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Food for thought: a qualitative assessment of medical trainee and faculty perceptions of nutrition education

Olivia Kunitsky¹, Mahdi Taye¹, Karla Feeley¹, Hugh Johnson¹, Abigail Glynn¹, Avery Stivale¹, Matthew Hamers¹, Alexis Notarianni², Sireesha Mamillapalli¹, Gabi Waite¹ and Sonia Lobo^{1*}

Abstract

Background The American Society of Clinical Nutrition recommends 37 to 44 h of undergraduate medical nutrition education. The Total Health Curriculum at Geisinger Commonwealth School of Medicine (GCSOM) contains 14 h of objective-based nutritional instruction. This study aimed to examine the perceptions of key stakeholders regarding the role of nutrition in medicine and to identify barriers, opportunities for improvement, and roles/responsibilities for innovative implementation of nutrition education.

Methods This exploratory, qualitative study employed a phenomenological approach and inductive coding process. Purposive sampling recruited medical students, undergraduate medical education (UME) faculty, physicians, and other healthcare professionals at GCSOM and affiliated clinical sites. Semi-structured focus groups and one-on-one interviews were conducted via videoconferencing. Audio recordings were transcribed using NVivo 14. Transcripts were manually reviewed alongside the audio files to ensure accuracy. Data were systematically organized using the qualitative research methodology Rigorous and Accelerated Data Reduction (RADaR). Microsoft Copilot was used to assist with thematic analysis. Outcomes were compared, and consensus was obtained among raters.

Results Twenty-five individuals were interviewed: 12 UME faculty, five students, and eight healthcare professionals, including two physicians. Participants included 18 females and seven males, aged 23 to 69 years. 92% of participants believed that all physicians should receive nutrition education and 40% felt unsatisfied with their nutritional training. For barriers, the qualitative analysis identified these themes: (1) time constraints, (2) assessment and prioritization, (3) insufficient faculty expertise, and (4) bias and stigma. For improvement opportunities, the qualitative analysis identified these themes: (1) curriculum design, (2) practical application, (3) patient-centered approach, and (4) trainee perceptions. For roles/responsibilities, the qualitative analysis identified these themes: (1) accreditation bodies, (2) stakeholder involvement, (3) public policy and legislation, and (4) multilevel responsibility.

Conclusion Participants acknowledged a need for more medical nutrition education to prepare physicians who are equipped to manage the nutritional needs of patients. They recognized key challenges hindering the advancement

*Correspondence:
Sonia Lobo
slobo1@geisinger.edu

Full list of author information is available at the end of the article



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of such education, proposed various forms of improvement, and identified roles for successful implementation. Future research will assess community perspectives and expand sample diversity.

Keywords Nutrition, Medical education, Curriculum, Lifestyle medicine, Preventive medicine, Nutrition counseling, Medical training

Background

Dietary risk factors were associated with 11 million deaths and 255 million disability-adjusted life-years (DALYs) across 195 countries in 2017, with high sodium intake and low intake of whole grains and fruits being the leading risk factors [1]. It is estimated that one in every five deaths could be mitigated with dietary improvements. In the United States (US), the importance of integrating nutrition and dietary counseling into preventive health services to reduce chronic disease has been recognized by Healthy People 2010 and subsequent editions [2]. According to the most recent data from Healthy People 2030, the proportion of health care visits by adults with obesity that included counseling on weight loss, nutrition, or physical activity declined from 24.8% in 2016 to 21.0% in 2019, remaining below the program's target of 32.6% [3]. The public health emphasis on nutrition counseling is reflected in medical trainees' awareness of the impact nutrition has on their patients' health. When 125 first- and second-year medical students from Dalhousie University in Nova Scotia were asked about their attitudes regarding nutrition, 97.6% of students recognized the importance of nutritional counseling in improving patient outcomes, and 91.2% felt that physicians are influential in changing patients' dietary behaviors [4]. The perceived importance of nutrition in preventing chronic diseases extends well into trainees' postgraduate medical training. A study of internal medicine residents, cardiology fellows, and faculty at New York University Langone Health revealed that physicians rated nutrition and physical activity equally as important as statin therapy in reducing cardiovascular disease risk [5]. While nutrition's role in modern medicine is recognized, the specific responsibilities of physicians in managing patients' nutritional needs are often ambiguous, with some viewing them as the primary provider of nutritional care while others see them as coordinators who refer patients to registered dietitians [6, 7].

This ambiguity surrounding the physician's role as a provider of nutritional care is reflected in the formal education dedicated to nutrition. For instance, the National Academy of Sciences (1985) recommends 25 h of nutrition education to be incorporated into undergraduate medical education (National Research Council) [8], while the American Society of Clinical Nutrition recommends an average of 37 to 44 h [9]. However, a national survey of medical nutrition education in the US indicates that 62 to 73% of medical schools fall short of providing students

with adequate training, averaging 19.6 h of nutrition instruction, thus impacting their ability as future physicians to provide nutritional counseling [10]. In a recent study that assessed nutrition education content in GCSOM's Total Health Curriculum, we determined that our curriculum also does not meet these national recommendations, with roughly 14 h spent on learning objective-based nutritional instruction, primarily during the preclinical phase and centered around basic sciences [11, 12]. We believe equipping students with adequate nutrition knowledge would align with GCSOM's curricular goals of training compassionate physicians who provide individualized patient care and promote community health.

