



Hands-on Cooking in Medical Schools: Diffusion of a Prevention Education Innovation

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Abstract

Educating physicians early and often on how to have conversations with patients about diet to prevent and treat chronic disease is imperative, yet under realized. Some innovative medical schools have begun implementing hands-on cooking (HOC) programs to fill this gap, but how these programs are promoted is unknown. This study assessed the prevalence and innovation characteristics of HOC programs offered to medical students in the USA. Content analysis of webpages was conducted using a Diffusion of Innovation (e.g., relative advantage, compatibility, complexity, trialability, and observability) framework. Themes of *relative advantage* included increasing students' confidence, improvements in medical and interprofessional education, and translating into a benefit to patients through improved care. *Compatibility* codes showed only a quarter of webpages referred to the program as “evidence-based.” *Complexity* codes showed most (86%) webpages clearly described the course. About half the webpages described the program as an elective, suggesting *trialability* of this innovation. Many (43%) of the programs referenced use of a standardized “culinary medicine” curriculum, contributing to the *observability* of this innovation. Within the sample of schools, 35% provided HOC programs for their students. These findings suggest HOC programs have a strong foothold in healthcare education and provide a framework from which future studies might examine what effects innovative, successful HOC programs have on curriculum development, student experience, and, ultimately, patient outcomes.

Keywords Hands-on Cooking · Cooking · Medical nutrition education · Interprofessional education · Schools, medical · Diffusion of innovation · Physicians · Chronic disease · Primary prevention

Introduction

In 1893, the *British Medical Journal* published a call for medical students to attend four sick care and convalescent cookery courses to “gain practical information on matters of such vital importance to their future patients” [1, p. 35].

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Although the need for medical nutrition education was recognized over 125 years ago, medical schools have only recently begun to integrate formal nutrition education programs into the curriculum. Many of the leading causes of death are related to lifestyle and nutrition, including stroke, hypertension, and diabetes—all of which increased significantly from 2016 to 2017, according to the latest National Vital Statistics Report from the Centers for Disease Control and Prevention released in June of 2019 [2]. Despite the upward trend in the incidence of preventable chronic diseases, and evidence showing the role of dietary choices in preventing and treating chronic disease [3], the proportion of clinical visits in the USA that include nutrition counseling is only about 12% [4]. Well-documented barriers for providers to offer nutrition counseling include limited knowledge, counseling skills, time, and reimbursement [5, 6]. Complex challenges related to patient health behaviors cannot be solved with singular approaches; however, intervening at multiple levels (e.g., environmental, policy, community, clinical, and individual) can exert

synergistic effects [7, 8]. At the community healthcare level, nutrition training for health profession students has been an intervention of ongoing interest for decades, yet continues to be lacking [9, 10]. There is a need to understand the types of medical nutrition education programs offered in US medical schools, how those programs are marketed to prospective students, and the factors that facilitate integration of nutrition into medical curricula across the country.

Hands-on Cooking as Nutrition Education for Chronic Disease Prevention

Recent opinion articles published by or about physicians, including “How to Improve Clinical Practice and Medical Education about Nutrition” by David Katz, MD [11], “Ignorance of Nutrition is No Longer Defensible” by Neal Barnard, MD [12], and “Training Physicians About Nutrition” with Dr. Stephen Devries [13], call for increased inclusion of nutrition training in medical education as an ethical and imperative charge. In 2018, the American Heart Association published a scientific advisory for medical education outlining the gaps and opportunities for enhancing medical nutrition education, calling this need and its potential approaches “compelling, urgent and abundant” [14]. To answer this call, a re-emergence of unique, hands-on cooking (HOC) and culinary programs is appearing in medical school curricula globally [15]. The Goldring Center for Culinary Medicine (GCCM) curriculum developed by the Tulane University School of Medicine is now licensed by medical schools across the USA to increase nutrition education in programs [16–18]. Culinary medicine (CM)—a term coined in 2016—is defined as “blending the art of food and cooking with the science of medicine” [19, 20]. Other schools with integrative or lifestyle medicine centers offer similar cooking programs to fill the gap in nutrition education for medical students [14, 21].

