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Consensus Statement | Medical Education

Proposed Nutrition Competencies for Medical Students and Physician Trainees
A Consensus Statement

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Abstract

IMPORTANCE In 2022, the US House of Representatives passed a bipartisan resolution (House of Representatives Resolution 1118 at the 117th Congress [2021-2022]) calling for meaningful nutrition education for medical trainees. This was prompted by increasing health care spending attributed to the growing prevalence of nutrition-related diseases and the substantial federal funding via Medicare that supports graduate medical education. In March 2023, medical education professional organizations agreed to identify nutrition competencies for medical education.

OBJECTIVE To recommend nutrition competencies for inclusion in medical education to improve patient and population health.

EVIDENCE REVIEW The research team conducted a rapid literature review to identify existing nutrition-related competencies published between July 2013 and July 2023. Additional competencies were identified from learning objectives in selected nutrition, culinary medicine, and teaching kitchen curricula; dietetic core competencies; and research team–generated de novo competencies. An expert panel of 22 nutrition subject matter experts and 15 residency program directors participated in a modified Delphi process and completed 4 rounds of voting to reach consensus on recommended nutrition competencies, the level of medical education at which they should be included, and recommendations for monitoring implementation and evaluation of these competencies.

FINDINGS A total of 15 articles met inclusion criteria for competency extraction and yielded 187 competencies. Through review of gray literature and other sources, researchers identified 167 additional competencies for a total of 354 competencies. These competencies were compiled and refined prior to voting. After 4 rounds of voting, 36 competencies were identified for recommendation: 30 at both undergraduate and graduate levels, 2 at the undergraduate level only, and 4 at the graduate level only. Competencies fell into the following nutrition-related themes: foundational nutrition knowledge, assessment and diagnosis, communication skills, public health, collaborative support and treatment for specific conditions, and indications for referral. A total of 36 panelists (97%) recommended nutrition competencies be assessed as part of licensing and board certification examinations.

CONCLUSIONS AND RELEVANCE These competencies represent a US-based effort to use a modified Delphi process to establish consensus on nutrition competencies for medical students and physician trainees. These competencies will require an iterative process of institutional prioritization,

(continued)

Key Points

Question What are the essential nutrition competencies that should be taught to medical students and physician trainees?

Findings Through a modified Delphi process, an expert panel reached consensus on 36 nutrition competencies to recommend at undergraduate and/or graduate medical education levels. Participants recommended that nutrition competencies be included as part of licensing and board certification examinations.

Meaning The identified nutrition competencies will require institutional prioritization, revision, refinement, and expansion over time.

+ Invited Commentary

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Abstract (continued)

refinement, and inclusion in current and future educational curricula as well as licensure and certification examinations.

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Introduction

Dietary patterns are one of the strongest behavioral influences on disease risk regardless of individual genetics.[1,2] Seven of the 10 leading causes of death in the US are directly affected by diet.[3] In 2020, 42% of US adults and nearly 20% of US children were classified as having obesity.[4] More than 10% of US adults have diabetes, and 38% have prediabetes.[5] It is estimated that 60% of current US children will develop obesity before the age of 35 years.[6] Simultaneously, in 2022, approximately 12.8% of US households experienced food insecurity, a state in which access to adequate food for active, healthy living is limited by lack of money and other resources.[7] Food and nutrition insecurity is strongly correlated with risk of chronic disease and is a manifestation of health inequities.[8,9] The collective effect of all of these statistics comes at a great cost, with the US currently spending $4.3 trillion on health care annually, 90% of which is spent on care for patients with chronic diseases.[10,11] Diet plays a key role in the pathogenesis of many of these chronic diseases; therefore, food and dietary interventions offer an opportunity for improving population health and reducing morbidity, mortality, and health care costs.[12]

Despite the association between dietary patterns and chronic disease, there are no nationally required nutrition competencies in undergraduate medical education (UME), and such competencies are limited or completely absent from the requirements for most medical specialties in graduate medical education (GME).[13-15] What does exist is a multitude of suggested nutrition competencies in the academic literature, but these suggested competencies are not uniform nor agreed on by regulators and are not tested on licensing or certification examinations.[16] In addition, physicians have repeatedly acknowledged insufficient training in practical skills to advise patients about food and nutrition.[17-20] There is little to suggest that the US public is aware of this educational void.

To address the discrepancy between nutrition-related medical education and national health outcomes, in May 2022, the US House of Representatives passed a bipartisan resolution (House of Representatives Resolution 1118 at the 117th Congress [2021-2022]), introduced by Representatives James McGovern (D-MA) and Michael Burgess (R-TX), calling for meaningful nutrition education in medical schools, residency, and fellowship programs.[21] Concerned about the increasing prevalence of diet-related disease and Medicare costs, totaling $800 billion in 2019, and conscious that federal funds are the single largest source of GME funding, the resolution urged medical training programs to meaningfully increase nutrition education to "ensure competency in nutrition for physicians and other health professionals."[21] In addition, Representative McGovern conveyed that Congress expects this issue to be addressed in light of their annual financial support for medical trainees in US hospitals (estimated at $16.2 billion in 2020).[22,23]

In March 2023, the Accreditation Council for Graduate Medical Education (ACGME) hosted a nutrition education summit in collaboration with the Association of American Medical Colleges and the American Association of Colleges of Osteopathic Medicine.[24] Educators were invited to discuss methods to improve UME and GME nutrition training and subsequently agreed to develop a consensus-based methodology, with the aim of producing a recommended list of nutrition competencies for medical students and physician trainees.

This report represents a US-based effort to generate consensus on food and nutrition competencies in medical education via a modified Delphi process, with 3 aims: (1) describe the modified Delphi process method used to build consensus on nutrition competencies, (2) present the competencies, and (3) provide recommendations for implementing recommended competencies into existing UME and GME programs. By recommending competencies as opposed to individual

curricula, institutions and training programs retain the flexibility to incorporate such competencies into existing or forthcoming curricula in ways that meet their respective needs.