The inadequacy of structured nutrition education in medical training is not unique to GCSOM; nutrition education is suboptimal in medical curricula worldwide. A systematic review of nutrition in medical education included studies conducted in the US ($n=11$); Europe ($n=4$), including a general European study, one in Italy, Albania, and the UK; Middle East ($n=1$), specifically the United Arab Emirates; Africa ($n=1$), specifically Ghana; Asia ($n=1$), specifically Japan; and Australia. The review concluded that "nutrition is insufficiently incorporated into medical education, regardless of country, setting, or year of medical education" [13]. To further illustrate this final point, most students at Dalhousie University placed a high value on nutrition in patient care, yet had low levels of agreement with the following statements: "The amount of time dedicated to nutrition education in my medical school seems appropriate"; "Nutrition education is well integrated into various aspects of my curriculum"; and "My medical education in terms of nutrition has prepared me for my career as a physician" [4]. Similarly, an American Academy of Pediatrics survey completed by 10 fourth-year medical students and 14 pediatric interns showed that participants were dissatisfied with their nutrition training. They felt ill-prepared to meet patients' nutritional demands, particularly during pregnancy, childhood, and adolescence, when proper nutrition is vital for healthy development [14]. There is also a significant gap between the nutrition education provided during medical training and its practical application in clinical settings. A pivotal study by Robert Kushner highlighted this issue, demonstrating that over half of primary care physicians received nutrition training at some point in their careers, yet many lacked confidence in providing dietary counseling to their patients [15]. These findings

underscore the need not only for more nutrition education, but also for improvements in its quality and relevance to patient care.

This study aimed to assess medical trainees' self-perceived proficiency in nutrition across various training levels, examine attitudes and beliefs about the significance and delivery of nutrition education in medical training, and provide a comprehensive overview from preclinical instruction through fellowship training to identify educational shortcomings. Additionally, it gathered recommendations for more effective incorporation of nutrition education into undergraduate and graduate medical curricula, while gaining a deeper understanding of the obstacles and enabling factors. The findings will inform the development of innovative curricula to improve nutrition competency among medical trainees at our institution.

Methods

Qualitative approach and research paradigm

We conducted a qualitative study employing a phenomenological approach guided by social learning theory. By exploring the meaning of experiences, including both *what* and *how* they are perceived, this approach allowed us to deepen our understanding of the complex phenomena related to learning, behavior, and communication within the field of medical nutrition education [16]. Social learning theory provides a lens to examine how individuals acquire behaviors and attitudes through observation and interaction within their social contexts. We believe this is an appropriate model to view medical education, as learning is largely influenced by role models and exposure to clinicians and other healthcare professionals during pre-clinical instruction and clinical rotations [17].

Sampling and recruitment

Purposive sampling was used to identify medical students, UME faculty, residents, physicians, advanced practitioners, registered dietitians, certified diabetes educators, and obesity/nutrition researchers. Participants were limited to GCSOM and its affiliated hospital systems, including the Geisinger Health System, Guthrie Robert Packer Hospital, and AtlantiCare. Members of the research team and individuals under 18 were excluded from participating. Targeted or broadcast emails about the voluntary study were sent to faculty and students to recruit individuals interested in participating in virtual semi-structured, one-on-one interviews or focus groups to assess perceptions related to nutrition education throughout various levels of medical training. Snowball sampling was used to recruit additional participants. Individuals who agreed to participate were emailed the consent form to review ahead of the session. Voluntary,

informed verbal consent was obtained from each participant before proceeding with the interview or focus group. The study protocol, including verbal informed consent, was reviewed and approved by the Geisinger Institutional Review Board (IRB) (Protocol #2023–1250).

Semi-structured interview guide

A semi-structured interview guide was used to assess perceptions, beliefs, and recommendations related to medical nutrition education (see Additional file 1). The interview guide was created through iterative discussions between members of the research team and internally tested to minimize possible ambiguity, generate follow-up prompts, and ensure the appropriateness and comprehensiveness of the contents of the interview guide. The interview guide consisted of a sociodemographic survey gathering basic information and academic background, followed by open-ended questions focusing on understanding participants' perspectives of nutrition education, its integration in medical training, the adequacy of nutrition-related knowledge and skills among medical professionals, and self-perceived nutrition competency across various stages of education and practice. The semi-structured interview guide was tailored to include questions and follow-up probes specific to the participants' current level of training and position and aimed to solicit suggestions for UME and graduate medical education (GME) curricular improvement. All members of the research team were trained in conducting semi-structured interviews to ensure consistency and reliability.

Data collection

Five semi-structured focus groups and ten one-on-one interviews were conducted virtually between September 2023 and April 2024, using one or two interviewers and a designated notetaker. Pseudonyms were established at the beginning of each session to de-identify participants. The semi-structured interview guide promoted robust discussions among participants of diverse backgrounds and addressed various aspects of nutrition education in medical training. All interviews were audio recorded in Zoom, and then recordings were transcribed using NVivo 14 to produce 15 similarly formatted interview transcripts. Each NVivo transcript was compared with the audio file by a member of the research team to ensure accuracy of the transcript. Observer notes created by the designated notetaker present during each interview were consulted to settle any discrepancies or clarify information.

Data analysis

Qualitative data were systematically organized using Rigorous and Accelerated Data Reduction (RADaR) to produce a more condensed and concise presentation of

the textual data [18]. Column and row headings for the RADaR table were informed by the semi-structured interview guide. Each transcript was reviewed by two different team members to create a comprehensive Phase 1 RADaR table in Microsoft Excel. Data that did not address the research questions were eliminated to produce a Phase 2 data table. Microsoft Copilot (with commercial data protection) was used to assist in thematic analysis and in the development of focused codes and clusters from each row of the Phase 2 RADaR table. The “more precise” designation was applied to the conversation, and Copilot was accessed on July 2–8, 2024. A code refers to a key word(s) used to summarize text, while a cluster is created from a group of codes that share similarities and thematic relatedness [19]. Based on the work of Turobov, Coyle, & Harding, artificial intelligence (AI) prompts were customized to align with the semi-structured interview guide and overall research purpose (Fig. 1) [19]. Manual analysis was conducted to verify the AI-produced codes and clusters. The Phase 2 RADaR table was consulted to verify participant quotes included in the AI output.