Aspry et al. [14] outline many unique ways to integrate medical nutrition education into existing undergraduate, graduate, and continuing education curriculum, including addressing nutrition in biological system-specific didactic lessons, offering clinical exposure, supporting small group sessions, and developing elective courses. Many of these programs are also offered to allied health profession students such as future dietitians and nurses, and to practicing clinicians or members of the community. By engaging multiple disciplines in HOC programs, learning competencies in interprofessional education (IPE)—a parallel strategy included in health profession education that addresses prevention and care of chronic disease as a healthcare team [22]—are met concurrently. IPE is defined by the World Health Organization as occurring when “students from two or more professions learn about,

from and with each other to enable effective collaboration and improve health outcomes” [23].

Despite the clear links between nutrition and chronic disease prevention, the integration of nutrition education programs in medical school curricula has been underutilized and understudied. To date, no study has assessed diffusion of HOC programs into medical school education, including the ways in which these programs are marketed to prospective students. Rogers’ Diffusion of Innovations (DOI) [24] has been used to understand the adoption of multitudes of social and technological innovations [25–28]. This theoretical framework describes how likely an innovation is to diffuse through a system according to the following: (1) how the innovation is communicated; (2) the attributes of the innovation (i.e., relative advantage, compatibility, complexity, trialability and observability); (3) the characteristics of adopters of the innovation; and (4) the social system in which the innovation exists [24]. The objective of this study was to assess the prevalence and characteristics of HOC programs offered to medical students by examining how their medical school websites communicate the attributes and social context of this innovative pedagogical approach using the DOI framework.

Methods

Procedure and sample

This study is a content analysis of nutrition education programs described on medical school websites. The Liaison Committee on Medical Education (LCME) list of accredited US medical schools (as of February 2019) was used to identify school websites for the sample [29]. We excluded Doctor of Osteopathy schools and schools that did not offer HOC programs directly to medical students. Identification of HOC programs was made by referencing the list of medical schools from the LCME list and employing a Google search using the terms “School Name” and “Culinary Medicine.” If the Google search did not return any meaningful results, we conducted an additional search directly on the medical school’s website (if search was available) for “cooking” and “culinary.” Webpages were excluded if they did not explicitly mention the school’s name. Webpages for the study sample were identified between February and April 2019. Our final sample was reduced from 115 webpages representing 65 schools to 81 webpages representing 53 schools due to either lack of codable content, broken links, or sampling error. Secondary demographic and geographic data about the schools were acquired from the American Association of Medical Colleges [30].

Data Collection and Analysis

Our codebook was developed from operationalized constructs from DOI and included categories for attribute constructs (relative advantage, compatibility, complexity, trialability, and observability) [24]; adopter characteristics (gender and race of students, and geography and tuition of the schools); and social system constructs (social determinants of health and health equity such as food cost and food access) [31]. In addition, consideration was made for how frequently the curriculum of Tulane University was mentioned, since it has been licensed to other schools [32]. One qualitative variable was coded using text from the webpage describing relative advantage of the HOC program. These data were analyzed and categorized into four themes: increasing students' confidence working with patients, medical education improvements, IPE, and perceived benefit to patient outcomes.

Coding of the final sample of webpages was conducted between March and July 2019. Two coders worked independently in an iterative process to code the same sub-sample of webpages, then met to discuss inter-coder reliability findings for each question that did not have substantial agreement and revised the codebook accordingly. After agreeing on the final codebook, inter-coder reliability was run on a sub-sample ($n = 22$ or 27% of the final sample). Cohen's Kappa across all categories ranged from 0.63 to 1, which is within the moderate to strong ranges [33]. Per US Department of Health and Human Services guidelines [34], review by the IRB was not required for this study because human subjects were not involved. All summaries and inter-rater reliability calculations were produced using SPSS version 25 (Armonk, NY: IBM Corp.). A map of the USA identifying locations of medical schools with HOC programs and those without HOC programs was produced using R for Statistical Computing (Vienna, Austria: R Foundation for Statistical Computing). See Supplemental Materials: Appendix A.

Results

There were 81 webpages identified for coding for the study, representing HOC programs from 53 accredited medical schools in the USA. These schools comprise approximately 35% of the 152 medical schools with either full, provisional, or preliminary accreditation by the LCME for the 2017–2018 school year. Table 1 shows a profile of student demographics and tuition per data reported to the American Association of Medical Colleges about 2017–2018 graduates for the schools represented in the current study. Just over half (56.6%) of schools in the study sample are public medical schools.