Methods

Study Design

A modified Delphi process was used to achieve consensus on nutrition competencies for medical students and physician trainees. The Delphi method is a structured, iterative technique that is well suited for elucidating complex issues and achieving consensus among experts.[25] Rather than garnering free-text ideas from the start, as is done in a traditional Delphi process, the modified Delphi method provided panelists with a list of existing nutrition-related competencies extracted from the literature as a framework to guide their thinking about the competencies best suited to advance nutrition education. All panelists took part in the process voluntarily and received no compensation. Panelists provided written informed consent to participate and completed a conflict-of-interest form before the process began. Harvard T.H. Chan School of Public Health served as the coordinating center for the study between June 2023 and October 2023. The study received an exemption determination by the Harvard Human Research Protection Program because it did not collect information about human participants and does not contain identifiable information. This study followed the Standards for Quality Improvement Reporting Excellence (SQUIRE) reporting guideline.[26]

To identify existing nutrition-related competencies published between July 2013 and July 2023 to be voted on as part of this modified Delphi survey, the research team conducted a rapid literature review, focusing on both the academic literature and gray literature (see eTable 1 in the Supplement for search terms).[27,28] Additional competencies were identified from learning objectives in selected nutrition, culinary medicine, and teaching kitchen curricula; dietetic core competencies; and research team–generated de novo competencies. Inclusion criteria and methods to identify relevant gray literature and additional competencies are described in eMethods 1 in the Supplement.[29,30] Identified competencies were compiled and subsequently refined through use of a scoring rubric, assessing for comprehensibility and relevance to ensure a manageable number of competencies advanced for inclusion in the modified Delphi process.

Recruitment

Expert panel members were identified by 2 groups: the Teaching Kitchen Collaborative[31] and the ACGME. The research team, with input from the Teaching Kitchen Collaborative, identified 22 subject matter experts at accredited medical education institutions. The ACGME identified 15 residency program directors and review committee members from 10 specialties with milestone development experience.[32] This process resulted in a total panel size of 37 (**Table 1**), in line with best practice guidance for Delphi processes.[25]

Assembling a multidisciplinary team allowed for input from a variety of specialties and areas of expertise to increase the likelihood that competencies for which there was consensus would be adopted after publication. Panelists included PhD, DO, and MD medical educators; practicing MD and DO physicians; registered dietitian nutritionists (RDNs) and PhD nutrition scientists; and practicing RDNs.

Potential panelists were sent a letter in June 2023 inviting them to take part in the process. All 37 invitees agreed to participate. With diverse geographic origins, the 37 panelists provided a cross-continental basis of input (eFigure in the Supplement). Panelist identities remained anonymous until after the final survey round to minimize potential bias. Potential conflicts of interest were reviewed, and none were deemed sufficient for exclusion.

Table 1. Members of the Modified Delphi Survey Expert Panel (N = 37)

Individual	Title or residency specialty	Institution
Subject matter experts who teach nutrition and/or have authored curricula relating to culinary medicine and nutrition education involving teaching kitchens (n = 22)		
Jaclyn Albin, MD, CCMS, DipABLM[a]	Associate Professor of Internal Medicine and Pediatrics	University of Texas Southwestern
Hope Barkoukis, PhD, RDN, LD, FAND[a]	Chair, Department of Nutrition	Case Western Reserve University, School of Medicine
Helen Delichatsios, MD[a]	Clinician-Educator	Massachusetts General Hospital
Stephen Devries, MD	Executive Director	Gaples Institute
Christopher P. Duggan, MD, MPH	Professor of Pediatrics	Harvard Medical School
Kofi Essel, MD, MPH, FAAP[a]	Clinical Associate Professor of Pediatrics	George Washington University School of Medicine & Health Sciences; Elevance Health
Beth Frates, MD, FACLM, DipABLM	Physician	Massachusetts General Hospital
Aviad Haramati, PhD[a]	Professor of Integrative Physiology	Georgetown University School of Medicine
Timothy S. Harlan, MD, FACP, CCMS[a]	Associate Professor of Medicine	George Washington University School of Medicine & Health Sciences
Michelle E. Hauser, MD, MS, MPA, FACP, FACLM, DipABLM[a]	Clinical Associate Professor of Surgery and Medicine, Obesity Medicine Director; Internal Medicine/Obesity Medicine Staff Physician	Stanford University School of Medicine; Veterans Affairs Palo Alto Health Care System
David Leopold, MD, DABFM, DABOIM, DipABLM[a]	Assistant Professor Medicine	Hackensack Meridian Health
Amy Locke MD, FAAFP, ABOIM, DipABLM[a]	Professor and Chief Wellness Officer	University of Utah
Auden McClure, MD, MPH[a]	Associate Professor of Medicine	The Dartmouth Institute
John Wesley McWhorter, DrPH, MS, RDN, LD, CSCS[a]	Director, Lifestyle Medicine	Suvida Healthcare
Jo Marie Reilly, MD, MPH[a]	Professor of Clinical Family Medicine	Keck School of Medicine of University of Southern California
Melinda Ring, MD, FACP, ABOIM, CNS, DipABLM, IFMCP[a]	Director, Osher Center for Integrative Health	Northwestern University
Kate Shafto, MD[a]	Assistant Professor of Medicine	University of Minnesota Medical School; Hennepin Healthcare
Linda Shiue, MD, DipABLM[a]	Director, Culinary Medicine	Kaiser Permanente; Kaiser Permanente Bernard J. Tyson School of Medicine
Wendelin Slusser, MD, MS[a]	Associate Vice Provost	University of California–Los Angeles
Terri Stone, MD, FACP, DipABLM[a]	Physician	Georgetown University Medical Center
Jennifer Trilk, PhD, FACSM, DipACLM[a]	Director, Lifestyle Medicine Programs	University of South Carolina School of Medicine Greenville
Olivia Thomas, MS, RDN[a]	Director of Culinary Nutrition	Boston Medical Center
Residency directors recruited by the ACGME (n = 15)		
Meredith Alston, MD	Obstetrics & Gynecology	Intermountain Health/Saint Joseph Hospital
Fred Buckhold, MD	Internal Medicine	Saint Louis University
Robert Danoff, DO, MS, FACOFP, FAAFP	Family Medicine & Community Health	Jefferson Health
Stephanie Dewar, MD	Pediatrics	University of Pittsburgh School of Medicine
Jennifer Di Rocco, DO	Pediatrics	University of Hawaii
Pamela Hansen, MD	Physical Medicine & Rehabilitation	University of Utah
Joanna Lewis, MD	Pediatrics	Advocate Children's Hospital
Joshua R. Mann, MD, MPH	Preventive Medicine	University of Mississippi Medical Center
Saroj Misra, DO, FAAFP, FACOFP	Clinical Affairs	A.T. Still University, Kirksville College of Osteopathic Medicine
Tiffany Murano, MD	Emergency Medicine	Columbia University
Amy Oxentenko, MD, FACP, FACG, AGAF	Internal Medicine	Mayo Clinic-Rochester

