Committee on Medical Education. Service learning has been linked to students developing attributes of altruism, more favorable academic outcomes, increased interpersonal and communication skills, improved clinical skills, and heightened understanding of community issues, which are critical for physicians to address complex public health problems such as obesity.

Culinary medicine courses in medical school may be most effective if they include elements of active and/or experiential learning. Active learning allows students to integrate knowledge into practical understanding through improved engagement in the curriculum. It provides students with the opportunity to practice and apply course material in a format that can be meaningful. Students learn more through active learning across classes of different sizes, levels, and subjects. Higher learning gains are possible when active learning is implemented. In addition, a recent meta-analysis has demonstrated that effective techniques for nutrition education include curriculum, cross curriculum, and experiential learning approaches. Active and experiential learning strategies can include 1-minute articles, case studies, coaching, team based problem solving, and hands on approaches. Across all levels of learning, instructors are utilizing new active teaching methods that can enhance critical thinking skills, participation, and understanding.

Overview of the Present Research

In the current investigation, the authors describe the development and pilot testing for the Cooking Up Health (CUH) culinary medicine elective that was offered to first and second year medical students at Northwestern University's Feinberg School of Medicine in 2017. This elective was developed and implemented jointly by the Osher Center for Integrative Medicine at the Feinberg School of Medicine at Northwestern University, and Common Threads, a non-profit organization that provides cooking and nutrition education to children and adults in underserved neighborhoods.

The first aim of the current investigation involves evaluating the feasibility and acceptability of the elective by examining class attendance rates, retention, and qualitative and quantitative feedback about the course. The secondary aim examines the preliminary efficacy of this elective in preparing medical students to counsel patients in successful behavior change around nutrition and cooking, as well as to improve medical students’ own cooking and nutrition confidence, attitudes, and behaviors. The authors hypothesized that students who participate in the CUH culinary medicine elective would show increased confidence in counseling patients in successful behavior change around nutrition and obesity, improved attitudes about the importance of nutrition counseling in patient care, increased confidence in their own cooking abilities and their ability to maintain a healthful diet, greater frequency in cooking home-cooked meals, improved overall diet, and an increase in positive attitudes toward cooking.

Methods

Curriculum development

The CUH curriculum development was an iterative process involving a multifaceted review, including that of existing nutrition curriculum at the Feinberg School of Medicine and other academic programs; recent scientific literature in the field of nutrition and disease; and cooking and nutrition curriculum for the lay public, including those created by Common Threads for families and children.

CUH curriculum

Approach. The CUH culinary medicine elective was developed to provide medical students with a knowledge base of diet, lifestyle, and nutrition and how they relate to disease. The didactic portion of the elective included a combination of lectures and readings related to nutrition and disease, as well as group meetings for interactive practice in counseling and motivational interviewing to promote healthy behaviors. Each class concluded with a hands-on chef-led culinary session on preparing plant-based meals along with a group dinner. Students utilized kitchen tools,
explored plant-based meals, practiced behavior change coaching regarding diet, and strategized ways to incorporate evidence-based health lifestyle approaches into both their personal life and medical practice. These patient-centered coaching exercises allowed students to practice skills with instructor feedback, which is an integral component of active learning as it identifies real-time ways to improve.20 Students also engaged in discussion around cultural competencies and nutrition, food access and advocacy, and ethical issues such as the role of media in consumer choice.

A distinguishing characteristic of the CUH curriculum was its emphasis on plant-based or plant-forward diets in the applied nutrition science, disease association research, and recipes included in the culinary preparation. This focus was chosen for several reasons as follows: an increasing preponderance of data supporting the benefit of plant-based diets in significantly reducing the incidence of, or risk factors for, cardiovascular disease, type 2 diabetes, and obesity; the medical faculty personal preference for this diet based on these health benefits and taste; and student feedback that those who personally followed plant-based diets would be uncomfortable with food preparation of animal meats.21–23

Learning component. The learning component of the culinary medicine elective consisted of six in-class sessions. Each session ran ~2.5 h, during which students learned information about relevant topics and gained hands-on experience in a kitchen. Table 1 summarizes the core content of each in-class session. The curriculum was designed for groups of 10–12 students, led by 1–2 faculty facilitators and a chef instructor. Each lesson focused on applied nutrition concepts and the practical application to disease prevention. Each lesson was composed of the following:

1. Applied nutrition science
2. Hands-on plant-based cooking in the kitchen
3. Prevention and management of disease with nutrition
4. Patient coaching
5. Exposure to cultural cuisines for cultural competency around food
6. Applied public health perspectives when working with diverse population

Topics included mindful eating, the Standard American Diet, the U.S. Department of Agriculture’s Dietary Guidelines for Americans 2015, understanding state of the science of macronutrients, the gut microbiome and impact of diet, food sensitivities, and inflammation as a precursor to chronic disease. Scientific literature underpinning each of these topics was presented in the form of journal articles, videos, and websites. Students were encouraged to continue to cook and eat mindfully outside of class. Students were engaged in conversation in between classes using a Facebook group page and Google Classroom. Students and faculty used these interactive forums to upload pictures of home-cooked meals, recipes, and tips.