Table 1 Descriptive characteristics of medical schools with hoc programs ($N = 52$)

	Median	IQR
Gender		
Men	52%	6%
Women	48%	6%
Race		
American Indian or Alaska Native	0%	0%
Asian	20%	17%
Black or African American	5%	5%
Hispanic, Latino, or of Spanish origin	3%	5%
Native Hawaiian or Pacific Islander	0%	0%
White	53%	24%
Other	2%	2%
Multiple race/ethnicity	8%	6%
Unknown race/ethnicity	1%	2%
Non-US citizen and non-permanent resident students	1%	3%
Graduating class size 2018	151	60
Tuition + fees	\$48,067.31	\$14,138.00

Demographic data missing from one medical school with preliminary accreditation status

Table 2 shows the proportions of coded variables categorized by the attribution constructs that are part of the DOI theory. Interprofessional education was described in 33.3% of the webpages, and 96.3% described a focus on special populations (including students, patients, or people with certain chronic diseases) that would derive some benefit from the program. Food cost and food access for patients were mentioned in 42% of the webpages coded. Many of the webpages (67.9%) described the credentials of the instructors for the courses, with some courses having multiple instructors. Credentials most commonly cited were medical doctor (46.9%), registered dietitian or licensed dietitian nutritionist (43.2%), and chef (24.7%). The purpose of the course or program was clear in 86.4% of the pages and the common term for these types of classes, “culinary medicine,” was used in a majority (79%) of them. Only 2.5% of the courses were required, while more than half (55.6%) were clearly described as electives in the coded sample. Photos were present in 71.6% of the webpages, and only 9.9% had videos. Fruits and vegetables appeared in 45 of the 58 photos (77.6%), kitchens were clear in 38 (65.5%) of the photos, and 3 (5.2%) showed gardens. Tulane University's culinary medicine curriculum was referenced in 43.2% of the webpages coded. Class sizes mentioned in the sample had a median of 15 students (IQR = 9; minimum = 5, maximum = 80), but only 25 of the 81 webpages coded contained this information.

Box 1 presents a summary of selected excerpts from the study sample representing the relative advantage construct

Table 2 Frequencies of observing variables coded for the study sample of HOC-related webpages categorized by Diffusion of Innovation theory construct ($N = 81$)

Diffusion of Innovation construct	Coded variables identified on webpage	<i>n</i> (%)
Relative advantage of participating in the program	Certificate or credential offered	3 (3.7)
	IPE described	27 (33.3)
	Special populations mentioned as benefiting from the program	78 (96.3)
	Program referred to as “innovative,” “cutting edge,” “trail blazing,” or similar	15 (18.5)
	Compatibility with educational culture of the school	
Compatibility with educational culture of the school	Program referred to as “evidence-based”	21 (25.9)
	Student or special interest group mentioned	5 (6.2)
	Program referred to as “progressive,” “nontraditional,” “alternative,” or similar	2 (2.5)
	Food access, food deserts/swamps, food cost, budget meals, health equity/disparities mentioned	34 (42)
	Credentials of course/program instructors	
	MD	38 (46.9)
	RD/LDN	35 (43.2)
	Chef	20 (24.7)
	Not mentioned	26 (32.1)
	Program initiated by students	9 (11.1)
	Program initiated by faculty	22 (27.2)
Program champion individual(s) mentioned	67 (82.7)	
Complexity of understanding program content and delivery	Class frequency/format described	35 (43.2)
	Purpose of the class or program clearly described	70 (86.4)
	Program described as culinary medicine	67 (79)
Trialability of enrollment in the program	Course or program is required	2 (2.5)
	Course is an elective	45 (55.6)
	Course is a pilot	5 (6.2)
	Course is a seminar or other	12 (14.8)
	Class size is mentioned	25 (30.9)
Observability of the program on relevant communication channels	Social media present on webpage	
	Facebook	72 (88.9)
	Twitter	72 (88.9)
	Instagram	28 (34.6)
	LinkedIn	35 (43.2)
	YouTube	31 (38.3)
	Other	44 (54.3)
	None	5 (6.2)
	Photos present	58 (71.6)
	Fruits and vegetables in photos	45 (77.6)
	Kitchen in photos	38 (65.5)
	Garden in photos	3 (5.2)
	Videos present	8 (9.9)
	Source	Blog or news post on the medical school website
News outlet website		8 (9.9)
Medical school curriculum		16 (19.8)
Other media source		9 (11.1)
Tulane’s Culinary Medicine curriculum referenced		35 (43.2)

from the DOI theory, either through the program objectives, expected patient outcomes, or the innovative approach taken in the program implementation. A full list of excerpts collected in this study is available in Supplemental Materials: Appendix B.

