Neglected Nutrition:

A Call to Action for the Federation of State Medical Boards (FSMB) and the National Board of Medical Examiners (NBME) to Update the United States Medical Licensing Examination (USMLE)

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ABSTRACT

With more than 93 million US adults already living with obesity (Centers for Disease Control and Prevention, 2018), it is unsurprising that obesity-related diseases like type II diabetes, coronary heart disease, stroke, and several types of cancer are becoming the most prevalent health concerns physicians are presented with. Accordingly, nutrition is now a recognized determinant in three of the top four leading causes of death in the United States and subsequently has been validated extensively as an effective preventative health measure through experimental, observational, and controlled clinical trials (Kris-Etherton et al, 2014). Despite evidence supporting nutrition as a cost-effective and low-risk treatment for chronic disease, fewer than thirty percent of medical schools meet the minimum hours of nutrition education recommended by the National Research Council (Bradley et al, 2017). Therefore, medical schools are not adequately training their students in nutrition, which results in lack of confidence in both student and physicians to counsel patients about healthy dietary behaviors. Medical schools prioritize their students' performance on the USMLE Step exams, and thus shape their curricula around what competencies are present on those exams. By using an ecological model as the framework for intervention, a two-part literature review encompassing the community, organizational, and policy levels was conducted. Upon analysis of the most prevalent nutrition-related treatment recommendations published by professional medical organizations, six specific, evidence-based, nutrition-related competencies were outlined. These recommended competencies are put forward as essential additions to the USMLE Step exams.

INTRODUCTION

Statement of the Problem

According to the Bipartisan Policy Center, fewer than thirty percent of medical schools currently meet the minimum hours of nutrition education recommended by the National Research Council (Bradley et al, 2017). Thus, it is unsurprising that less than twenty-five percent of physicians report feeling adequately trained to counsel their patients on healthy eating or physical activity (Bradley et al, 2017).

Since 1985, the National Academy of Sciences has advised the National Board of Medical Examiners (NBME), the organization that develops the United States Medical Licensing Examination (USMLE), to cover basic nutrition knowledge (Hark et al, 1997). Over the past several decades, the USMLE, a three-step examination necessary for medical students to pass in order to practice as a licensed physician, has evolved to include some nutrition-related competencies. However, while nutrition generally appears throughout examination material, it is addressed in a manner that is not reflective of the chronic conditions that patients currently experience (Patel et al, 2015). For example, vitamin and mineral deficiencies encompass the majority of the nutrition-related competencies on the exam, displayed through references to conditions like Beriberi, Pellagra, Scurvy, and Rickets. However, all of these conditions are rarely encountered nowadays in the United States, and the proposed treatments are vitamin supplements not a change in eating habits (Patel et al, 2015).

As the current obesity epidemic increases exponentially across the nation, obesity-related diseases like type II diabetes, coronary heart disease, stroke, and several types of cancer are also rising in prevalence. With more than 93 million US adults already living with obesity

(Centers for Disease Control and Prevention, 2018), some statistical models report that in thirty years, one in three adults will suffer from type II diabetes (Patel et al, 2015). Thus, there is a growing demand to address the nutrition-related health needs of the American population. In order to accomplish this, physicians need to be adequately trained in nutrition-related practices, such as medical nutrition therapy and dietary behavior change, in order to attend to the changing clinical profile patients now, and will increasingly continue to, experience.

This thesis aims to inform the two owning and governing bodies of the United States Medical Licensing Examination (USMLE), the Federation of State Medical Boards (FSMB) and National Board of Medical Examiners (NBME) regarding the current literature related to the present nutrition-related content currently on the USMLE and how it impacts the subsequent nutrition-related knowledge of medical students and physicians. Further, a set of nutrition-related competencies will be recommended for the FSMB and NBME to include on future USMLE Step examinations. The ecological model framework, originating from public health theories of prevention, will be used to convey how higher-level policies, in this case policies to update the USMLE exam, can influence lower organizational and interpersonal levels, like the academic competencies in individual medical schools.