Service component. Service learning was an integral and unique aspect of the CUH elective, as students apply the knowledge about nutrition, as well as cultural and socioeconomic factors related to food consumption, by visiting Chicago Public Schools (CPSs) to teach children. This service component of the elective capitalized on a

<table>
<thead>
<tr>
<th>Lesson component</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
<th>Five</th>
<th>Six</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied nutrition</td>
<td>Healthy diet and relationship to food</td>
<td>Carbohydrates, grains, sweeteners, glycemic index/load</td>
<td>Herbs and spices, plant proteins, fiber, dietary pre- and probiotics</td>
<td>Fats, sodium, potassium, nutrient content of food, environmental connection</td>
<td>Chronic inflammation</td>
<td>Nutrient content of food, environmental connection</td>
</tr>
<tr>
<td>Disease prevention with nutrition</td>
<td>Obesity</td>
<td>Diabetic</td>
<td>Obesity</td>
<td>Diabetes</td>
<td>Cardiovascular</td>
<td>Life cycle</td>
</tr>
<tr>
<td>Public health</td>
<td>Obesity epidemic</td>
<td>Motivational interviewing</td>
<td>Coaching</td>
<td>Environmental impact of dietary choices</td>
<td>Cultural competency in the community and classroom</td>
<td>Global cooking, bento boxes, cooking, healthy cooking, cooking techniques</td>
</tr>
<tr>
<td>Culinary skills</td>
<td>Mediterranean diet</td>
<td>Asian</td>
<td>Korean, Chinese, Thai</td>
<td>Italian, German, French, Mexican</td>
<td>Indian, Brazilian</td>
<td>Vietnamese, Indonesian, Thai</td>
</tr>
<tr>
<td>Cooking up health curriculum</td>
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</table>

Table 1. Cooking Up Health Curriculum

Service component. Service learning was an integral and unique aspect of the CUH elective, as students apply the knowledge about nutrition, as well as cultural and socioeconomic factors related to food consumption, by visiting Chicago Public Schools (CPSs) to teach children. This service component of the elective capitalized on a
partnership between the Osher Center and the non-profit organization Common Threads. Through this partnership, the medical students were able to apply their newly acquired knowledge by volunteering in established Common Threads programs to teach children about basic healthy nutrition concepts and easy hands-on food preparation. Medical students were expected to co-facilitate a minimum of four sessions of a grade school nutrition curriculum called “Small Bites” at a local Chicago Public School for elementary-school children.

### Table 2. Quantitative Course Evaluation Feedback at the Postclass Assessment

<table>
<thead>
<tr>
<th>Items</th>
<th>Cohort 1 (n=8, 89%)</th>
<th>Cohort 2 (n=12, 100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoyed taking this elective</td>
<td>6.57 (0.53)</td>
<td>6.67 (0.49)</td>
</tr>
<tr>
<td>I would recommend this course to others</td>
<td>6.43 (0.79)</td>
<td>6.25 (1.05)</td>
</tr>
<tr>
<td>I found the skills I learned from this course to be useful</td>
<td>6.43 (0.54)</td>
<td>6.17 (0.84)</td>
</tr>
<tr>
<td>I practice the skills I learned from this course regularly</td>
<td>6.14 (0.38)</td>
<td>6.33 (0.99)</td>
</tr>
<tr>
<td>This course has helped me as a medical student</td>
<td>6.29 (0.49)</td>
<td>6.08 (0.90)</td>
</tr>
<tr>
<td>This course has helped me as a person</td>
<td>6.29 (0.76)</td>
<td>6.42 (0.67)</td>
</tr>
<tr>
<td>This course has changed my attitude about medicine and healthcare</td>
<td>5.57 (1.27)</td>
<td>5.42 (1.38)</td>
</tr>
<tr>
<td>I have incorporated the skills they learned from this elective into my work</td>
<td>5.43 (0.98)</td>
<td>6.67 (0.49)</td>
</tr>
<tr>
<td>I plan to incorporate the skills I learned from this course into my future career</td>
<td>6.00 (0.58)</td>
<td>6.75 (0.45)</td>
</tr>
</tbody>
</table>

The response scale for all items ranged from 1 (Strongly Disagree) to 7 (Strongly Agree).

### Table 3. Qualitative Course Evaluation Feedback: Example Responses for Each Prompt

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Cohort 1</th>
<th>Cohort 2</th>
</tr>
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<tbody>
<tr>
<td>(1) Has this course helped you as a medical student and as a person?</td>
<td>Yes, this course has given me valuable insight into how nutrition plays a vital role across all different disease pathologies and that there is a systemic improvement with a healthier diet. As a person, I will use these skills to improve the health quality of my own life, as well as learn how to cook for myself, and potentially for others in the future</td>
<td>Absolutely! There are a host of challenges that medical students face. Beyond the academic barriers, there are also the lifestyle changes that come with this transition into adulthood. Equipping myself with nutritional knowledge and kitchen skills will not only enable me to connect with my patients who struggle with these issues but also they will translate to me incorporating this into my own life.</td>
</tr>
<tr>
<td>(2) Has this course changed your attitude toward medicine and healthcare?</td>
<td>The course has made me see how important and effective nutrition counseling can be as a part of primary prevention care. I hope that I will not simply prescribe medications but also work hard to help patients make beneficial lifestyle changes</td>
<td>I’ve become aware of the disproportionately minuscule amount of time that is dedicated toward nutritional counseling in our healthcare setting. This course has reinforced the importance of applying preventative approaches through patient education.</td>
</tr>
<tr>
<td>(3) How do you see yourself integrating, if at all, any of the skills from class into your work with patients (or your career plans)?</td>
<td>I hope that I can use what I’ve learned to effectively educate my patients about the health effects of different foods and the benefits of a plant-based diet. I also think the tools I’ve gained from this course will allow me to make specific concrete recommendations to my patients when it comes to nutrition counseling.</td>
<td>Putting nutrition theory to practice in counseling patients—I feel a lot more confident in doing this. I emerged from this class with a mental toolkit for how I approach dietary strategies for various diseases (e.g., HTN, HF, CAD, GI inflammatory disease)</td>
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<tr>
<td>(4) What were your favorite aspects of the class?</td>
<td>My favorite aspects of the class included hands-on learning through cooking, having a specific diet topic to discuss each week (e.g., fat, sugar, inflammation, and so on), and teaching nutrition to children at Jenner Elementary School!</td>
<td>The kids I met at the middle school—I can tell they really appreciate learning new stuff about preventing diseases down the road, especially because they knew many of these diseases so personally (e.g., HF, DM2)</td>
</tr>
<tr>
<td>(5) What aspects of the class do you think could be improved</td>
<td>The lecture portion could be shortened, and more activities could be planned to learn the information. Making the class material more accessible by putting it online would be very helpful! Integrating the Jenner Elementary component throughout the course, rather than all at the end</td>
<td>Maybe talk about healthier ways to eat meat since not all patients will go for a recommendation of dropping it altogether.</td>
</tr>
</tbody>
</table>