(continued)

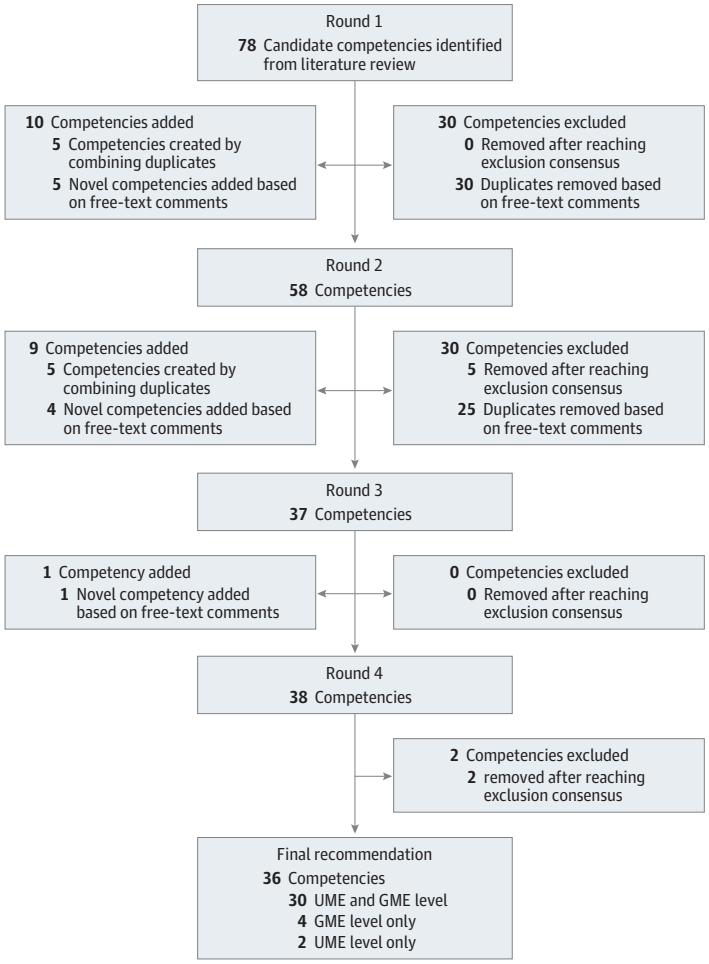
Table 1. Members of the Modified Delphi Survey Expert Panel (N = 37) (continued)

Individual	Title or residency specialty	Institution
Stacey Pierce-Talsma, DO, MS, FNAOME	Osteopathic Neuromusculoskeletal Medicine	University of New England College of Osteopathic Medicine
Stacy Potts, MD, MEd	Family Medicine	UMass Chan Medical School
Suzanne Sampang, MD	Psychiatry	Cincinnati Children's Hospital Medical Center; University of Cincinnati College of Medicine
Karen Studer, MD, MPH, MBA	Preventive Medicine	Loma Linda University

Abbreviation: ACGME, Accreditation Council for Graduate Medical Education.

[a] Individuals who have taught nutrition curricula in a setting that includes a teaching kitchen.

Figure. Competency Refinement Process



GME indicates graduate medical education; UME, undergraduate medical education.

Data Collection

Panelists were sent a link to a SurveyMonkey (Symphony Technology Group) survey and given 10 days to provide responses, after which the results were analyzed. In the first 2 survey rounds, panelists ranked each competency on a scale from 1 to 5 (1 = not required, 2 = optional, 3 = helpful, 4 = important, and 5 = essential). In rounds 3 and 4, they indicated at which level of medical education (UME, GME, both UME and GME, or neither) they considered the competencies to be essential. Competencies were excluded prior to the following round if 70% of all panelists scored it as 1, 2, or 3 or included if 70% of all panelists scored it as 5 (**Figure**). The use of 70% as the threshold for consensus is standard practice for Delphi processes.

Panelists were invited to provide free-text comments to suggest rewording of competencies or inclusion of additional competencies. The anonymized analyses and free-text comments were shared with all panelists prior to voting in the next round.

During round 2, panelists were asked to propose methods for monitoring institutional implementation of competencies and evaluating individual students' ability to demonstrate competence. In round 3, the expert panel voted on which of these they considered to be relevant and at which level of medical education. Again, 70% of all panelists was used as the threshold for consensus.

Data Analysis

The core research team (eMethods 2 in the Supplement) analyzed the data after each survey round and were not part of the expert panel. These coauthors addressed panelists' comments between rounds by removing duplicate competencies, splitting compound competencies, and modifying verbiage to reflect current educational standards.

Results

Competency Identification

The academic literature review yielded 520 articles. After removal of duplicates, the research team reviewed 518 article titles, 176 abstracts, and 131 full texts. Fifteen articles met inclusion criteria for competency extraction (eTable 2 in the Supplement) and yielded 187 competencies; only 15 of 187 suggested competencies included the word "food" (eTable 3 in the Supplement). In the gray literature review, researchers extracted competencies from 7 relevant websites. Additional competencies were identified as described in the Methods. Through review of gray literature and other sources, researchers identified 167 additional competencies for a total of 354 competencies to compile and refine as described.

Competency Consensus

After 4 survey rounds, the expert panel agreed to recommend 36 competencies from those identified through the literature review. These 36 competencies were recommended to be taught at UME and GME levels—30 at both the UME and GME levels, 4 at the GME level only, and 2 at the UME level only (**Table 2**).