Box 1 Select quotes excerpted from webpages about the relative advantage of HOC programs

Increasing students' confidence working with patients

"What's unique about our course is that students not only get the hands-on training, but there's also a large reflective component to get students to really think about how they would take this back to their patients"

"In the pilot program, students were surveyed about their confidence in giving nutrition advice at the start and end of the program. Confidence grew from 57 percent at the start to 86 percent walking out the door."

Medical education improvements

"Traditional medical education can tell you biologically how nutrition works, but not practically. This class helped bridge the gap between theory and practice."

"The Center arms medical professionals with more to offer suffering patients than pamphlets and advice to 'eat less, exercise more.' (Probably everyone knows by now that's the way to lose weight-a 'how' would be appreciated.)"

Interprofessional education

"What I'm loving about this program is that we're making a community together. It's not like them and us, it's all [of] us."

"Having this experience gives me more confidence in working with interprofessional teams."

Perceived benefit to patient outcomes

"We teach medical students, and they teach the community."

"This project is intended to enhance students' recognition of the socio-economic and cultural context within which patients make decisions about their health."

Discussion

This study examined the prevalence and characteristics of HOC programs offered to medical students as they are represented on medical school websites and how these programs communicate the attributes and social context of this innovative educational strategy through the framework of Diffusion of Innovations. With the call for increased nutrition education in medical school curricula, it is important to understand how HOC programs are being utilized to meet this need as well as the characteristics of those adopting such programs. With just over a third of accredited medical schools promoting HOC programs for students on their websites identified in this study, there is opportunity to progress this innovative approach in medical nutrition education. While there were just two webpages dated in 2013 that referenced HOC programs, there is a clear upward trend in HOC programming, with 38 webpages that referenced programs dated between 2017 and

2018. The following paragraphs summarize how the attributes of the programs were described.

Relative advantage Qualitative excerpts regarding program benefits and outcomes from each of the websites were thematically categorized to demonstrate common and distinguishing advantages of the HOC programs. Confidence is often cited as a barrier to physicians providing nutrition care to patients due to limited nutrition education in their professional training [17, 35, 36]. Improved confidence in providing medical nutrition care after participation in HOC programs is increasingly being demonstrated in the literature [15, 17, 37] and this confidence might at the very least offer benefits to physicians' own health [38]. There were several excerpts found on webpages included in this study that support the claim these HOC programs show promise as a strategy to address the barrier of low confidence. Similarly, incorporating HOC programs into medical training is a unique strategy to improve nutrition education in curricula [14, 17, 39] and is substantiated by a quote found on a webpage evaluated for this study, stating that HOC programs "bridge the gap between theory and practice."

Another theme that emerged in the excerpts were the benefits of IPE-focused HOC programs and the reference to facilitating a team-focused attitude. This is consistent with the findings of a recent study conducted with medical and dietetic students that blended IPE and CM, which showed perceptions of team performance in both groups was enhanced after the program [40]. Blending the concepts of HOC programs with IPE is recommended by the recent Science Advisory from the American Heart Association [14] and a position paper from the Academy of Nutrition and Dietetics, *Interprofessional Education in Nutrition as an Essential Component of Medical Education* [41]. Finally, while the theme of perceived benefit to patient outcomes emerged from the excerpts, no direct evidence was provided on the websites to support this. Measuring patient outcomes that result from medical students participating in HOC programs continues to be elusive in the literature and is consistently named as a primary area of needed research to support program efficacy in patient care [15, 37, 40].

Compatibility The websites included in this study were examined for emphasizing food environment considerations, such as food security, access, and cost as well as health equity. Mention of these factors in 42% of the websites is considered a reflection of a priority to educate students on social determinants of health consistent with the recommendations in *Framework for Educating Health Professionals to Address the Social Determinants of Health* commissioned by the Institute of Medicine, the Board on Global Health, and the National Academies of Sciences, Engineering and Medicine in 2016 [14]. The education components of the framework

include experiential and collaborative learning, an integrated curriculum, and continuing professional development [14]. The nature of HOC programs lends to inclusion of these components as well and should be considered in future medical nutrition education program development as outlined in the recent Science Advisory from the American Heart Association [14] and integrated into clinical practice to provide the best patient-centered care [31]. Additionally, many HOC programs address medical nutrition education with an interdisciplinary team of leaders as was shown in this analysis where physicians, dietitians, and/or chefs were mentioned as instructors of the sessions. This is consistent with the findings of a study assessing health-related culinary education programs where a majority of the programs highlighted were led by credentialed individuals representing different disciplines [15]. If IPE is a focus of the HOC programs, as was found in a third of the websites assessed in this study, not only should the students be from different professional foci, developing partnerships across institutional departments, with outside stakeholders and community partners such as nutrition or Extension educators, community health workers, and culinary schools or chefs to lead programs is recommended [42, 43].