CAD, coronary artery disease; DM2, diabetes mellitus type 2; GI, gastrointestinal; HF, heart failure; HTN, hypertension.
Through the combination of these complementary learning and service components, medical students learned basic culinary skills; steps to create nutritious and palatable plant-based meals; relationships between food, health, and disease; and cultural competencies around nutrition. The participants also got real-world experience using health coaching and teaching skills during both culinary and community class times (Table 1).

Evaluation

A single group, pre–post, nonexperimental pilot design was used to test the feasibility, acceptability, and preliminary efficacy of the first two cohorts of the CUH elective. In cohort 1, the structure of the course was such that students first completed the in-class learning component (six in-class didactic sessions) and, subsequently, completed the service component in the CPS classrooms after the last in-class learning component.

Based on student feedback (see Table 3), the structure of the course was modified for cohort 2, such that the didactics were removed from the actual meeting time, and shifted to a series of 3–8 min videos students watched before class. In-person time was devoted to simulated patient coaching, student-led research discussions, and culinary sessions in the kitchen. Preparation for each class included videos, article review, and assignments totaled 60–90 min for cohort 2. In addition, the in-class learning component and the service component were completed concurrently in cohort 2. As such, students in cohort 1 completed assessments administered at three time points as follows: (1) the beginning of the elective (precourse assessment), (2) the end of the in-class learning component (postclass assessment), and (3) the end of the service component (postservice assessment), and students in cohort 2 completed assessments administered at two time points as follows: (1) the beginning of the elective (precourse assessment) and (2) the end of the elective (postcourse assessment).

The questionnaires for both cohorts assessed students’ confidence in counseling patients about nutrition and obesity, attitudes toward nutrition counseling in patient care, confidence in their own cooking abilities and ability to eat a healthy diet, their actual cooking and healthful eating behaviors, and their dietary intake (see Measures section below). In this study, the authors focus on the outcome measures that were most relevant for the current research. The authors collected additional measures that are listed below. In this study, the authors focus on the outcome measures that were most relevant for the current research. The authors collected additional measures that are listed below.

In the postclass and postservice assessments, students also completed feedback regarding the acceptability of the course (e.g., their enjoyment of the course and how much they incorporated the skills from the course into their daily lives) (see Acceptability section below). All assessments were administered online using the Qualtrics survey software for online data collection and management. Qualtrics is a secure, HIPAA compliant web-based application designed to support data collection and management for research studies. The procedures were approved by the Institutional Review Board at Northwestern University, and all participants provided informed consent.

Measures

Acceptability

Quantitative. At all follow-up assessments (cohort 1: postclass assessment and postservice assessment, cohort 2: precourse assessment), students provided quantitative and qualitative feedback about their personal experience with the course and their plans for continued practice of the skills. Specifically, for the quantitative feedback, participants indicated their agreement to the following statements on a scale from 1 (Strongly Disagree) to 7 (Strongly Agree): (1) I enjoyed taking this elective, (2) I would recommend this course to others, (3) I found the skills I learned from this course to be useful, (4) I practice the skills I learned from this course regularly, (5) This course has helped me as a medical student, (6) This course has helped me as a person, (7) This course has changed my attitude about medicine and healthcare, (8) I have incorporated the skills I learned from this elective into my work, and (9) I plan to incorporate the skills I learned from this course into my future career.

Qualitative. Participants provided open-ended responses to the following prompts: (1) Has this course helped you as a medical student and as a person? If so, how? (2) Has this course changed your attitude toward medicine and healthcare? If so, how? (3) How do you see yourself integrating, if at all, any of the skills from class into your work with patients (or your career plans)? (4) What were your favorite aspects of the class? and (5) What aspects of the class do you think could be improved? Results were tabulated verbatim, and for each prompt, the most common themes were noted, and then an exemplary quote was chosen for presentation that best captured the most common themes.

Nutrition counseling

Perceived competency in providing basic nutrition education (cohort 1 and 2). Medical students’ perceived competency in providing basic nutrition education was assessed using the measure used by Connor and colleagues. In this scale, medical students were given a list of 10 nutrition topics based on the Dietary Guidelines for Americans and were asked to indicate their competence providing basic nutrition education on each topic using the following scale: “yes, I feel competent,” “no, I do not feel competent,” or “unable to assess competency.” The nutrition topics (based on the Dietary Guidelines for Americans) included: “Replacing unhealthy fats with healthier fats” and “Increasing vegetable intake.”

Perceived confidence in obesity counseling (cohort 1 and 2). Medical students’ perceived confidence in obesity counseling was assessed using the Perceived Competency in Obesity Counseling Scale (PCOC) (cohort 1: α = 0.89; cohort 2: α = 0.91). The PCOC has been shown to have good internal consistency and validity in prior samples of resident physicians. This 18-item scale assessed students’ confidence in implementing the “5A’s”: (1) Assessing obesity risk and motivation to change, (2) Advising lifestyle change, (3) Agreeing with the patient on collaboratively setting goals, (4) Assisting and addressing barriers and resources, and (5) Arranging for follow-up. Participants reported their
confidence in each activity using the following scale: 1 (Not at all Confident) to 5 (Extremely Confident). Sample items include: “I can personalize healthy lifestyle advice for each patient I see” and “I can work with my patient to select specific strategies to lose weight.”