Results

Twenty-five individuals agreed to participate in the study (Table 1). Eighteen (72%) participants identified as female and seven (28%) identified as male. Participant ages ranged from 23 to 69 years. Of these participants, 12 (48%) were UME faculty; five (20%) were medical students; three (12%) were registered dietitians, two of whom were certified to counsel patients with diabetes mellitus; two (8%) were practicing physicians, one resident physician and one attending physician; one (4%) was a nutrition researcher; one (4%) was a nurse practitioner; and one (4%) was a nutrition specialist. Seven individuals (28%) indicated that they hold a nutritional degree or certificate.

Of the 25 individuals who participated in the study, 92% ($N=23$) believed that all physicians should receive nutrition education, while 8% ($N=2$) were unsure. Of those asked about their satisfaction with their training in nutrition, 52.6% ($N=10$) percent felt unsatisfied with their nutrition training, 31.6% ($N=6$) were satisfied, and 15.8% ($N=3$) provided mixed sentiments. Of those asked, 84.6% ($N=11$) indicated that most physicians are not properly equipped to manage the nutritional demands of patients, 7.7% ($N=1$) felt that physicians are equipped, and 7.7% ($N=1$) were unsure.

The qualitative analysis yielded several major themes and subthemes related to the objectives of the study, which are outlined below (Table 2) and further illustrated by quotes. To protect the identity of study participants, only a participant number and occupation were provided for each statement.

Self-perceived training, resources and competence in nutrition

Participants in this study tended to assert that medical trainees and physicians often lack sufficient knowledge in nutritional care. Interviewees described the reliance of physicians on external resources such as UpToDate or referrals to dietitians in nutritional care scenarios. Due to a lack of a nationally standardized medical nutrition curriculum, some participants further noted that the only physicians they knew that could adequately advise patients on diet had to personally pursue additional education on the subject.

“No. Totally fallen through the cracks. National embarrassment. Medical school is no exception. [Nutritional education] should be at the high school level, at the college level all the way through. Should be required education.” (P1, UME faculty).

“I don’t think so because they google a lot of stuff on resources like UpToDate. I won’t say a strict no, because they know when to refer to a nutritionist or dietitian as an option to fall back on. But dietitians are scheduled months out sometimes, and it’s not practical for patients with either transportation issues or who have trouble remembering appointments down the line. I think if physicians were able to provide a little more knowledge to the patient during that initial encounter, it could go a long way.” (P24, medical student).

“I think most physicians would not unless they have a love for nutrition and they’re doing some research. I mean, there are some Geisinger Docs that, you know, had taken some advanced education because that was just something they were interested in” (P25, registered dietitian).

Several participants noted skills that medical residents should have to provide better nutritional care. A clear theme was the ability of residents to collect a detailed nutrition history of patients. Several participants described it being important not only to know when and how to approach conversations about dietary habits, apply research, and involve further specialists, but also when to consider cultural socioeconomic factors in each patient.

These important skills, however, were not reflected as material covered in the training of most interviewees. Experiences in nutrition education typically were from classes in undergraduate education, additional master’s degrees, or informal training. Participants expressed a lack of formal nutrition training during medical school, despite the previously mentioned skills that most agreed were needed going into residency.