Monitoring and Evaluation Method Identification

Six methods reached consensus for evaluating medical student and physician trainee competence, and 2 methods reached consensus for monitoring the implementation of competencies at medical schools and in residency programs (**Table 3**). A total of 36 panelists (97%) recommended that nutrition education competencies be evaluated through licensing examinations or board certification examinations. In addition, 35 panelists (95%) agreed that institutions should report on their teaching relating to nutrition competencies, and 34 panelists (92%) agreed that surveys of students should be used to assess their competency and confidence in this area. Finally, 27 panelists (73%) recommended a competency related to the impact of food choices on the environment (Table 2).

ACGME Core Competency Domain Categorization

After the final round of the survey, competencies were reviewed by a subset of residency program directors, with input from the ACGME. Competencies were sorted into the ACGME's 6 core competency domains: patient care and procedural skills; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; professionalism; and systems-based practice (eTable 4 in the Supplement).

Table 2. Nutrition-Related Competencies That Achieved 70% or Greater Consensus by the Expert Panelists

No.	Competency	Agreement level, No. (%) (N=37)
Recommended at both the UME and GME levels		
1	Provides evidence-based, culturally sensitive nutrition and food recommendations to patients for the prevention and treatment of disease[a]	37 (100)
2	Screens for food insecurity and nutrition insecurity and makes appropriate referrals for those identified at risk[a]	37 (100)
3	Works with other health professionals to deliver a multidisciplinary approach to nutrition care[a]	37 (100)
4	Identifies pathophysiological and/or socioeconomic circumstances which may lead to metabolic syndrome or malnutrition[a]	36 (97)
5	Assesses the nutritional status of a patient with a brief diet and food history or questionnaire, anthropometric measurements, and appropriate laboratory tests[a]	36 (97)
6	Starts a sensitive, nonjudgmental conversation about food and lifestyle in a brief consultation within a primary or secondary care setting[a]	36 (97)
7	Demonstrates knowledge of the nutritional content of foods including the major dietary sources of macronutrients and micronutrients[a]	36 (97)
8	Integrates evidence-based nutrition information from national nutrition guidelines, scientific publications, and other sources into patient care[a]	36 (97)
9	Demonstrates knowledge of public health nutrition, including the social determinants of health, and how it can reduce the burden of disease and improve access to adequate, healthy food[a]	36 (97)
10	Demonstrates sensitivity to the social, cultural, emotional, economic, educational, and psychological factors that may affect an individual's nutrition behavior, food choices, and health status[a]	36 (97)
11	Demonstrates knowledge of the pathological states that can affect the absorption of macronutrients, micronutrients, and other food-based compounds	36 (97)
12	Identifies nutrient deficiencies and recommends foods and/or supplements as needed	35 (95)
13	Demonstrates empathy and sensitivity when counseling patients with obesity and eating disorders	35 (95)
14	Assesses diet and food intake and performs a comprehensive nutrition-focused physical examination to identify factors affecting a patient's health status	34 (92)
15	Utilizes evidence-based models of behavior change to assess patients' readiness in order to effectively counsel patients for how to modify their diet and food choices to improve health	34 (92)
16	Guides patients with regard to food choices in establishing lifelong dietary patterns to promote healthy weight and prevent or address chronic disease	34 (92)
17	Identifies community-based nutrition resources for patients experiencing food and nutrition insecurity	34 (92)
18	Communicates diet, food, and nutrition information to patients using their preferred language, via interpretative services if needed, based on education and health literacy levels	34 (92)
19	Listens carefully, compassionately, and nonjudgmentally while taking a nutrition history	34 (92)
20	Demonstrates knowledge of the difference between food allergies and food intolerance	33 (89)
21	Interprets physical examination data and biomarkers against reference ranges to identify patients at risk of malnutrition	33 (89)
22	Demonstrates awareness of one's own biases about food, food choices, obesity, and "healthy eating"	33 (89)
23	Provides brief counseling interventions to help patients decrease visceral adiposity or reduce risk of metabolic syndrome	32 (87)
24	Demonstrates knowledge of how energy and nutrient requirements in health and disease states differ across the lifespan	32 (87)
25	Demonstrates knowledge of possible drug-nutrient interactions between certain foods, beverages, and medications	32 (87)
26	Demonstrates knowledge of nutritional differences between unprocessed, minimally processed, and ultraprocessed foods	31 (84)
27	Interprets information on nutrition facts panels, nutrition labels, and menus to make appropriate recommendations to support patients' individual needs and food choices	30 (81)
28	Identifies factors which affect their personal health and nutrition status	29 (78)
29	Demonstrates knowledge of the environmental impact of food production and how food choices can promote or diminish both personal and planetary health	27 (73)
30	Demonstrates knowledge of how to create culinary nutrition SMART goals for personal use and for patient care	27 (73)

(continued)

Table 2. Nutrition-Related Competencies That Achieved 70% or Greater Consensus by the Expert Panelists (continued)

No.	Competency	Agreement level, No. (%) (N=37)
Recommended at the GME level for appropriate specialties only		
31	Identifies and refers patients for eating disorders and psychosocial problems including emotional eating and binge eating	36 (97)
32	Makes appropriate referrals to a range of professionals to support the patient to achieve their health goals	35 (95)
33	Describes indications, administration, and complications of clinically assisted nutrition and hydration support (oral, enteral, and parenteral)	35 (95)
34	Demonstrates knowledge of breastfeeding, chestfeeding, and complementary feeding practices	31 (84)
Recommended at the UME level only		
35	Demonstrates knowledge of the functions of essential nutrients	36 (97)
36	Demonstrates knowledge of the principles of a healthy balanced diet, in accordance with national nutrition guidelines	35 (95)

Abbreviations: GME, graduate medical education; SMART, Specific, Measurable, Achievable, Relevant, and Time-Bound; UME, undergraduate medical education.

[a] Competencies recommended to be considered for initial enhancement of existing curricula.

Table 3. Recommended Methods for Evaluating Medical Student and Resident Competence and Monitoring Institutional Implementation of Nutrition Competencies

Method	Level of education	Agreement level, No. (%) (N = 37)
Evaluation method		
Objective structured clinical examinations	UME	37 (100)
Simulated patient exercises	UME and GME	37 (100)
Licensing examination or board certification examinations	UME and GME	36 (97)
Multiple choice questionnaires	UME and GME	33 (89)
Case vignettes or studies	UME and GME	32 (87)
Direct observations	UME and GME	28 (76)
Monitoring method		
Institutional self-reporting	UME and GME	35 (95)
Survey of students	UME and GME	34 (92)

Abbreviations: GME, graduate medical education; UME, undergraduate medical education.