Attitudes toward nutrition in patient care (cohort 1 and 2). Medical students’ attitudes in counseling patients on nutrition were assessed using items from the Nutrition in Patient Care Survey (NIPS). Acceptable psychometric properties have been demonstrated for the NIPS in prior samples of medical students and residents, including good internal consistency and stability (test–retest reliability). The original scale is 45 items. Given time constraints, the authors excluded the 20-item clinical behavior subscale from the NIPS that asked respondents to rate the importance of engaging in various types of clinical behavior related to diet and nutrition. The authors excluded this subscale, because the authors expected that there would be limited variance for this sample (i.e., medical students who opted to take part in a culinary medicine elective) in their ratings of how important it would be to engage in various clinical behaviors related to diet and nutrition. That is, the authors expected that there would likely be a ceiling effect in this sample, such that most students would rate these types of clinical behaviors to be important in medicine. Instead, the authors included the remaining 25 items in the NIPS that focused on respondents’ attitudes toward the role of nutrition in routine patient care (eight items; cohort 1: \( \alpha > 0.44 \); cohort 2: \( \alpha > 0.60 \)), the role of the physician–patient relationship in changing a patient’s diet (eight items; cohort 1: \( \alpha > 0.06 \); cohort 2: \( \alpha > 0.69 \)), the role of patient behavior and motivation in changing their own diet (three items; cohort 1: \( \alpha > 0.85 \); cohort 2: \( \alpha > 0.86 \)), and physician efficacy in changing a patient’s diet (six items; cohort 1: \( \alpha > 0.60 \); cohort 2: \( \alpha > 0.60 \)). Sample items include the following: “Physicians can have an effect on a patient’s dietary behavior if they take the time to discuss the problem” and “Specific advice about how to make dietary changes could help some patients improve their eating habits.” Participants reported their agreement with each item using the following scale: 1 (Strongly Disagree) to 5 (Strongly Agree).

Cooking attitudes, confidence, and behaviors

Cooking and nutrition confidence, attitudes, and behaviors (cohort 1: full measure, cohort 2: cooking attitudes subscale only). Cooking and nutrition confidence, attitudes, and behaviors were assessed using the Cooking with the Chef Evaluation Instrument. The Cooking with the Chef Evaluation Instrument is a 56-item instrument that has been found to demonstrate acceptable psychometric properties, including reasonable stability (test–retest reliability) and validity in samples of parents, caregivers, and cooks. This instrument assesses respondents’ cooking confidence (cohort 1: \( \alpha > 0.67 \); 17 items: e.g., “How confident do you feel about using knife skills in the kitchen”), cooking attitudes (cohort 1: \( \alpha > 0.40 \); cohort 2: \( \alpha > 0.64 \); 7 items: e.g., “I do NOT like to cook because it takes too much time”), and cooking behaviors (cohort 1: \( \alpha > 0.52 \); 10 items: e.g., “How often did you prepare meals from basic ingredients (such as whole fresh produce).” In addition, the instrument assesses respondents’ nutrition confidence and behaviors by assessing respondents’ confidence in incorporating fruits and vegetables into diet (cohort 1: \( \alpha > 0.53 \); four items: e.g., “How confident do you feel about eating the recommended 9 half cup serving of fruits and vegetables daily), as well as whether respondents keep fruits and vegetables in the home (eight items: e.g., “Did you have raw or cooked vegetables in your home last week?”). The authors modified the original instrument to be consistent with the skills and lessons taught in their CUH elective. Specifically the authors removed one item from the cooking confidence subscale that focused on respondents’ confidence in using the microwave and the authors removed two items from the cooking behaviors subscale that were focused on reheating leftovers, because the authors did not consider reheating/microwaving to be consistent with the cooking skills that were taught in the elective. In addition, the authors removed two items that focused on keeping fruit juice in the home from the “keeping fruits and vegetables in the home” subscale, because the authors did not consider fruit juice to be consistent with the diet emphasized in the elective. Finally, the authors added “cooking with oils (e.g., olive oil)” as an additional item in the cooking confidence subscale, because the elective emphasized the ability to cook using oils (e.g., making homemade salad dressing). In cohort 1, the authors used the full measure, whereas in cohort 2 the authors only included the cooking attitudes subscale (seven items).

Cooking and Food Skills Measure (cohort 2 only). In cohort 2, confidence and engagement in cooking and food skills were assessed using the Cooking and Food Skills Measure which has been shown to predict saturated fat intake and fiber intake in adults. The Cooking and Food Skills Measure has demonstrated satisfactory reliability, validity, and temporal stability in prior samples of students and in a nationally representative sample. The Cooking and Food Skills Measure is a 33-item measure that assesses whether respondents engage in a variety of cooking behaviors (cohort 2: \( \alpha > 0.81 \); 14 items: e.g., “roast/bake food in the oven”; “fry/stir-fry food in a frying pan”) and food practices related to planning and preparing meals at home (cohort 2: \( \alpha > 0.89 \); 19 items: e.g., “plan meals ahead,” “prepare or cook a healthy meal with only a few ingredients on hand”) and their confidence in engaging in each of the cooking behaviors and food practices.