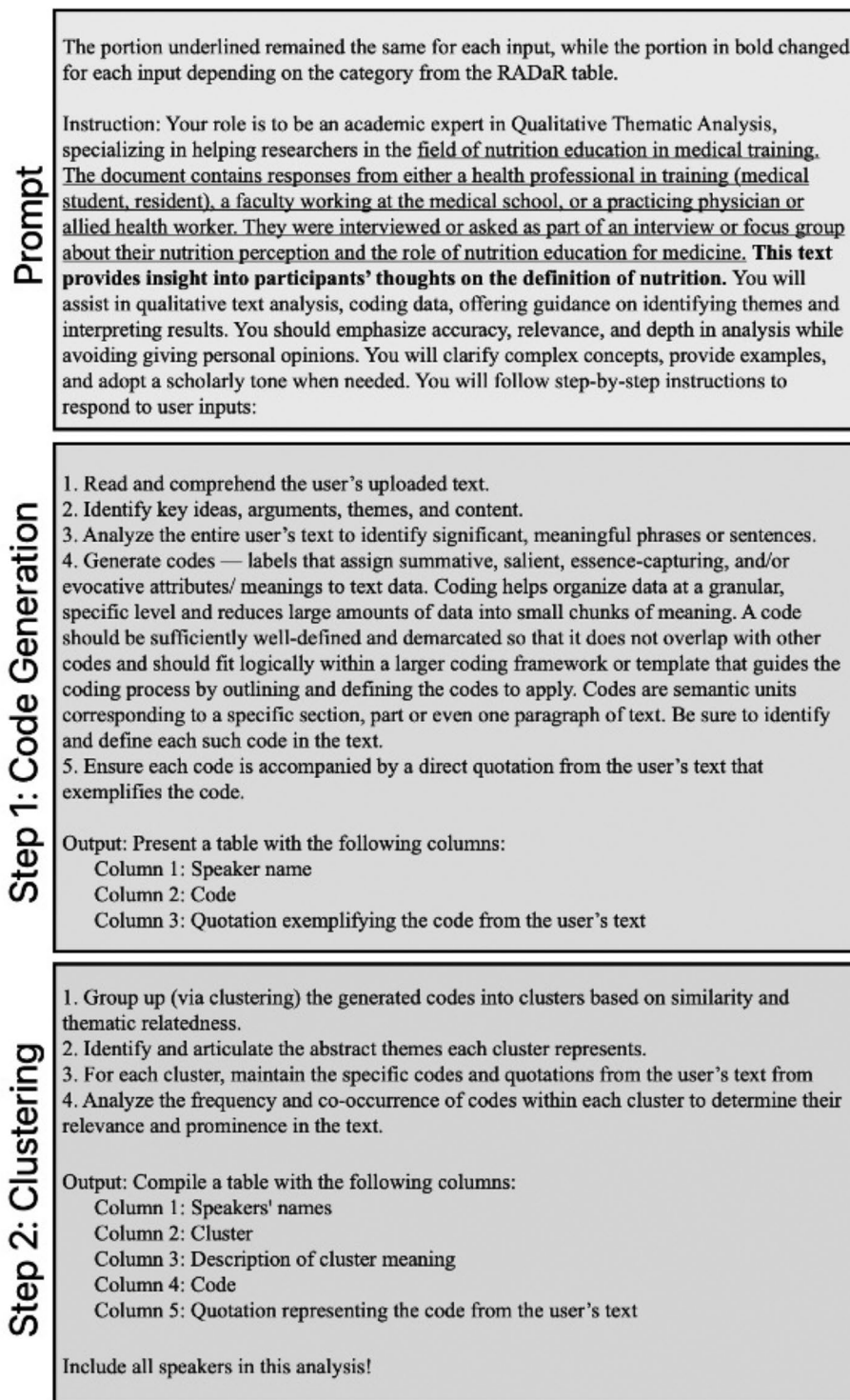


Fig. 1 AI prompt used to generate codes (Step 1) and clusters (Step 2) (Adapted from [19]). The portion underlined in the prompt remained the same for each input, while the portion in bold changed for each input depending on the category from the RADaR table

Table 1 Participant demographics (n = 25)

Demographic	Number (n)	Percentage (%)
Age (years)		
23-32	7	28%
33-42	6	24%
43-52	7	28%
53-62	3	12%
>63	2	8%
Highest Degree		
MD in Training	5	20%
MS	1	4%
MSW	1	4%
MPH	1	4%
RD	3	12%
NP	1	4%
MD	6	24%
PhD	7	28%
Gender		
Female	18	72%
Male	7	28%
Non-Binary	0	0%
Occupation		
Medical Student	5	20%
UME Faculty	12	48%
Resident Physician	1	4%
Attending Physician	1	4%
Registered Dietitian	3	12%
Other Professional	3	12%

MD doctor of medicine; MS master of science; MSW master of social work; MPH master of public health; RD registered dietitian; NP nurse practitioner; PhD doctor of philosophy; UME undergraduate medical education

“The extent of nutrition interaction was mostly indirect and not formally integrated into my preceptor interactions.” (P24, medical student).

“[We] talked about carbs and protein and ghrelin in GI but didn’t focus much on treatment besides telling patients to exercise and eat healthy.” (P19, medical student).

“Most of what I learned about nutrition was during the last 9 years of working at Geisinger.” (P23, other professional).

Importance of nutrition training in medical education

Participants discussed their understanding of nutrition, including its scientific basis, role in nourishment, and its importance in healthcare. Irrespective of their training, all participants acknowledged the importance of nutrition to human health, noting its impact on disease prevention, treatment, and overall health promotion. Several participants also emphasized the connection between nutrition and mental health.

“I think it is one of the core parts of human health. We all need nutrition to survive, but I think it can do

Table 2 Themes and subthemes related to the objectives of the study

Themes	Subthemes
Self-Perceived Training, Resources, and Competence	Lack of formal training External resources and dietitian referrals Self-directed interest or learning Nutritional skills for residency
Importance of Nutrition Training in Medical Education	Nutrition and mental health Disease prevention and management Societal and individual aspects of nutrition Training for various health professionals
Barriers to Nutrition Education	Time constraints Assessment and prioritization Insufficient faculty expertise Bias and stigma
Nutrition Integration Throughout Medical Training	Curriculum design Practical application Patient-centered approach Trainee perceptions
Facilitators to Nutrition Education	Accreditation bodies Stakeholder involvement Public policy and legislation Multilevel responsibility

so much more than just meet basic minimal needs. It plays into mental health, physical health, and prevention of chronic conditions. I would rate it 5/5 as being the most important to human health.” (P24, medical student).

“With good nutrition, you’ll not only have better physical health, but also better social relations and mental health.” (P6, attending physician).

Societal aspects of nutrition like access to food, oversimplification of nutrition, and the use of food as medicine were also noted by participants as important to medical nutrition training.

“We all assume that everybody has good access to food, to good food. That’s not the case.” (P14, UME faculty).

“Nutrition can be oversimplified in pop culture and non-medical settings with things like weight loss apps that consider calorie counting as the only factor rather than thinking about nutrition.” (P15, UME faculty).

“We can use food as medicine to help, and it allows for better patient outcomes when medicine and

nutrition are used together.” (P21, other professional).

Participants agreed that nutrition is an important part of preventing and managing diseases, particularly chronic diseases. Further, they recognized that specific nutrients and dietary choices can impact health conditions and outcomes.

“Poor nutrition increases the risk of all chronic diseases from diabetes to heart disease to cancers. There’s a definite correlation with poor nutrition and increased risk for chronic disease.” (P25, registered dietitian).

“There are over 220 different obesity-related diseases, which are related to nutrition. It’s also related to a bunch of different cancers, high blood pressure, diabetes, metabolic syndrome, arthritis, sleep apnea. The first line management for these chronic diseases is working on diet and exercise.” (P22, resident physician).