Background and Significance

Part I: Nutrition-related Content Covered on the USMLE

According to the FSMB and NBME, the USMLE includes nutrition on both the Step 1 and 2 exams. For over 30 years, the degree to which nutrition is comprehensively included in both medical education and licensure examinations has remained uncertain. A study published in the American Journal of Clinical Nutrition in 1997 examined the extent to which the 1986 Part I and

II and the subsequent 1993 Step 1 and 2 exams adequately addressed nutrition (Hark et al, 1997). Five nutrition professionals coded nutrition-related content of the exams to identify the change in coverage from 1986 to 1993 (Hark et al, 1997). It was found that on the Part I/Step 1 exam, nutrition-related content increased from 9% to 11%, and on the Part II/Step 2 exam, it increased from 6% to 12% (Hark et al, 1997). In accordance with the patient profile and health needs of the early 1990s, this was considered to be adequate in amount; however, the content and appropriateness of the items quantified were never evaluated (Hark et al, 1997).

Although the content and format of the USMLE exam has evolved since its inception, it is apparent that relevant nutrition concepts that are imperative to the understanding of chronic disease are still absent (Patel et al, 2015). A more recent study demonstrated this knowledge gap by reviewing several types of materials pertaining to the 2012/2013 USMLE exam (Patel et al, 2015). Due to the confidential nature of the actual Step exams, researchers examined and analyzed the nutrition-related information of the USMLE Step 1, 2, and 3 Content Description documents released by the test administrators as well as two prominent Step 1 preparation books (Patel et al, 2015). The findings corroborated those of earlier studies; adequate nutrition-related material was present, but the actual content of the material was severely lacking (Patel et al, 2015). It was reported that there was minimal information regarding chronic diseases, no apparent content related to disease prevention, and major gaps in essential specifics revolving around clinical morbidities and food/nutritional science (Patel et al, 2015).

To date, there is only a brief summary of the content changes that were planned for the 2015-2016 USMLE exam that could be readily found. The handout put forth by the USMLE administrators on April 8, 2015 outlines what will and will not change for Step 1, 2, and 3

examinations. The Step 1 exam in 2015 reportedly included an increased focus on quality improvement principles and safety science. Meanwhile, the Clinical Knowledge section of the Step 2 exam in 2015 emphasized quality improvement principles, safety science, epidemiology, biostatistics, population health, professionalism, and interpersonal and communication skills. Thus, there has been no outwardly or apparent effort to expand the inclusion of nutrition knowledge related to chronic diseases on any of the USMLE examinations so far.

Part II: Importance of Nutrition-related Medical Education

Nutrition is a recognized determinant in three of the top four leading causes of death in the United States, including diseases of the heart, malignant neoplasms, and cerebrovascular diseases (Kris-Etherton et al, 2014). Its importance as a preventative health measure has been validated extensively through experimental, observational, and controlled clinical trials, all of which have contributed to the dietary recommendations we are familiar with today (Kris-Etherton et al, 2014). Furthermore, diet and physical activity interventions aimed at the treatment of chronic disease have increasingly shown improvement and benefits that equal, if not greater, than those of pharmacological remedies (Kris-Etherton et al, 2014). Hence, there is an abundance of evidence that supports nutrition as a cost-effective and low-risk means to treat and prevent chronic disease (Kris-Etherton et al, 2014).

Even though the importance of nutrition education for medical providers has been well-established, it remains a low priority for medical training institutions (Kris-Etherton et al, 2014). A 2010 survey reported that medical schools offering a dedicated nutrition course had declined by 10% from 2000 to 2005 (Kris-Etherton et al, 2014). Further, by 2008 only 19.6 medical school

hours on average were devoted to nutrition-education and skill building, which undercuts the Institute of Medicine's 25-hour recommendation (Kris-Etherton et al, 2014). As expected, in a questionnaire administered by the Association of American Medical Colleges (AAMC), over 50% of medical students during this time period (2000-2005) reported that the time spent on medical nutrition education was inadequate (Patel et al, 2015).

Numerous studies substantiate the lack of confidence both medical students and physicians feel regarding their nutrition-related knowledge and ensuing skills to counsel patients about a healthy diet. This is an unacceptable, significant gap in medical training that negatively impacts the level of care patients later receive. Although this issue is not new, the magnitude of its deleterious effects are expanding – even if the alarming, upwards trend of obesity and obesity-related diseases diminish, the next several generations of US physicians will be caring for a population of patients with a clinical profile influenced by obesity (Patel et al, 2015). Furthermore, physician education in nutrition is essential because they traditionally act as the gatekeepers of medical care in this country (Kris-Etherton et al, 2014). Thus, by increasing physician nutrition knowledge, not only would they feel comfortable counseling patients at least on a basic level, but they would also become greater proponents and sources of referral to other relevant health care professionals, like registered dieticians and nutritionists (Kris-Etherton et al, 2014).