Complexity Culinary medicine as a term is well defined in the literature but there are no specific guidelines for what constitutes content, delivery, structure, or educational goals for programs [15]. It is not clear if this standardized definition is readily understood and acknowledged nor if a common meaning is conveyed by healthcare professionals when referring to it. Despite this, nearly 80% of the websites reviewed in this study referred to their HOC program as culinary medicine, and the majority of them had a clearly defined purpose or objective. While outside the scope of this study, future research could examine the elements of programs identifying as culinary medicine to build consensus of what qualifies as such.

Trialability A substantial barrier to adding nutrition elements of medical education programming is the already full curricula [10]. A novel approach to circumventing this issue is by establishing an HOC program as an elective course. Over half of the HOC programs described in the websites reviewed in this study indicated that the program was an elective, which seems to be an effective way to ensure sustainability and institutional buy-in, and promote continuity and longevity of this important educational innovation.

Observability There is no set standard for the type of facility in which HOC programs are offered [15]. To gauge if programs described on the websites analyzed in this study were offered in a kitchen facility, photos were examined. Of the 58 photos present on the websites, 65% of them showed some type of kitchen. While medical nutrition education can be achieved in

many ways, a longitudinal study of medical students showed statistically significant increased feelings of competence and positive attitudes toward providing nutrition care for patients in students who participated in a HOC program over those who received training only in a traditional clinical setting [37]. Similar results were found in a study that blended the two modes of education and measured positive changes in nutrition-related behavior personally and professionally among participants at baseline and again at 3 months post-program [44], suggesting that interactive, experiential learning in a kitchen-type facility is an important component of nutrition education. Another measure of observability was whether the website mentioned Tulane's Goldring Center for Culinary Medicine in describing the HOC program. While it was not distinguished if the featured program was licensed by Tulane or the curriculum was serving as a model, nearly half of the websites examined made note of the GCCM.

There are several important limitations of this study related to sampling and data interpretation. First, the sampling method was an Internet search that accounted only for webpages identified between February and April 2019. Given the continuously changing nature of websites and the possibility that a program exists without any Web presence, the study sample is likely an under-representation of HOC programs in US medical schools. Also, with regard to sampling, osteopathic medical schools were excluded as their curricula are accredited by the American Osteopathic Association Commission on Osteopathic College Accreditation (COCA), whereas allopathic medical schools are accredited by the LCME. Since not all webpages had dates included, there is no way to fully understand the timeline of the development of these programs through this method of research. Coding for a reference to Tulane's culinary medicine program did not require clear statement that the referring school was licensing Tulane's program. Finally, class size was collected when a webpage mentioned a number of students without differentiating sessions or cohorts if it was not clearly mentioned. Due to the nuance in these data collection methods, some caution is required when interpreting them in relation to the constructs from a theory such as Diffusion of Innovations.

Conclusion

This study is the first to examine the status of HOC programs as a medical curricular innovation through readily available content on the Internet. Currently, there is a Web presence of HOC programs in more than a third of accredited medical schools and many of these programs market the curriculum as educating medical students about patients' social determinants of health. In addition, many HOC programs prioritize interprofessional education and make use of the standardized curriculum with the name "Culinary Medicine" from Tulane

University, contributing to the observability of this innovation. The qualitative data are promising from the students and faculty of medical schools describing the HOC programs' efficacy in increasing confidence in having nutrition conversations with patients, as this is an important aspect of the patient–provider relationship and associated patient outcomes. Altogether, these findings suggest HOC programs are gaining traction in medical nutrition education and have the potential to ameliorate the public health burden of chronic disease by engaging physicians in primary prevention efforts with their patients. Future research should examine implementation of HOC programs from educators' perspectives, including osteopathic medicine and other types of health sciences schools, and assess the effects of various medical nutrition education approaches on both physician and patient outcomes.

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Data Availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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