Despite participants’ agreement of the importance of nutrition on disease prevention and management, some participants pointed out that providing preventive nutrition is challenging because of our health system and policies.

“Insurance companies force us to operate this way because they don’t cover a pre-diabetic or obesity dietitian visit. They only cover the visit when the patient is beyond return.” (P12, registered dietitian).

When asked whether all physicians should receive training in nutrition, participants strongly agreed that they should; moreover, they emphasized the need for nutrition education across various health professions, not just physicians. Some participants highlighted the importance of nutrition education in mental health and other specific specialties such as psychiatry. They also discussed the role of nutrition in patient care and lifestyle choices and the need for physicians to guide these choices.

“Yes, nutrition is essential to life and all medical providers should receive training” (P9, other professional).

“Yes, anyone that is going to be prescribing and giving recommendations (nurse practitioners, physician assistants, midwives). I think most health care practitioners would benefit from nutrition training.” (P16, UME faculty).

“Yes, it factors so heavily into how our patients do at home and those daily choices that we can’t watch them make or we can’t prescribe are going to influ-

ence how our treatments work.” (P8, medical student).

Barriers to nutrition education

Generally, participants recognized that there are many existing curricular requirements students need to complete during the four years of medical school, with the curriculum being described as “tight” (P2, UME faculty) with many learning objectives “crammed” (P1, UME faculty) into it. Many participants expressed the difficulty of making curricular changes and figuring out where nutritional content would fit best.

“Time is always a barrier, especially depending on the type of curricular structure and how difficult it is for an individual discipline to add content time or make changes” (P16, UME faculty).

Participants felt that trainees are expected to learn and apply an enormous amount of content in a short period of time, citing informational or cognitive overload that could result from the addition of more content.

“Limits on the amount of information students can learn” (P10, medical student).

“So much stuff for us to learn” (P22, resident physician).

Most participants felt that time was a true barrier preventing more nutrition education from being incorporated into the medical curriculum. However, a few participants had opposing viewpoints on the concept of time.

“Often, time isn’t really an issue, but folks see it as an issue. So, I think ways in which we can augment what we’re already doing could be integrated rather than thinking about adding on” (P15, UME faculty).
“Time should not be a factor unless you think linearly, you’re going to line up a set of bricks, one after the other after the other. Then of course you’re going to run out of time... We got to quit thinking linearly” (P14, UME faculty).

Many participants felt that there is a lack of nutritional expertise among medical science educators and physicians, who serve as teachers for young trainees. Participants also recognized that nutrition is a field that requires expertise in multiple disciplines to teach effectively, ranging from basic and clinical sciences to Systems Society and Humanism in Medicine (SSHM).

"I also think one of the other challenges is with people, is how many folks will be involved in this. We think about nutrition. It's broad, it's basic science, it's clinical signs, it's SSHM. So, there are a lot of folks that should be involved in some way" (P15, UME faculty).

One participant countered that there is not necessarily a lack of expertise, but rather that the existing expertise is underutilized; moreover, some participants expressed that this lack of expertise may be due to the quickness with which nutritional policies and research are developing.

"Let's tap into all that, all the expertise we already have in the school and in the clinical space" (P14, UME faculty).

"Current nutrition textbooks don't address all the new developments in a proper way, so I think we are sort of light years behind" (P5, UME faculty).

"Time and rapid pace at which new research comes out. It's constantly evolving and changing, so it's hard to keep up with that" (P11, registered dietitian).

Participants recognized that there is a lack of nutrition representation on both in-house and board exams. They concluded that there is no incentive to prioritize nutrition education in the medical curriculum. Participants noted that this lack of assessment focus creates curricular constraints and restrictions on what can be taught, so students are forced to engage in self-directed education based on their interests to learn more about nutrition.

"I don't think I was actually assessed on my nutritional knowledge ever. Even on STEP exams" (P24, medical student).

"Scoring low in nutrition has never really impacted test scores or graduation rates, so there's never been an incentive to make it more of a priority" (P9, other professional).

"It was more ask questions if you have them and everything I learned was self-sought out" (P24, medical student).

When nutrition is included in assessments, there were comments discussing the discrepancy between nutrition assessment and nutrition application with patient interactions. One participant noted that the lack of reinforcement through practical application creates a retention problem for students.

"It was more in the context of a disease process rather than about the everyday practice of nutrition like I would have hoped" (P24, medical student).

"I think the focus has been on simply the medical knowledge piece in terms of what does a vitamin do and whatnot, as opposed to the rest of the competency domains in terms of how to utilize" (P13, UME faculty).

"The way we're currently assessed works to get the knowledge into your brain temporarily, but I think we have a problem of forgetting things after an exam" (P10, medical student).

Participants recognized that students, those who practice medicine, and those who design curricula are all capable of bias and stigma regarding nutrition and nutrition-related disorders, such as malnutrition and obesity.

"I don't know if it's [physicians] don't have the time or if they're afraid. They feel, you know, maybe looking at someone who's large, it's falling on deaf ears" (P7, UME faculty).

Many participants noted that there is a preference for medication over lifestyle changes in medicine, creating "skepticism" towards disease management using diet and exercise. Participants commented that there are societal factors outside of academia that contribute to this culture in the medical curriculum. The most identified societal factors were related to monetary compensation, insurance coverage, and the public's view on nutrition.

"[Physicians are] paid more to prescribe meds, [and] patients might not respect something like a nutritional intervention as much as something they can get at a pharmacy" (P5, UME faculty).