It is evident that the need for nutrition education in medical schools is both necessary and lacking. Potential reasons to explain this discrepancy have been explored, including the exponentially expanding medical knowledge in conjunction with limited class time, nutrition experts unavailable to teach, and inadequate clinical opportunities with formal training to

practice lifestyle counseling skills (Patel et al, 2015). Since medical schools overwhelmingly view their duty and success as a measure of how well their students perform on the USMLE Step exams, a unique opportunity presents itself. Thus, if the USMLE exams included test questions regarding nutritional therapies as they related to chronic disease, medical schools would be both incentivized and compelled to include these items in their curricula. Furthermore, exam content encompassing nutritional recommendations for potential patients suffering from conditions like obesity, type II diabetes, hypertension, and hyperlipidemia would better prepare future physicians for the patient population they are going to encounter.

AIMS

The goal of the first part of this thesis, a literature review, is to understand and consolidate the current evidence relating to nutrition education in US medical schools. The second part, the analysis of nutritional treatment recommendations for obesity, will consolidate and compare the suggested nutritional interventions made by esteemed, professional medical organizations. Combined, the review and analysis will then be used to inform the USMLE administering and governing bodies, FSMB and NBME, of the essential nutrition-related updates necessary for the exam. Specific nutrition-related competencies will be extracted from the most cited treatment recommendations and be put forth as content recommended for inclusion on future iterations of the USMLE Step exams.

In order to both appeal to the relevant stakeholders and maximize the understanding of the importance of nutrition-related knowledge of medical students and physicians, the two-part literature review will cover three distinct levels of the proposed ecological model. The first part will include the nutrition-related content of the most current USMLE exam (community

level), and nutrition education in medical schools (organizational level). The second part will be comprised of a consolidation and analysis of the nutrition-related treatment recommendations for obesity put forth by professional medical organizations (policy level). Following this thorough review, the most prominent and relevant nutrition competencies deemed necessary for future physicians to know will be identified and integrated into actionable recommendations. Then, a formal proposal for the improvement of nutrition concepts covered on the USMLE will be composed for the FSMB and NBME to review.

The specific aims of this thesis are as follows:

1. Apply the Ecological Model as a framework for organizing the literature reviews and subsequent analysis
2. Conduct a literature review in the areas of:
    a. Nutrition-related content of the USMLE
    b. Nutrition-related curricula included in medical schools
    c. Nutrition-related treatment recommendations for obesity published by professional medical organizations
3. Complete a thorough analysis of the nutrition recommendations in order to identify necessary nutrition competencies that should be included on the USMLE
4. Organize a formal proposal and call-to-action for the USMLE to be updated and submit it to FSMB and NBME

FRAMING THE LITERATURE REVIEWS: THE ECOLOGICAL MODEL

Originating in the 1960s, predominantly among community psychologists, ecological models were popularized as ways to approach the determinants of issues that extended beyond individuals (Richard et al, 2011). The principles from biological ecology were translated to mimic and describe relationships between individuals and their environment (Richard et al, 2011). The "dynamic complexity within an ecosystem" was used as an outline for the ecological perspective, which was later refined and applied to health promotion interventions by McLaren & Hawe (Richard et al, 2011). They visually conceptualized different levels of influence by showing a series of concentric circles, with each larger circle representing an increasing reach of influence (Richard et al, 2011). The levels interacted with one another, and they included the intrapersonal realm, interpersonal process, organizational processes, community, and public policy (Richard et al, 2011).

Ecological models are effective in the development of health interventions because they clearly demonstrate the need for multiple, dynamic health education and promotion strategies to achieve population-level changes (Richet et al, 2011). Even though these models are not novel, practitioners continue to focus on individual and interpersonal determinants as leverage points for interventions (Richet et al, 2011). Individual or interpersonal levels may offer more transparent data collection opportunities and faster quantifiable results; however, the outcomes are often insignificant, unsustainable, and neglect relevant political and cultural barriers. Thus, interventions targeted at levels beyond the individual, like public policy, are both more impactful and effective.

An ecological model was used as a framework to organize the hierarchal influences that determine how nutrition counseling fits within the patient-physician relationship. In order to categorize the convoluted network of interactions between society, policy, physicians, and patients, with respect to nutrition, I created a cause-and-effect cyclical diagram (Figure 1).