Discussion

Thirty-six nutrition competencies for medical students and physician trainees were identified through a modified Delphi process: 30 at both UME and GME levels, 2 at the UME level only, and 4 at the GME level only. The expert panel reached consensus on 6 methods for evaluating the ability of medical trainees to demonstrate the competencies and 2 methods for monitoring teaching of the competencies by institutions.

It is worthwhile highlighting several results, either because of the significant implications they have for the delivery of medical education or because they offer a novel perspective on the topic of nutrition education. First, 97% of panelists recommended that nutrition education competencies be evaluated through licensing examinations or board certification examinations. Currently, there are no such requirements for medical students or physician trainees. Second, 95% of panelists agreed that institutions should report on their teaching relating to nutrition competencies, and 92% agreed that surveys of students should be used to assess their competency and confidence in this area. Third, 73% of panelists recommended a competency related to the impact of food choices on the environment (Table 2; competency 29). This topic relating to the environmental impact of food choices is not currently taught at UME or GME levels in most medical training programs.

The academic literature searches performed to identify nutrition-related competencies revealed that only 15 of 187 suggested competencies included the word "food" (eTable 3 in the Supplement). Moreover, most of these competencies related to topics such as food allergies and intolerances, food access, and food composition as opposed to practical advice to patients about individual food choices.

In addition to categorizing the competencies within ACGME core competencies, the research team reflected on the broad themes represented by the proposed nutrition competencies and defined these as follows: foundational nutrition knowledge, nutrition-related assessment and diagnosis, nutrition-related communication skills, public health nutrition, collaborative support and treatment for nutrition-related conditions, and indications for referrals. These themes are similar to previously published categories of nutrition competencies in medical education.[14]

The research team also undertook a further iterative process of reflection on the final competencies after the Delphi process had concluded to identify possible gaps in the competencies (ie, areas of nutrition education that we believe to be important but that were not addressed by the final 36 competencies identified through the literature review and voting process). Possible gaps identified by individual team members were then discussed and triangulated with those identified by other team members until consensus was reached on 12 possible gaps (**Box**).[33-37] As innovation in food, nutrition, and health continues and as experience with incorporating nutrition competencies in medical education grows, this list of gaps is likely to evolve and expand. Educators should be alert to this possibility when making future refinements to curricula.

Incorporation of all 36 nutrition competencies recommended by the expert panel, in addition to the 12 identified competency gaps, may not be feasible or practical in the short term for medical educators and trainees. By nature of the modified Delphi process, many of these competencies have partial or substantial overlap. Within the list of 36 recommended competencies in Table 2, 10 have been proposed by the expert panel to be prioritized for incorporation into existing curricula. All 10 competencies achieved 97% or greater consensus and were judged to be applicable at both UME and GME levels.

There are several suggested next steps to support educators with incorporation of these competencies into curricula. First, deans of medical education and residency program directors have the latitude to decide which nutrition competencies are most relevant to their respective programs and in which order they should be incorporated. As stated, it is unrealistic to envision the incorporation of all 36 recommended competencies initially, and those competencies selected for inclusion into current curricula should, ideally, be integrated into existing curricular components as opposed to being added as stand-alone educational initiatives. This approach has been recommended elsewhere.[14] For example, a nutrition theme could be developed as part of existing educational materials across clinical domains, such as cardiology, endocrinology, obstetrics and

Box. Possible Gaps in the Recommended Competencies

- Whether, when, and how to recommend antiobesity medications, including glucagon-like peptide 1 (GLP-1) agonists, in combination with diet and lifestyle guidance[33]
- How to educate patients about connections between dietary patterns, food systems, the environment, and planetary health
- How to responsibly and effectively bill for nutrition-related services, including shared medical appointments and culinary medicine consultations in collaboration with registered dietitian nutritionists[34,35]
- How to summarize evidence relating to the positive effect of eating with others, especially as this affects children and older adults[36]
- How to recognize and promote healthy food environments, particularly in health care settings
- How to provide evidence-based advice to patients about the use or avoidance of dietary supplements
- How to refer patients to relevant state and federal food assistance programs, including "food is medicine" nutrition services
- How to work toward making the healthy and affordable choice the default choice across settings and populations (ie, how to advocate for changes in the food ecosystem)
- How to assess knowledge of nutrition requirements throughout the lifecycle
- How to optimize the solicitation of a food history to maximize patient engagement and relevant referrals[37]
- How to responsibly use artificial intelligence and associated technologies to provide patients practical advice about nutrition and food choices
- How to provide evidence-based guidance to patients regarding healthy beverage consumption and avoidance of unhealthy beverages

gynecology, pediatrics, family medicine, preventive medicine, public and community health, and other required elements of UME and GME training.

Second, it is suggested that each educational institution should map (1) course directors and instructors interested in incorporating the recommended competencies, ideally as a new theme across curricular elements, and (2) current resources for food and nutrition education (eg, medical and dietetics faculty with appropriate expertise, teaching kitchen facilities or access to local culinary schools, and enthusiasm from senior leaders to champion food and nutrition education across the institution). This approach will enable institutions to identify strengths and weaknesses and allow interested parties to collectively develop a customized strategy to leverage and build on these resources to deliver meaningful food and nutrition education.

Third, those interested in incorporating the recommended competencies should be aware of resources to support them.[38-42] For those who incorporate these competencies into their curricula, we recommend that they socialize their planned changes beforehand, both within their institution and among the broader medical education community externally. It is also vital that those who attempt incorporation provide insights for others by sharing their experiences through seminars, webinars, publications, and/or conference presentations. In addition, we invite educators to share with the corresponding author their experiences incorporating these competencies so that the outcomes and lessons can be discussed in future presentations and scholarship. This will help interested parties co-create a coordinated strategy to incorporate these competencies. Fourth, educators may benefit from the creation of a searchable repository of nutrition education curricula for use by health educators, as this may ease the adoption and implementation of proposed competencies.