Nutrition education integration throughout medical training

Participants in this study identified several opportunities for the integration of nutrition education throughout medical training. There was consensus among the interviewees that integrating nutrition education into the existing curriculum at various levels is a superior approach to reinforcing the skill set of medical trainees. In addition, several participants emphasized a longitudinal approach to nutrition education, beginning in medical school and continuing into residency and fellowship, along with providing continuing education opportunities.

"Throughout one's medical training. Starting with introduction to nutrition in the medical school and progressing towards more in-depth understanding/practicing/application into later years of residency/fellowship." (P6, attending physician).

"Continuing education whenever it can be fit in" (P11, registered dietitian).

Most of the participants quoted the importance of building a strong foundation of knowledge during pre-clinical phase 1 through case-based learning (CBL) sessions and iterations of integrated science courses (ISC) in the existing curriculum and gravitated towards elective options when approaching phases 2 and 3.

“CBL cases and ISC workshops; make it a ‘thread’ (smaller than a theme); weave it into the different blocks: gouty arthritis in MSKD, gluten intolerances in GI, diet allergies for immunology, salt and potassium content in Renal, carb counting and glycemic index in Endo/Repro, nutrition for pregnancy in Endo/Repro, binge eating and caloric restriction in Neuro/Psych” (P18, UME faculty).

“Yeah, definitely just more lectures about nutrition for like med students and then more like a dedicated rotation spending time with a nutritionist to actually apply what they’re learning.” (P22, resident physician).

“If there was to be a nutrition course offered at GCSOM, a shorter or light version of the course could be offered towards the end of the pre-clerkship years before students go into the clinical space. Then do another course in the 4th year. Maybe a rotation, especially in the early part of medical school where medical students can go maybe shadow a dietitian.” (P24, medical student).

Recommendations for practical hands-on experiences and an integrative, holistic approach were discussed to highlight the importance of considering patients’ wellbeing. They included considering nutritional interventions along with pharmacological management and alternative remedies in addition to practicing real-world application of nutritional knowledge.

“Integration into pre-clinical blocks, along with having students do community outreach through clinics or community events at the school if students are properly trained and competent enough to give advice and discuss nutrition” (P7, UME faculty).

“Consider for each condition pharmacological and other treatment options...Include evidence-based alternative treatment into reimbursement.” (P5, UME faculty).

Apart from homing in on scientific nutritional knowledge, several participants voiced the importance of taking a patient-centered approach while assessing their needs, cultural, social and financial/economic limitations. Participants agreed that a comprehensive patient assessment and motivational interviewing foster an increased understanding of patient perspectives, thereby enabling

practicing medical professionals to provide well-suited nutritional care.

“Being able to gather a nutrition history, being able to dive into social factors and access to food, motivational interviewing, cultural competency with foods and personal preferences” (P16, UME faculty).

“Knowledge about different food choices and substitutions, being able to provide dietary advice to patients” (P22, resident physician).

Addressing perceptions and attitudes of practicing medical professionals towards nutrition-related health conditions such as obesity is seen as a valuable opportunity for improvement. Participants emphasized the importance of clear, empathetic physician-patient communication and the need to address these issues with sensitivity, avoiding stigmatization.

“Seeing obesity as a medical condition involving malnourishment rather than stigmatizing it and seeing patients as ‘lazy’ or ‘not caring,’ also seeing obesity as a spectrum” (P6, attending physician).

“Being sensitive and not scaring the patient since weight and nutrition are personal topics.” (P7, UME faculty).

Facilitators to nutrition education

Participants explained that the curriculum is limited by the content of national medical licensure examinations, such as the United States Medical Licensing Examination (USMLE) Step exams. Participants concluded that initiatives need to come from a higher level to create standards that would drive curricular change.

“[Educators are] constrained to what’s on Step 1” (P1, UME faculty).

“There are some limitations in what we can teach. Lack of incentive to teach it” (P5, UME faculty).“We can push things a certain level, but in isolation we can only take it so far. Step/Boards have to step up” (P1, UME faculty).

Some participants emphasized that those who are directly affected by nutrition education like medical educators, medical students, and physicians should be the individuals advancing nutrition training. A couple of participants noted that students need to express a desire for increased nutrition education. Several participants also commented on the role of educators in implementing curriculum and conveying the value of nutrition to students. One participant touched on the implementation of nutrition education in the clinical setting.

“One more stakeholder that I think would be essential would be our students. Maybe ask recent alumni that have done a bit of their residency and see if they felt prepared with what was already provided, or if they felt that there was capacity anywhere to shove even more in the curriculum” (P3, UME faculty).

“We need to be very focused in delivering nutritional content and it has to be implemented in such a way that the students recognize the value and necessity of it” (P2, UME faculty).

“I think we also need to bring hospital leadership into it to help with the patient side of things, like with patient education and getting this information or these courses available to other healthcare providers outside of medical school” (P24, medical student).

Other participants stated a need for a more systemic approach that involves governmental bodies making legislative or public policy changes. There was a sentiment that only so much can be done at the individual level, and that there are obstacles to advancing medical nutrition education and allowing nutrition to be a bigger part of medical care that needs to be addressed at a higher level.

“Policy level - we can provide all the tools, we can provide all the information about healthy nutrition. But at the end of the day, living in a food desert is beyond the control of the community. There’s an opportunity to really involve more local and state governments to really address nutrition issues in the state and beyond” (P15, UME faculty).

“Legislation could help with improvements. One thing for dietitians, there’s very limited insurance coverage to see a dietitian...They’ll cover for diabetes. They’ll cover for end stage kidney disease, but Medicare/Medicaid doesn’t cover for any other diseases. So, there’s so many things out there, pre-diabetes. You can’t come see a dietitian. If you had pre-diabetes, you have to wait until you have diabetes. So, I think on a legislative standpoint, we need some reform so that we could get coverage for people to help prevent it, because we’re just chasing it after the fact. You know, we’re not showing them how they can prevent the disease. So that is the biggest barrier with nutrition” (P25, registered dietitian).