Dietary intake

Dietary intake: frequency of consuming various foods (cohorts 1 and 2). Dietary intake was assessed using the PrimeScreen Dietary Screening Tool. The PrimeScreen Dietary Screening Tool is a 17-item questionnaire that assesses the frequency that respondents consume various foods (e.g., dark leafy vegetables and meat). The PrimeScreen has been shown to have adequate reproducibility and comparability in studies of participants from the general population. In cohort 1, participants responded to the questionnaire using the original scale: 0 = never, 1 = less than once per week, 2 = once per week, 3 = 2–4 times per week, 4 = nearly daily or daily, and 5 = twice or more daily. In cohort 2, the authors modified the scale for clarity as follows: 0 = never/rarely, 1 = 1–3 times a month, 2 = 1–4 times a
week, 3 = daily/almost daily, and 4 = twice or more daily. The authors grouped participants’ dietary intake into the following categories: (1) fruits and vegetables (cohort 1: zs >0.59; cohort 2: zs >0.17), (2) meat (cohort 1: zs >0.53; cohort 2: zs >0.59), (3) whole grains (single item), (4) dairy (single item), and (5) baked goods (single item). In cohort 2, the authors added an additional category: (6) plant-based protein (described below; cohort 1: zs >0.40; cohort 2: zs >0.73).

The authors modified the original measure developed by Rifas-Shiman and colleagues to be consistent with the goals of the present research investigation. First, the authors removed two items from the original scale that were focused on taking vitamins and supplements, as the authors did not consider these questions to be pertinent to their research question at hand. Second, the authors added the following items to the measure, “poultry (chicken, turkey, duck)” in cohort 1 and “seafood (fish, shrimp, mussels)” in cohort 2, because the original measure only assessed the consumption of red meat (i.e., “beef, pork, or lamb as a main dish” and “processed meats (sausages, salami, bologna, hot dogs, bacon)” as indicators of meat consumption. In addition, in cohort 2, the authors added items from Lea et al. to better capture participants’ plant-based protein intake.31 Specifically, the authors included the following three items to the questionnaire as a new plant-based protein category: “nuts (almonds, walnuts, hazelnuts, pecans),” “seeds (sunflower, pumpkin, chia, flax, hemp, sesame),” and “legumes (beans, chickpeas, lentils, soybeans).” Moreover, in cohort 2, the authors added the following two questions from Lea et al. to capture the number of servings of fruits and vegetables that participants were consuming, in addition to their frequency of consumption: “How many servings of fruit do you usually eat each day? (1 serving = 1 medium piece of fruit such as an apple; 2 small fruits such as plums; 1 cup of diced fruit; or 4–6 pieces of dried fruit. Please do not count fruit juice)” and “How many servings of vegetables do you usually eat each day? (1 serving = 1/2 cup cooked vegetables or 1 cup of fresh vegetables. Please do not count fried vegetables, such as potato chips or fries)” (cohort 2: zs >0.65). Third, the authors changed the time frame of the measure: While the original measure asked respondents to indicate the frequency they consumed each item “during the past year,” the authors asked respondents to indicate the frequency they consumed each item “during the past month” so that the authors could get a more sensitive assessment of potential changes in respondents’ diet as a function of participating in the elective.

Knowledge and confidence about eating a plant-based diet (cohort 2 only). In cohort 2, the authors added questions that assessed respondents’ knowledge about plant-based diets and their confidence in their ability to prepare plant-based meals. Specifically, the authors assessed respondents’ knowledge about plant-based diets using the following single item questions: “How much knowledge do you currently have about substituting animal-based proteins with plant-based proteins in your diet?” Participants responded using the following scale: 1 = not at all, 2 = a little, 3 = a moderate amount, 4 = a lot, and 5 = a great deal. In addition, the authors assessed participants’ confidence in preparing plant-based meals using the following single item questions: “How confident do you feel in your ability to prepare plant-based meals?” and “How confident do you feel in your ability to substitute animal-based proteins with plant-based proteins in your diet?” Participants responded using the following scale: 1 = not at all confident, 2 = slightly confident, 3 = moderately confident, 4 = very confident, and 5 = extremely confident.

Statistical analyses

Data analysis was conducted using SPSS Version 23 (IBM Corp., Armonk, NY). To examine whether students showed changes over time in their preliminary efficacy outcomes as a function of participating in the elective, the authors conducted repeated-measures analysis of variance (ANOVA) models on the preliminary efficacy outcome measures with time point as a within-subject factor. To control for multiple comparisons in the ANOVAs, Bonferroni corrections were applied to the post hoc comparison tests. The authors report the means and standard deviations of participants’ scores on each preliminary efficacy outcome, including the possible ranges of each scale, in Tables 4 and 5. Cohen’s $d$ effect sizes were calculated to illustrate the magnitude of change in preliminary efficacy outcomes over time.

Results

Participants

Nine first-year medical students were enrolled in cohort 1 (6 women, 3 men; $M_{age} = 22.44$, $SD = 0.88$, age range: 21–24 years), and 12 medical students were enrolled in cohort 2 (8 women, 4 men; $M_{age} = 22.08$, $SD = 1.08$, age range: 20–24 years).

Feasibility

Retention was high across both cohorts: 89% of the students in cohort 1 were retained through the postcourse follow-up assessments, whereas 100% of the students in cohort 2 were retained through the postcourse follow-up assessment. Moreover, rates of class attendance were high: 96% of students attended each class in cohort 1, and 99% of students attended each class in cohort 2. The reasons for missing class were due to illness. Moreover, attendance for the service component was 100% across both cohorts.