Future Implications

This article focuses on US medical education. However, the US is not alone in facing critical health challenges due to poor dietary quality and insufficient food and nutrition education training for medical students and physician trainees, and there are similar efforts in other countries to address this issue.[43-46] The creation of an "Undergraduate Curriculum in Nutrition for Medical Doctors" in the UK bears comparison with our study.[47] The UK effort had parallels; however, it was not a formal research study, it focused on UME only, and there was less focus on communication skills and behavior change. Physician educators from other nations may consider replicating our approach if they have not already done so.

Over recent years, there has been an increase in the number of medical schools and residency training programs incorporating experiential learning to teach food and nutrition concepts. Specifically, 19 of the 22 nutrition subject matter experts (Table 1) have incorporated experiential learning strategies through a range of hands-on cooking facilities, including built-in, pop-up, mobile, and virtual teaching kitchens[48-50]; shared medical appointments[34]; and culinary medicine consultations.[35] Culinary medicine is currently taught in at least 34 medical schools across the US; there is mounting evidence that medical students and physician trainees who receive culinary medicine education change their own cooking and eating behaviors and demonstrate increased confidence in discussing food and nutrition with their patients.[51] Given the increasing use of these experiential learning strategies, future nutrition-related competencies should take these educational models into consideration, as they may be especially useful in the translation of nutrition principles into practical advice about food composition, selection, and preparation for patients, medical students, physician trainees, and practicing physicians. Although this article focuses on nutrition competencies for medical students and physician trainees, we share the view that they are also applicable to practicing physicians. Practicing physicians receiving enhanced nutrition education may change their own eating behaviors as well as demonstrate increased confidence in advising patients about improved food choices.[52]

Patients who are counseled on good nutrition report improvements in their dietary patterns.[53] This counsel is especially effective when coming from physicians, as evidenced by the report that patients whose physicians advised them to lose weight were 3 times more likely to attempt to do

so.[54] Furthermore, just as the purpose of clinical rotations is to better equip medical students to work with specialty experts and not necessarily to make students the experts themselves, learning about nutrition is likely to lead to more collaborative activity and better appreciation for the skill set of RDNs. A recent publication demonstrated that physicians with prior nutrition training were significantly more confident providing nutrition counseling to their patients and referring to RDNs.[55] By contrast, physicians without any nutrition training were less likely to refer to RDNs. Another study suggests that physicians who receive even a modest amount of nutrition education are nearly twice as likely to refer patients to nutrition professionals as those who do not.[56] Future research should explore the association of meaningful nutrition education for medical students and physician trainees with patterns of referral to and co-management of patients with dietetic and other health professionals.

In an imagined future, physicians will be appropriately trained in nutrition and will be able to translate nutrition science into practical, evidence-based, accessible, and culturally sensitive advice about food for patients, families, and communities. This will address the goals of the House of Representatives Resolution 1118 at the 117th Congress (2021-2022)[21] and will enhance the health of people and the planet. The competencies identified in this article provide an initial step on this relatively uncharted educational path.

Strengths and Limitations

This study has several strengths. First, the expert panel was large, high quality, and diverse in terms of professional credentials. Stratified purposeful sampling was used to construct a group containing 37 experts, 22 (59%) of whom were academic faculty with familiarity designing and teaching curricula relating to nutrition education for medical students and physician trainees and 15 (41%) of whom were residency program directors who had worked closely with the ACGME. All 37 experts initially invited to participate agreed, resulting in a participation rate of 100% across the entire process. Including both nutrition subject matter experts and residency program directors increases the probability that the results are representative of a range of views and have the potential to be implemented practically. By including residency program directors with a background in medical education but without a specific interest in food and nutrition teaching, we ensured that the process contained medical educators with heterogeneous views who could act as critical allies.

This study also has some limitations. First, this is a US-based survey, which may limit its international generalizability. Avenues for possible international replication are discussed above. Second, there are potential gaps in the competencies. The consensus-building process was initially informed by existing competencies from the literature. Although suggestions of additional competencies were solicited during the process, reduction or avoidance of the gaps may have been accomplished by being more proactive in this solicitation. However, this could have created an additional challenge by further increasing the number of competencies and therefore making it more difficult to achieve consensus. In addition, while it was appropriate in the context of a modified Delphi process, the use of competencies from the literature as a starting point for the process may have introduced bias by framing the panelists' views on which competencies should be recommended. An alternative process whereby the panelists suggested all competencies themselves could have been considered.

Conclusions

The identified competencies represent a US-based effort to use a modified Delphi process to establish a consensus about nutrition education competencies for medical students and physician trainees. This list will require institutional prioritization, revision, refinement, and expansion over time and will be an iterative process whereby medical educators incorporate recommended nutrition competencies into current and future educational curricula as well as licensure and certification examinations.

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REFERENCES

1. Landry MJ, Ward CP, Cunanan KM, et al. Cardiometabolic effects of omnivorous vs vegan diets in identical twins: a randomized clinical trial. *JAMA Netw Open*. 2023;6(11):e2344457. doi:10.1001/jamanetworkopen.2023.44457

2. Khera AV, Emdin CA, Drake I, et al. Genetic risk, adherence to a healthy lifestyle, and coronary disease. *N Engl J Med*. 2016;375(24):2349-2358. doi:10.1056/NEJMoa1605086

3. Xu J, Murphy SL, Kochanek KD, Arias E. Mortality in the United States, 2021. National Center for Health Statistics, Centers for Disease Control and Prevention. December 22, 2022. Accessed August 6, 2024. doi:10.15620/cdc:122516

4. Obesity and overweight. National Center for Health Statistics. Centers for Disease Control and Prevention. January 5, 2023. Accessed August 18, 2024. https://www.cdc.gov/nchs/fastats/obesity-overweight.htm

5. National diabetes statistics report. Centers for Disease Control and Prevention. November 29, 2023. Accessed January 10, 2024. https://www.cdc.gov/diabetes/php/data-research/?CDC_AAref_Val=https://www.cdc.gov/diabetes/data/statistics-report/index.html