Some participants felt that the responsibility for implementation should not fall on one individual or organizational body, but rather should be more of a collective effort with interprofessional collaboration.

“I think that this is truly an interprofessional opportunity to make changes” (P13, UME faculty).

“I guess it starts originally with the academic side of things and then circles down to the community” (P8, medical student).

“I feel like it’s kind of on all levels” (P22, resident physician).

Discussion

Previously, we quantified structured content hours dedicated to nutrition education in GCSOM’s Total Health Curriculum and uncovered notable gaps, especially in reinforcing nutrition counseling skills and addressing social determinants of health [11, 12]. The current study contextualizes these findings and highlights the various perspectives of key stakeholders regarding self-perceived competency in nutrition, the importance of nutrition education in medical training, opportunities for improvement, and barriers and facilitators for implementing nutrition education.

Participants without a degree or certificate in nutrition reported low nutritional competency, citing a lack of formal education in medical training as the main contributing factor. All five medical students who were interviewed—three from the pre-clinical phase (phase 1: Principles of Medicine and Practice) and two from the clinical phase (phase 3: Career Differentiation and Exploration), reported a low level of self-perceived nutrition competency but highlighted different aspects of their medical training. Students in phase 3 emphasized their lack of confidence interacting with patients about nutrition-related topics and noted low nutrition competency among the doctors they interacted with, while the phase 1 students underscored their lack of nutritional knowledge due to limited textbook/classroom learning materials. By comparison, a Dalhousie University study assessing self-perceived nutrition competency among first- and second-year medical students, found that first year students reported higher levels of competency than second year students [4]. Our findings most likely reflect the varied extent of training received by phase 3 students compared to phase 1 students and indicates that nutritional competency does not improve as students progress through our Total Health Curriculum.

Collectively, study participants’ main exposure to nutrition education was outside of the curriculum and largely self-sought based on personal interest. Regardless, participants felt that to provide better patient care, clinicians should be competent in multiple facets of nutrition care such as gathering a comprehensive nutrition history, providing dietary advice, practicing evidence-based nutritional medicine, collaborating with other professionals like dietitians, and considering the role of socioeconomic factors in patient behavior. These suggested competencies align with findings from a study by Caldow et al.

that assessed what doctors with formal nutrition training think they need to know about nutrition [6]. Physicians in that study noted the importance of providing prescriptive nutrition advice to patients as a part of an interdisciplinary team, recognizing how the social determinants of health impact dietary choices and nutrition status, and critically evaluating nutrition literature to avoid promoting “fad” diets and misinformation.

Despite the lack of formal training and standardization of nutrition education, all participants recognized the importance of nutrition to overall health, mental health, and disease prevention or management. Most (92%) participants felt that all physicians should receive nutrition training, particularly primary care providers. Healthcare professionals such as physician assistants, nurse practitioners, pharmacists, mental health providers, psychologists, social workers, case managers, nurses, nurses’ aides, and midwives were also mentioned as needing training. In fact, there was a general sentiment that anyone who interacts directly with patients or provides hands-on care should receive nutrition education. Citing various healthcare professionals, participants believed that nutritional care requires collaboration among providers, rather than physicians being the sole providers of care. Some participants felt that specialists (i.e., psychiatrists, cardiologists, endocrinologists, wound care physicians) also need training, which differs from published literature reporting primary care physicians as the main doctors providing nutritional care [7]. Given that only 1% of the content on the gastroenterology certifying examination covers nutrition, there is a clear disconnect between the nutrition competencies evaluated in sub-specialty training and the importance participants place on having specialists proficient in nutrition [20]. The main barriers reported as hindering the advancement of medical nutrition education were time constraints, lack of expertise, assessment/prioritization, and bias and stigma. Time was the most frequently mentioned barrier, yet there was some variation in participants’ perspectives. While most participants felt that time was a legitimate barrier, a couple participants suggested that the issue may not be with time itself, but rather how that time is being perceived and used throughout the curriculum. Many participants recognized that time constraints and assessment/prioritization are intertwined. Participants noted that because there is limited time, the curriculum is restricted to the content covered in assessments. Additionally, students will devote less priority, time, and cognitive effort to topics like nutrition that are not as frequently tested on in-house and USMLE exams. Participants also reported a lack of faculty expertise in nutrition. This aligns with a concept in previous literature called a “catch 22,” where there is an issue providing medical trainees with

nutrition education, because there is a lack of knowledge among physicians and medical educators [21].

Our study suggests that integrating nutrition education throughout medical training is a more effective approach than teaching it as a stand-alone topic. These findings are supported by the work of the Association for Nutrition’s working group in the United Kingdom, which identified numerous opportunities to embed nutrition competencies in the General Medical Council’s Outcomes for Graduates. For instance, nutrition plays a crucial role in safe medication prescribing due to potential drug-nutrition interactions, highlighting the need for its integration into pharmacology. Moreover, integrating nutrition into pharmacology could offer nutrient-based alternatives to medications, reducing the need for polypharmacy and enhancing patient care [22]. As medical school curricula increasingly integrate previously separate courses into a single unit and introduce clinical exposure earlier in training, our findings underscore the need for nutrition training to model these changes towards integrated education.

Participants also shared challenges they faced as individuals navigating the healthcare system and emphasized the need for legislative reforms. Recent legislation aimed at improving medical nutrition education, such as New York State Senate Bill S4401A, calls for the development and distribution of resources for practicing physicians related to continuing medical education and training in nutrition [23]. Similarly, the Medical Nutrition Therapy Act of 2023 expands Medicare coverage to individuals with chronic diseases beyond diabetes and chronic kidney disease [24]. These legislative efforts demonstrate the growing demand for nutrition-competent physicians and emphasize the relevance of our study’s findings.