Figure 1: *Cyclical diagram to inform ecological model.*

This demonstrates how the FSMB and NBME fit within the factors that ultimately determine how physicians interact with patients regarding nutritional treatment recommendations. Starting at the circle in the top, center of Figure 1, societal and political views shape how nutrition is valued generally, which determines what physicians are expected

to know. This assumption of knowledge is portrayed as what material medical students are tested on for the USMLE exams. Medical schools teach their students based on the competencies tested on such exams, so physician knowledge is directly impacted by what FSMB and NBME decides to include. After completing the USMLE exams, these new physicians take that knowledge to their patients, which eventually permeates throughout society.

From this cyclical diagram, I was able to parse out more specific factors that influenced the inclusion of nutrition in medical school curricula. Starting from the policy level at the top and ending with the individual level at the bottom, I created the ecological model shown below (Figure 2).

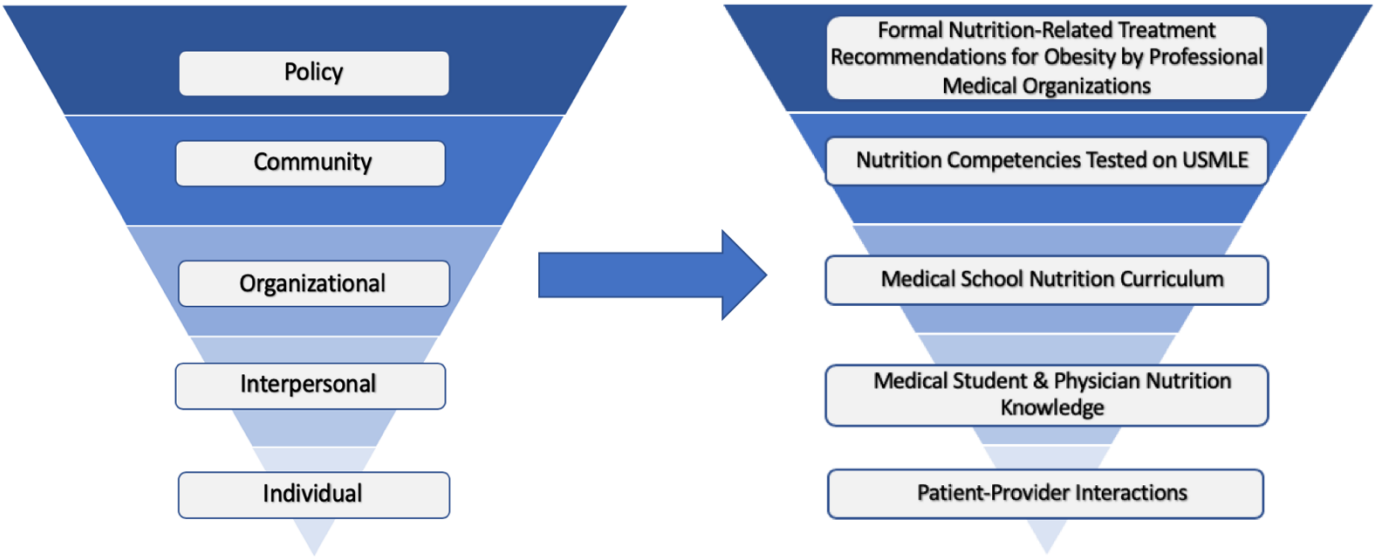

Figure 2: *Ecological model framing interaction of nutrition knowledge at various levels impacting physicians.*

In order to devise a significant intervention, this thesis will include a multi-part literature review that focuses on the policy, community, and organizational levels. After gaining a

comprehensive insight into how these levels interact to ultimately affect impact the medical school nutrition curricula, then a combined policy- and community-level intervention will be proposed. Intervening at both the policy- and community- levels is the most practical point of entry for this thesis because it will have population-level impact while avoiding unrealistic, arduous processes involving mass social or legislature change. The goal is that targeting the USMLE exam will have a cascading effect; First, it will impact medical schools, medical students, practicing physicians, and eventually reach patients themselves through the interactions they have with their healthcare practitioners.

LITERATURE REVIEW

Part I: Community and Organizational Levels – Nutrition-related content of the USMLE Exams and Medical School Curricula

Methods

In order to understand the comprehensive landscape surrounding the prevalence and barriers of integrating a more robust, standardized nutrition curricula in medical school, this first part of the literature review focuses on two important components. The first is an investigation of the nutrition-related content covered on the USMLE Step exams, which aligns with the community level depicted in the ecological model in Figure 2. The second part is a summary of the current state of nutrition concepts covered in undergraduate and graduate medical education, which corresponds to the organizational level presented in Figure 2.