6. Mozaffarian D, Liu J, Sy S, et al. Cost-effectiveness of financial incentives and disincentives for improving food purchases and health through the US Supplemental Nutrition Assistance Program (SNAP): a microsimulation study. *PLoS Med*. 2018;15(10):e1002661. doi:10.1371/journal.pmed.1002661

7. Food security and nutrition assistance. USDA Economic Research Service. November 29, 2023. Accessed July 10, 2024. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-security-and-nutrition-assistance

8. Gregory CA, Coleman-Jensen A. *Food Insecurity, Chronic Disease, and Health Among Working-Age Adults*. July 2017. Accessed December 4, 2023. https://www.ers.usda.gov/webdocs/publications/84467/err-235.pdf?v=1668.9

9. National Institute on Minority Health and Health Disparities. Food accessibility, insecurity and health outcomes. July 3, 2024. Accessed July 10, 2024. https://www.nimhd.nih.gov/resources/understanding-health-disparities/food-accessibility-insecurity-and-health-outcomes.html

10. Hoffman D. Commentary on chronic disease prevention in 2022. National Association of Chronic Disease Directors. 2022. Accessed December 4, 2023. https://chronicdisease.org/wp-content/uploads/2022/04/FS_ChronicDiseaseCommentary2022FINAL.pdf

11. American Medical Association. Trends in health care spending. March 20, 2023. Accessed January 10, 2024. https://www.ama-assn.org/about/research/trends-health-care-spending

12. Gropper SS. The role of nutrition in chronic disease. *Nutrients*. 2023;15(3):664. doi:10.3390/nu15030664

13. Devries S, Dalen JE, Eisenberg DM, et al. A deficiency of nutrition education in medical training. *Am J Med*. 2014;127(9):804-806. doi:10.1016/j.amjmed.2014.04.003

14. Lepre B, Mansfield KJ, Ray S, Beck EJ. Nutrition competencies for medicine: an integrative review and critical synthesis. *BMJ Open*. 2021;11(3):e043066. doi:10.1136/bmjopen-2020-043066

15. Broad Leib E, Shapiro M, Chan A, et al. *Doctoring Our Diet: Policy Tools to Include Nutrition in U.S. Medical Training*. Food Law and Policy Clinic, Harvard Law School. September 2019. Accessed December 4, 2023. https://chlpi.org/wp-content/uploads/2013/12/Doctoring-Our-Diet_-September-2019-V2.pdf

16. Adams KM, Kohlmeier M, Zeisel SH. Nutrition education in U.S. medical schools: latest update of a national survey. *Acad Med*. 2010;85(9):1537-1542. doi:10.1097/ACM.0b013e3181eab71b

17. Devries S, Agatston A, Aggarwal M, et al. A deficiency of nutrition education and practice in cardiology. *Am J Med*. 2017;130(11):1298-1305. doi:10.1016/j.amjmed.2017.04.043

18. Hachey S, Hamilton C, Goins B, Underwood P, Chao A, Dolin CD. Nutrition education and nutrition knowledge amongst obstetrics and gynecology residents. *Am J Obstet Gynecol*. 2023;228(1):S572. doi:10.1016/j.ajog.2022.11.971

19. Crowley J, Ball L, Hiddink GJ. Nutrition in medical education: a systematic review. *Lancet Planet Health*. 2019;3(9):e379-e389. doi:10.1016/S2542-5196(19)30171-8

20. Vetter ML, Herring SJ, Sood M, Shah NR, Kalet AL. 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. doi:10.1080/07315724.2008.10719702

21. McGovern JP. H.Res.1118 — Expressing the sense of the House of Representatives that the United States recognizes the mounting personal and financial burden of diet-related disease in the United States and calls on medical schools, graduate medical education programs, and other health professional training programs to provide meaningful physician and health professional education on nutrition and diet. 117th Congress (2021-2022). May 17, 2022. Congress.gov. Accessed January 10, 2024. https://www.congress.gov/bill/117th-congress/house-resolution/1118/committees

22. McGovern resolution on nutrition education in medical schools passes House. U.S. Representative Jim McGovern. May 17, 2022. Accessed January 10, 2024. https://mcgovern.house.gov/news/documentsingle.aspx?DocumentID=398867

23. In Focus. Medicare graduate medical education payments: an overview. September 29, 2022. Congressional Research Service. Accessed December 4, 2023. https://crsreports.congress.gov/product/pdf/IF/IF10960

24. Accreditation Council for Graduate Medical Education. Proceedings of the Summit on Medical Education in Nutrition. March 2023. Accessed January 24, 2024. https://www.acgme.org/globalassets/pdfs/nutritionsummit/nutrition-summit-proceedings.pdf

25. Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: how to decide its appropriateness. *World J Methodol*. 2021;11(4):116-129. doi:10.5662/wjm.v11.i4.116

26. SQUIRE. Revised Standards for Quality Improvement Reporting Excellence: SQUIRE 2.0. Accessed July 10, 2024. https://www.squire-statement.org/index.cfm?fuseaction=page.viewPage&pageID=471

27. Klerings I, Robalino S, Booth A, et al; Cochrane Rapid Reviews Methods Group. Rapid reviews methods series: guidance on literature search. *BMJ Evid Based Med*. 2023;28(6):412-417. doi:10.1136/bmjebm-2022-112079

28. Office of Management, National Institutes of Health. Literature search: databases and gray literature. Accessed January 24, 2024. https://www.nihlibrary.nih.gov/services/systematic-review-service/literature-search-databases-and-gray-literature

29. University of Cambridge. Systematic reviews: snowballing. Accessed February 20, 2024. https://libguides.cam.ac.uk/c.php?g=679598&p=4844614

30. Academy of Nutrition and Dietetics. ACEND accreditation standards for nutrition and dietetics graduate degree programs (GP) (future education model). November 1, 2021. Accessed January 10, 2024. https://www.eatrightpro.org/-/media/files/eatrightpro/acend/accreditation-standards-fees-and-policies/future-education-model-standard-and-templates-v2022/fem-graduate-reformat.pdf?rev=c48694162c6148c7a0a162707027fade&hash=4420CD68FB07A07E11DAC2027AAAC03E