Notably, this study is the first to combine the RADaR technique with AI for data analysis. The strength of this approach lies in the manual creation of the RADaR table, which simplified the dataset and provided a reference for validating AI-generated outputs. This manual review of transcripts familiarized researchers with the data, making it easier to validate AI results. Additionally, entering RADaR data into Copilot rather than full transcripts helped protect participant privacy, addressing ethical concerns around AI use in research [25]. While AI is not a replacement for human interpretation, it can supplement manual coding and enhance the efficiency of thematic analysis. However, AI has limitations, including a descriptive rather than interpretive nature, potential generation of false quotations, incorrect coding, and inherent biases [19, 25]. We found that Copilot sometimes assigned inaccurate codes requiring researcher re-direction, but it did not produce false quotations. Despite these limitations, AI can be a useful starting point in qualitative research, by performing the initial coding and

then allowing researchers to critically refine the findings using their expert judgment [19].

Additionally, to our knowledge, this investigation includes the widest range of participants, encompassing medical students, residents, clinicians, and educators. This breadth of perspectives offers key insights into the continuity of medical training and helps to easily identify transitional gaps. One notable limitation is that our sample included fewer postgraduate trainees and GME faculty members. Further, due to our sampling methods, our study may have favored students and faculty members with a particular interest in nutrition. The study was limited to the perspectives from one health system, which could affect the generalizability of the findings. While our study aimed to gather insights into the role of behavioral change theory and social determinants of health in medical nutrition education, the responses predominantly centered on perspectives regarding how nutrition content is taught to medical students. We believe that equipping future healthcare professionals with knowledge on nutrition is a crucial aspect of their training, however, we recognize that translating this knowledge into effective patient care also requires an understanding of relevant social forces and counseling techniques, such as motivational interviewing. Thus, we encourage further investigation into how behavioral change theories and social determinants of health related to nutrition are incorporated into medical school curricula.

While we focused on the perceptions of a wide range of stakeholders regarding nutrition education in the academic setting for this study, we also queried participants about barriers to advancing nutritional care in the clinical or community setting with an eye towards future steps. Reported obstacles included time constraints on appointments, lack of insurance reimbursement and coverage for preventive care, conflicting dietary information, and patient reluctance to adopt lifestyle changes over medications. Our future work will explore the perceptions of community members regarding nutrition, their experiences discussing nutrition with their physicians, and their thoughts on the level of nutritional knowledge physicians should have, aiming to pair those findings with insights from this study to inform adjustments of Geisinger's medical education curriculum.

Conclusion

This study underscores the critical need for enhanced nutrition education within medical training programs. Our findings revealed notable gaps in nutritional competency among medical trainees, particularly those without formal nutrition education. The lack of self-perceived competency in both pre-clinical and clinical phase medical students highlights the need for a more integrated and comprehensive approach to nutrition education

throughout the medical curriculum. Participants unanimously recognized the importance of nutrition in patient care and advocated for its inclusion across various healthcare professions. Despite the barriers identified, such as time constraints and lack of expertise, there is a clear consensus on the need for collaborative efforts to improve nutrition training in medical education. Future research will focus on expanding the sample size to include more postgraduate trainees and clinical faculty members, as well as exploring community perspectives on nutrition. These insights will be invaluable in refining medical education curricula to better prepare healthcare professionals for the nutritional aspects of patient care.

Abbreviations

AI	Artificial intelligence
CBL	Case-Based Learning
GCSOM	Geisinger Commonwealth School of Medicine
GME	Graduate medical education
ISC	Integrated Science Course
RADaR	Rigorous and accelerated data reduction
UME	Undergraduate medical education
USMLE	United States Medical Licensing Examination

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12909-024-06588-4>.

Supplementary Material 1

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Author contributions

OK: Thematic analysis, data collection, and writing- original draft and review and editing; MT: conceptualization, methodology, data collection, and writing- original draft and review and editing; KF: data collection; HJ: data collection and writing- review and editing; AG: data collection; AS: data collection and writing- review and editing; MH: data collection; AN: data collection. SM, GW, and SL contributed to all aspects of the study and writing the manuscript. All authors read and approved the final manuscript.

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Data availability

Data is available upon request from the corresponding author.

Declarations

Ethics approval and consent to participate

Ethics approval for this study was obtained by Geisinger's IRB (Federal-Wide Assurance No. 00000063) and met the criteria for exemption as defined in the US Department of Health and Human Services Regulations for the Protection of Human Subjects [945 CFR 46.104]. The study protocol, including verbal informed consent, was reviewed and approved by the Geisinger IRB (Protocol #2023 – 1250). The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Data were handled in anonymously and confidentially. Participation was voluntary and verbal informed consent was obtained from each participant before proceeding with the interview or focus group.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author information

OK, HJ, AG, and AS are preclinical medical students at GCSOM with varied interests in nutrition. MT, KF, and MH are clinical medical students. AN is a first-year neurology resident at Thomas Jefferson University Hospital. SM is an Assistant Professor of Biochemistry and Physiology; GW is Professor of Physiology and Immunology and Vice Chair of the Department of Medical Education; SL is a Professor of Biochemistry and Associate Dean for Research and Scholarship with an interest in nutrition education.

Author details

¹Department of Medical Education, Geisinger Commonwealth School of Medicine, Geisinger College of Health Sciences, 525 Pine Street, Scranton, PA 18509, USA

²Department of Neurology, Thomas Jefferson University Hospital, Philadelphia, PA 19107, USA

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