Acceptability

Quantitative feedback. As seen in Table 2, students across both cohorts reported high enjoyment of the course and strongly agreed that they would recommend the course to others ($M = 6.25$ to 6.67 out of 7, ranges: 4 to 7). Moreover, students strongly agreed that they found the skills they learned from this course to be useful and that they practiced the skills from the course regularly ($M = 6.14$ to 6.43 out of 7, ranges: 4 to 7). Moreover, students showed strong agreement that the course helped them both as medical students and as people more generally ($M = 6.08$ to 6.42 out of 7, ranges: 5 to 7). Students also indicated moderate agreement that the course changed their attitude about medicine and healthcare ($M = 5.42$ to 6.42 out of 7, ranges: 3 to 7). Finally, students indicated moderate to high agreement that they have incorporated the skills they learned from this
elective into their work (M = 5.43 to 6.67 out of 7, ranges: 4 to 7) and showed strong agreement for incorporating the skills from the elective into their future career (M = 6.00 to 6.75 out of 7, ranges: 5 to 7).

Qualitative feedback. Complementing the quantitative feedback about the course, the qualitative feedback also indicated high acceptability of the course. See Table 3 for example of responses for each prompt that represents common themes. Taken together, both the quantitative and qualitative feedback from students regarding the elective suggested that the elective was highly acceptable: Students reported enjoying the course and indicated that they planned to incorporate what they learned from the course into their future work with patients.

Preliminary efficacy outcomes

Nutrition counseling. As seen in Table 4, participation in the CUH elective was associated with increased confidence in basic nutrition counseling and obesity counseling over the course of the elective for students in both cohorts 1 and 2 (ps < 0.001), and their effect sizes were large (ds > 3.00). Post hoc comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that students in cohort 1 showed statistically significant increases in confidence from the precourse assessment to the postclass and postservice assessments for both basic nutrition counseling and obesity counseling, ps < 0.007. Students in cohort 1 did not show additional increases in confidence from the postclass to the postservice assessment for either basic nutrition counseling or obesity counseling, ps > 0.35. In addition, students in cohort 1 showed more positive attitudes about the importance of nutrition counseling in patient care over time (p = 0.003), and the effect size was large (d = 2.53). Specifically, post hoc comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant improvements in their attitudes toward the importance of nutrition counseling for patient care from the precourse assessment to both the postclass and postservice assessments, ps < 0.05. Students in cohort 1 did not show additional improvements in their attitudes from the postclass to the postservice assessment, p = 0.11. Students in cohort 2 did not show
improvements over time in their attitudes about the importance of nutrition counseling in patient care \((p = 0.32; d = 0.63)\).

**Cooking confidence, attitudes, and behaviors.** As seen in Table 4, participation in the **CUH** elective was associated with increased confidence in one’s cooking abilities over time for students in both cohorts 1 and 2 \((p < 0.01)\), and their effect sizes were large \((d > 1.70)\). **Post hoc** comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant increases in their cooking confidence from the precourse assessment to both the postcourse and postservice assessments, \(p < 0.02\). Students in cohort 1 did not show additional improvements in their cooking confidence from the postclass to the postservice assessment, \(p = 0.81\).

Moreover, students in cohort 1 showed a marginally significant trend suggesting more positive attitudes toward cooking over time \((p = 0.07)\), and the effect size was large \((d = 1.38)\). Specifically, **post hoc** comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant improvements in their attitudes toward cooking from the precourse assessment to the postclass assessment, \(p = 0.03\); however, these improvements were not sustained past the postclass assessment. Specifically, students’ cooking attitudes worsened from the postclass to the postservice assessment, \(p = 0.06\), such that their cooking attitudes at the postservice assessment did not differ from baseline levels, \(p = 0.63\). Students in cohort 2 did not show improvements over time in their attitudes toward cooking \((p = 0.16, d = 0.90)\).

Even though students in cohort 1 showed increased confidence in their cooking abilities and a trend toward more positive attitudes toward cooking over time, the authors did not find parallel changes over the course of the elective in their actual cooking behavior \((p = 0.32; d = 0.84)\).

Similarly, students in cohort 1 showed increased confidence in their ability to incorporate fruits and vegetables into their diet over time \((p = 0.001)\), and the effect size was large \((d = 2.61)\). **Post hoc** comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant increases in their confidence in their ability to incorporate fruits and vegetables into their diet from the precourse assessment to both the postcourse and postservice assessments, \(p = 0.005\). Students in cohort 1 did not show additional improvements in their cooking in their ability to incorporate fruits and vegetables into their diet from the postclass to the postservice assessment, \(p = 0.67\).

The authors did not find parallel changes over the course of the elective in the likelihood that students would actually

### Table 5. Preliminary Efficacy: Change from Baseline to the Postclass Follow-Up Assessments — Self-Reported Dietary Intake

<table>
<thead>
<tr>
<th></th>
<th><strong>Cohort 1</strong></th>
<th></th>
<th><strong>Cohort 2</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Baseline</strong></td>
<td><strong>Postclass</strong></td>
<td><strong>Postservice</strong></td>
<td><strong>Baseline</strong></td>
</tr>
<tr>
<td></td>
<td>((n = 9, 100%))\</td>
<td>((n = 8, 100%))\</td>
<td>((n = 10, 100%))\</td>
<td>((n = 12, 100%))\</td>
</tr>
<tr>
<td><strong>Frequency of eating (0 to 4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>3.00 (0.76)</td>
<td>3.13 (0.67)</td>
<td>3.25 (0.71)</td>
<td>0.58</td>
</tr>
<tr>
<td>Meat</td>
<td>1.67 (0.28)</td>
<td>1.29 (0.18)</td>
<td>1.54 (0.20)</td>
<td>3.90</td>
</tr>
<tr>
<td>Whole grains</td>
<td>3.25 (1.28)</td>
<td>3.88 (0.64)</td>
<td>3.25 (1.28)</td>
<td>1.16</td>
</tr>
<tr>
<td>Dairy</td>
<td>2.38 (1.51)</td>
<td>1.88 (1.25)</td>
<td>2.25 (1.49)</td>
<td>0.79</td>
</tr>
<tr>
<td>Baked goods</td>
<td>2.25 (0.89)</td>
<td>2.00 (0.76)</td>
<td>1.88 (0.83)</td>
<td>0.43</td>
</tr>
<tr>
<td>Plant-based proteins</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Serving # per days:**