31. Teaching Kitchen Collaborative. About TKC. Accessed January 10, 2024. https://teachingkitchens.org/about-tkc/

32. Edgar L, McLean S, Hogan SO, Hamstra S, Holmboe ES. *The Milestones Guidebook*. Accreditation Council for Graduate Medical Education. 2020. Accessed December 4, 2023. https://www.acgme.org/globalassets/milestonesguidebook.pdf

33. Almandoz JP, Wadden TA, Tewksbury C, et al. Nutritional considerations with antiobesity medications. *Obesity (Silver Spring)*. Published online June 10, 2024. doi:10.1002/oby.24067

34. Delichatsios HK, Hauser ME, Burgess JD, Eisenberg DM. Shared medical appointments: a portal for nutrition and culinary education in primary care—a pilot feasibility project. *Glob Adv Health Med*. 2015;4(6):22-26. doi:10.7453/gahmj.2015.060

35. Albin JL, Siler M, Kitzman H. Culinary medicine eConsults pair nutrition and medicine: a feasibility pilot. *Nutrients*. 2023;15(12):2816. doi:10.3390/nu15122816

36. Hanna K, Cross J, Nicholls A, Gallegos D. The association between loneliness or social isolation and food and eating behaviours: a scoping review. *Appetite*. 2023;191:107051. doi:10.1016/j.appet.2023.107051

37. Lee JJ, McWhorter JW, Bryant G, Zisser H, Eisenberg DM. Standard patient history can be augmented using ethnographic foodlife questions. *Nutrients*. 2023;15(19):4272. doi:10.3390/nu15194272

38. Association of American Medical Colleges. Home. Accessed January 12, 2024. https://www.aamc.org/home

39. AAMC. Home page. Accreditation Council for Graduate Medical Education (AAMC). Accessed January 12, 2024. https://www.acgme.org/

40. American Association of Colleges of Osteopathic Medicine. Accessed January 12, 2024. https://www.aacom.org/home

41. Health Meets Food. Home page. Accessed January 12, 2024. https://culinarymedicine.org/

42. Food is Medicine Coalition. Home page. Accessed January 12, 2024. https://www.fimcoalition.org

43. Broadley I, White R, Jaffee A. Nutrition training for medical professionals: where do we begin? *Br J Cardiol*. 2022;29(4):28. doi:10.5837/bjc.2022.028

44. Ganis L, Christides T. Are we neglecting nutrition in UK medical training? a quantitative analysis of nutrition-related education in postgraduate medical training curriculums. *Nutrients*. 2021;13(3):957. doi:10.3390/nu13030957

45. Obesity Canada. The need for nutrition education in medical school curriculum. June 14, 2018. Accessed January 10, 2024. https://obesitycanada.ca/snp/the-need-for-nutrition-education-in-medical-school-curriculum/

46. Orimo H, Ueno T, Yoshida H, Sone H, Tanaka A, Itakura H. Nutrition education in Japanese medical schools: a follow-up survey. *Asia Pac J Clin Nutr*. 2013;22(1):144-149. doi:10.6133/apjcn.2013.22.1.13

47. Association for Nutrition. *AfN UK Undergraduate Curriculum in Nutrition For Medical Doctors*. October 2021. Accessed August 17, 2024. https://www.associationfornutrition.org/wp-content/uploads/2021/10/2021-UK-Undergraduate-Curriculum-in-Nutrition-for-Medical-Doctors-FINAL.pdf

48. Badaracco C, Thomas OW, Massa J, Bartlett R, Eisenberg DM. Characteristics of current teaching kitchens: findings from recent surveys of the Teaching Kitchen Collaborative. *Nutrients*. 2023;15(20):4326. doi:10.3390/nu15204326

49. Eisenberg DM, Pacheco LS, McClure AC, McWhorter JW, Janisch K, Massa J. Perspective: teaching kitchens: conceptual origins, applications and potential for impact within food is medicine research. *Nutrients*. 2023;15(13):2859. doi:10.3390/nu15132859

50. MedEd nutrition education for medical schools and residency programs. Gaples Institute. Accessed January 24, 2024. https://www.gaplesinstitute.org/nutrition-cme/meded-medical-school-nutrition-resident-nutrition/

51. Newman C, Yan J, Messiah SE, Albin J. Culinary medicine as innovative nutrition education for medical students: a scoping review. *Acad Med*. 2023;98(2):274-286. doi:10.1097/ACM.0000000000004895

52. Eisenberg DM, Myrdal Miller A, McManus K, Burgess J, Bernstein AM. Enhancing medical education to address obesity: "see one. taste one. cook one. teach one.". *JAMA Intern Med*. 2013;173(6):470-472. doi:10.1001/jamainternmed.2013.2517

53. Moore M, Wang D, Berquist S, Bonnet J, Rastorguieva K. Dietary, cooking, and eating pattern outcomes from the Emory Healthy Kitchen Collaborative. *Ann Fam Med*. 2023;21(suppl 1):3761. doi:10.1370/afm.21.s1.3761

54. Galuska DA, Will JC, Serdula MK, Ford ES. Are health care professionals advising obese patients to lose weight? *JAMA*. 1999;282(16):1576-1578. doi:10.1001/jama.282.16.1576

55. Pojednic R, Phillips E, Shehadeh A, Muller A, Metallinos-Katsaras E. Physician nutrition advice and referrals to registered dietitians. *Am J Lifestyle Med*. 2022;17(6):847-854. doi:10.1177/15598276221092304

56. Devries S, Aggarwal M, Allen K, Kris-Etherton P, Theriot P, Freeman AM. Assessment of the low referral rate of cardiologists to dietitians/nutritionists. *Int J Dis Reversal Prev*. 2022;4(1):1-8. doi:10.22230/ijdrp.2021v3n2a303

SUPPLEMENT.

eTable 1. Search Terms for the Rapid Review of the Academic Literature
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eFigure. Modified Delphi Process Panelist Locations
eMethods 2. Description of the Core Research Team
eTable 2. Papers Meeting the Inclusion Criteria From the Academic Literature Review
eTable 3. Initial Identified Competencies From Academic Literature Review (n=187)
eTable 4. Proposed Nutrition Competencies, Sorted by ACGME Core Competencies and Harmonized Milestones