This multi-level literature review is comprised of peer-reviewed journal articles compiled from Columbia University Libraries' CLIO database from November 2019 to February 2020. Journal articles were searched for using combinations of the following key words:

obesity, nutrition, treatment, physician knowledge, physician attitude, medical school, medical student knowledge, USMLE. Only sources that were conducted in the United States, involved human subjects, and published in English between 2015 and 2020 were considered to be possibly relevant. Specific sources were then chosen based off how well the title and abstract content aligned with nutrition concepts covered on the USMLE Step exams, medical school nutrition curricula, and how these two factors influenced medical student and physician nutrition knowledge and counseling abilities.

Results

Community Level – Nutrition Competencies Tested on USMLE

Most likely due to the confidential nature of the USMLE Step exams, the literature regarding the nutrition-related content of the USMLE exams was extremely scarce. Even using the broadest of search criteria, only three articles that were even remotely related were found. This simply underscores the imminent need and opportunity for examining the role of nutrition, a widely accepted factor impacting disease, on standardized medical exams.

The study that was most relevant in highlighting what nutritional concepts were covered on the Step exams was the one mentioned in an earlier section by Patel and colleagues. The preliminary foundation for this investigation were focus groups conducted with medical students and residents, in which it was evident that the students felt ill prepared to counsel patients on proper nutrition (Patel et al, 2015). Even though students are dissatisfied with their medical nutrition training, medical school and residency programs continue to omit it from their curriculum (Patel et al, 2015). Thus, Patel states that examining the USMLE offers a

potential incentive to match medical nutrition curricula to the modern societal needs (Patel et al, 2015).

Accordingly, these investigators analyzed the nutrition-related information present on the USMLE Step 1, 2, and 3 "Content Description" documents and in two Step 1 preparation books (Patel et al, 2015). They found that while there was a significant mention of vitamin-related disorders, there was "a conspicuously low number of references in regard to chronic disorders that are influenced or cause by poor dietary choices, such as cardiovascular diseases and others" (Patel et al, 2015). Further, no references surrounding disease prevention and preventative medicine as it relates to lifestyle and nutrition (Patel et al, 2015).

A key aspect that was also missing in the exam documents was the lack of dietary details based on current nutritional science (Patel et al, 2015). For example, Patel points out that "the dietary recommendation for individuals who are overweight, with type 2 diabetes was 'to eat smaller meals with fewer carbohydrates' (Patel et al, 2015). The absence of both specificity and clear evidence make this statement an outdated, futile recommendation. Overall, this study highlighted the disconnect between what students should be, and actually are, learning surrounding nutrition and its importance in caring for patients.

The next study included in this review looked at how obesity was covered on the USMLE by enlisting staff from the National Board of Medical Examiners to code and evaluate obesity-related items that appeared on Steps 1 through 3 of the USMLE (Kushner et al, 2017). Since obesity, and many of the comorbidities that accompany it, adversely affects every organ system, it is essential that medical students are trained and tested regarding the prevention and treatment of obesity management (Kushner et al, 2017). Out of the 802 multiple choice

items that were reviewed, 289, or 36%, of them were considered relevant to obesity (Kushner et al, 2017).

This may seem substantial, but the actual concepts covered by those questions were insufficient; most items ended up pertaining to the diagnosis and management of obesity-related comorbid conditions rather than addressing the prevention, diagnosis, or management of obesity itself (Kushner et al, 2017). Overall, diagnosis and evaluation questions dominated the content matter, accounting for 60% of all questions, whereas the practice management domain, which is arguably more important for the long-term care of patients with obesity, meagerly encompassed just 2% (Kushner et al, 2017).

Even though this article doesn't make any detailed account of nutrition references in particular, it was included because of the nutrition-related recommendations it included. For improvements to the Step 1 exam, a subcategory relating to the "basic sciences of obesity" was proposed for "the food environment" (Kushner et al, 2017). Step 2 and 3 additions regarding the "assessment, diagnosis, and treatment of obesity" category included "evidence-based obesity treatment" (which can be assumed to include some aspect of nutrition) and "the role of dietary and physical interventions" (Kushner et al, 2017).

In addition, this article serves as an important indicator for the connection between USMLE content and medical education. Kushner and colleagues highlight previous findings in which "the dominant role of an examination to guide student learning [has been tested and] deliberately changing a curriculum assessment strategy altered student behavior and learning" (Kushner et al, 2017).