<table>
<thead>
<tr>
<th></th>
<th><strong>Cohort 1</strong></th>
<th></th>
<th><strong>Cohort 2</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Baseline</strong></td>
<td><strong>Postclass</strong></td>
<td><strong>Postservice</strong></td>
<td><strong>Baseline</strong></td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Plant-based diet ((1 to 5))</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge about plant-based diets</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Confidence in preparing plant-based meals</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Knowledge about substituting animal protein with plant-based protein</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Confidence about substituting animal protein with plant-based protein</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

\(p\)-values for within-group comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant increases in their cooking confidence from the precourse assessment to both the postcourse and postservice assessments, \(p < 0.02\). Students in cohort 1 did not show additional improvements in their cooking confidence from the postclass to the postservice assessment, \(p = 0.81\).

Moreover, students in cohort 1 showed a marginally significant trend suggesting more positive attitudes toward cooking over time \((p = 0.07)\), and the effect size was large \((d = 1.38)\). Specifically, **post hoc** comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant improvements in their attitudes toward cooking from the precourse assessment to the postclass assessment, \(p = 0.03\); however, these improvements were not sustained past the postclass assessment. Specifically, students’ cooking attitudes worsened from the postclass to the postservice assessment, \(p = 0.06\), such that their cooking attitudes at the postservice assessment did not differ from baseline levels, \(p = 0.63\). Students in cohort 2 did not show improvements over time in their attitudes toward cooking \((p = 0.16, d = 0.90)\).

Even though students in cohort 1 showed increased confidence in their cooking abilities and a trend toward more positive attitudes toward cooking over time, the authors did not find parallel changes over the course of the elective in their actual cooking behavior \((p = 0.32; d = 0.84)\).

Similarly, students in cohort 1 showed increased confidence in their ability to incorporate fruits and vegetables into their diet over time \((p = 0.001)\), and the effect size was large \((d = 2.61)\). **Post hoc** comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant increases in their confidence in their ability to incorporate fruits and vegetables into their diet from the precourse assessment to both the postcourse and postservice assessments, \(p = 0.005\). Students in cohort 1 did not show additional improvements in their cooking in their ability to incorporate fruits and vegetables into their diet from the postclass to the postservice assessment, \(p = 0.67\).

The authors did not find parallel changes over the course of the elective in the likelihood that students would actually
keep fruits and vegetables in the home \((p=0.39; d=0.74)\). Nevertheless, students in cohort 2 showed increased confidence in planning and preparing meals at home \((p=0.04)\), and the effect size was large \((d=1.84)\).

**Dietary intake.** As seen in Table 5, participation in the C Uh elective was associated with decreased meat consumption over time for students in cohort 1 \((p=0.045)\), and the effect size was large \((ds=1.49)\). Post hoc comparison tests (with a Bonferroni correction applied for multiple comparisons) revealed that in cohort 1, students showed statistically significant decreases in their meat consumption from the precourse assessment to the postcourse assessment, \(p=0.026\); however, these improvements were not sustained past the postclass assessment. Specifically, students’ meat consumption increased from the postclass to the postservice assessment, \(p=0.08\), such that their meat consumption at the postservice assessment did not differ from baseline levels, \(p=0.44\).

Students in cohort 2 also showed decreased meat consumption over time \((p=0.08)\), although the effect was only marginal in statistical significance. The effect size for the magnitude of change in meat consumption over time for students in cohort 2 was large \((d=1.55)\).

Students across both cohorts did not show changes in their frequency of consuming the other food categories, including: fruit and vegetables, whole grains, dairy, baked goods, and plant-based proteins \((all ps<0.17; ds<1.00)\). Nevertheless, the authors found that students in cohort 2 increased the number of servings of fruits and vegetables they consumed over the course of the elective \((p=0.04)\), and the effect size was large \((d=1.40)\).

**Knowledge and confidence about eating a plant-based diet.** As seen in Table 5, students in cohort 2 showed increased knowledge about plant-based diets, increased confidence in preparing plant-based meals, and increased knowledge and confidence in substituting animal protein with plant-based protein over the course of the elective \((all ps<0.002)\), and their effect sizes were large \((all ds>2.35)\).

**Discussion**

The current research provides preliminary evidence demonstrating the feasibility, acceptability, and efficacy of the C Uh culinary medicine elective. The elective showed high feasibility across two cohorts as follows: Rates of class attendance was high \((96\%–99\%)\), and retention was high \((89\%–100\%)\). In addition, student evaluations of the course indicated that the course was highly acceptable: Students reported enjoying the course and indicated that they would recommend the course to others. Moreover, students indicated that they found the skills learned from the course to be useful and that they planned to continue to incorporate what they learned from the course into their future work with patients.

The authors found preliminary evidence suggesting that the elective shows promise in increasing medical students’ comfort and confidence in nutrition and obesity counseling, improving medical students’ attitudes toward the importance of nutrition counseling in patient care, and increasing medical students’ own confidence in their cooking abilities. Interestingly, the effect of participating in C Uh on attitudes toward nutrition counseling was significant for cohort 1 but not cohort 2. It is not clear if this is an artifact of the larger number of repeated measures for cohort 1 or some other difference between the two cohorts. In addition, participation in the C Uh course was associated with improved health behaviors in medical students. Participation in the C Uh elective was associated with decreased meat consumption over the course of the elective for students in both cohorts 1 and 2 (although the effects in cohort 2 were only marginal in statistical significance). Cohort 2 also exhibited significant increases in the number of servings of fruits and vegetables consumed daily, although participation in the C Uh course was not associated with frequency of eating fruits and vegetables in either cohort. This difference could be a result of refinements in instrument measures to better capture student behaviors, including more specific questions related to the plant-based focus of the C Uh elective. The significant effects of the course on attitudes about healthy eating, cooking confidence, and dietary behaviors are especially notable, given the demands of medical school on students’ time. Participation in the course did not affect cooking attitudes or availability of fruits and vegetables in their home.

This may be due to students’ busy schedules and constraints on time at home; medical students consume many meals away from home. It would be of interest to explore increased awareness of healthy options when eating away from home. Alternatively, the time elapsed between pre- and postsurvey may have been too short for these young students to fully integrate cooking behaviors into their lives. Prior studies of curriculum impact on medical student health behaviors have noted that students most frequently reported barriers to achieving their health behavior goals as being too busy studying, finding it hard to change routine, being too busy in general, being sick or injured, setting expectations too high, and being too stressed.

The current results are consistent with those reported for another culinary medicine course suggesting that culinary medicine electives are broadly effective at increasing fruit and vegetable intake and competency in nutrition counseling in diverse settings and student populations. The current results go beyond the previous findings by showing that participation in C Uh decreased meat consumption in participants.

Strengths of the C Uh elective and the initial reported impact include the strong academic-community partnership between the Osher Center for Integrative Medicine and Common Threads. The partners provided unique and complementary skills which informed the curriculum development, methods of instruction, and importance of including public and community health issues. In addition, Feinberg School of Medical students and CPS principals and teachers were included in the initial need assessments and again after the first course implementation, with responsive changes made to address suggested improvements. The shift to a flipped classroom and active learning model was associated with improved student satisfaction. Feedback also led to a shift in the age of the CPS children taught during the service learning and a shift to a more open conversation between the grade school and medical school students about health and disease in relation to food and discourse about the path to becoming a doctor or other health professional.

Limitations of the current study include the small sample size; that students self-selected to enroll in the elective; the
lack of a control group; and that participant intake was based on retrospective self-report. In addition, the internal reliability statistics of many of the measures was low in the current study, likely due to the small sample size. Given the nascent stage of culinary medicine as a field, it was difficult to find measures that adequately captured the specific constructs the authors sought to assess. As a result, the authors ended up adapting many of the existing measures to be more aligned with the skills and lessons taught in the CUH elective (e.g., adding additional items to existing measures that focused more specifically on plant-based diets). A drawback of modifying existing measures is that it makes it more difficult to compare the results of their study with other studies that use the original items from those measures. Nevertheless, the authors believe that modifying the existing measures to be consistent with the broader goals of the current investigation allows us to better evaluate whether the CUH curriculum is effective in changing the specific attitudes, skills, and behaviors that the authors sought to change in the current course.

Future directions include exploring more objective measures of student eating and cooking behaviors; longitudinal measures to see if the positive impact on student confidence and attitudes translates to future career choices or practice; formal analysis of qualitative data to identify themes; and assessment of the impact of having medical students as teachers for Chicago Public School students. In addition the CUH curriculum is being shared with other institutions through a train-the-trainer model to allow greater dissemination to interested health professional schools, including options for interprofessional teaching and to adaptation to meet the capacity of different academic programs.

Formal dietetic counseling is normally provided by registered dietitians, who specialize in nutritional management of health and disease. However, relatively few patients are able to consult dietitians, and dietetic counseling is only reimbursed by insurance for a very restricted list of conditions. The CUH course may fill a gap in nutrition education of patients by equipping physicians with the knowledge and skills to advise patients and to recognize patients who should be referred to a dietitian for in-depth counseling, which may encompass culinary training.

The CUH elective provides a novel approach to medical education. Through leveraging a partnership between the Osher Center for Integrative Medicine and Common Threads, the current elective provides medical students unique opportunities to engage in active learning, including hands-on culinary sessions and the real-world application of their skills in service learning. Ultimately, this program of research may provide evidence to support widespread integration of the CUH into medical education and has the potential to prepare medical students to properly advise patients on nutrition and increase community and physician wellness to combat the rising rates of obesity, diabetes, and preventable diseases related to nutrition.

Acknowledgments

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Author Disclosure Statement

No competing financial interests exist.

Ethical Approval

Waived by the Northwestern University Institutional Review Board on 11/29/2016, STU00204233.

Previous Presentations

Oral Presentations and Panels:

- Osher Center Inaugural Integrative Medicine Research Conference, Chicago, Illinois, February 7, 2017
  Cooking Up Health: Study Design and Assessment Tools
- Integrative Medicine for The Underserved 7th Annual Conference, Chicago, Illinois, August 24–26, 2017
  Cooking it up in Chicago: Lessons from Two Culinary Medicine Programs
- Teaching Kitchen Collaborative Research Conference, Napa, California, February 7, 2018
  Cooking Up Health: Assessing the Efficacy of a Culinary Medicine Elective in Medical Students
- 2018 International Congress on Integrative Medicine and Health, Baltimore, MD, May 8–11, 2018
  (1) Power of a Community Based Organization and Academic Health Program Working Together to Deliver Integrative Medicine: A Culinary Medicine Case Study
  (2) Culinary Medicine: Lessons learned from implementing curricula across the country

Poster Presentations:

- Teaching Kitchen Collaborative Research Conference, Napa, California, February 7, 2018
  Power of a Community Based Organization and Academic Health Program Working Together to Deliver Integrative Medicine: A Culinary Medicine Case Study
- 2018 International Congress on Integrative Medicine and Health, Baltimore, MD, May 8–11, 2018
  Cooking Up Health: Assessing the Efficacy of a Culinary Medicine Elective in 2 Cohorts of Medical Students

References