A more recent study confirmed this finding as well; Khalil and associates investigated the relationship between student perceptions of medical school curricula and their subsequent performance on the USMLE Step 1 exam. Their major findings were that students recognized the supreme importance of the exam and consequently, the primary goal for medical schools in the first two years of the curriculum is to prepare them for that exam (Khalil et al, 2019). Unsurprisingly, since nutrition is not heavily covered on the current USMLE exams, medical schools do not teach it and students don't learn it. Khalil's study also included a score plot of student scores and it showed that nutrition, among others, was one of the lowest performing disciplines (Khalil et al, 2019).

There are three prominent findings from this part of the literature review. First, nutrition is not thoroughly covered or adequately represented on any of the USMLE exams. Second, medical school curricula are heavily dependent upon the content of the USMLE Step exams. Third, since medical schools essentially "teach to the exam," nutrition is not included in the curricula.

Organizational Level – Medical School Nutrition Curriculum

The overwhelming conclusion demonstrated in the literature is that, for a variety of reasons, students and providers more broadly feel hindered and incapable of counseling patients about healthy eating practices. However, this notion contradicts the accepted role of physicians directly outlined in the Healthy People 2020 objectives. One of the objectives includes a goal "to increase the proportion of physician office visits made by adult patients at which obese patients are counseled about weight reduction, nutrition, and physical activity" (Nair & Hart, 2018).

In short, the current medical education system fails to adequately prepare physicians to have meaningful, respectful, and educational discussions with patients about nutrition. However, this is not new information. The National Academy of Science released a report over thirty years ago recommending a minimum of twenty-five to thirty hours of nutrition education in medical school (Ockene et al, 2017). Despite this guidance, medical schools report meager, even declining, attempts at reaching this minimal threshold. One survey of U.S. medical schools found that the average required hours of nutrition declined from 2000 to 2012, from 20.4 to 19.0 respectively (Ockene et al, 2017).

Thus, it is unsurprising that lack of knowledge and insufficient education are among the most cited reasons physicians neglect counseling patient's nutrition. The academic research arena has underscored this vast deficiency, with a systemic review by Wadden and colleagues, reporting that no literature from 1980 to 2014 could be found documenting the provision of physician-led obesity counseling that met the Centers for Medicare and Medicaid Services guidelines (Nair & Hart, 2018).

Numerous studies have confirmed that awareness about the lack of nutrition education in medical school is not the issue. In 1995, just ten years after the National Academy of Science's report, the Department of Nutrition at the University of North Carolina at Chapel Hill released Nutrition in Medicine (NIM), a specialized nutrition curriculum designed for undergraduate medical education (Nair & Hart, 2018). Uptake and integration of NIM and similar nutrition education programs seem to be the area of stagnancy; An annual survey for the 2012-2013 academic year revealed that only 36% of the 121 respondent medical schools

were using the NIM curriculum and that 71% were failing to provide the bare minimum of 25 hours of nutrition education (Nair & Hart, 2018).

A more recent study also confirmed that the availability of nutrition-related obesity educational tools was not the problem, but rather medical schools are not using them (Butsch et al, 2020). While only 40 out of 141 allopathic medical schools responded, they reported on a variety of curriculum features, including coverage of topics related to the core obesity competencies established by the Obesity Medicine Education Collaborative (OMEC), their expectations regarding future incorporation of obesity into the curriculum, and perceived importance of obesity education (Butsch et al, 2020).

While only a mean of 10 hours of obesity-related education was taught across the four-year curriculum, very few schools reported covering some sort of obesity management care plan, such as nutrition interventions (Butsch et al, 2020). Despite the 2007 Association of American Medical Colleges (AAMC) call to action report that stated "medical education must assure that future physicians will be better prepared to provide respectful, effective care of overweight and obese patients," 62.5% of schools concluded that their students were only "somewhat prepared" to manage patients with obesity (Butsch et al, 2020). Further, over 50% of schools surveyed communicated that expanding obesity education was either a low priority or not a priority at all (Butsch et al, 2020).

Several studies have examined the barriers to integrating nutrition, and other obesity-related content, into medical school curriculum. The most common and substantial barrier reported is lack of room in an already-crowded curriculum (Butsche et al, 2020). Other noteworthy external barriers include poor faculty knowledge about obesity, lack of

standardized testing on obesity, and overall negative attitudes about the disease of obesity (Butsche et al, 2020). Although the literature overwhelmingly agrees that the lack of dedicated nutrition education in medical schools negatively impacts the way in which providers are prepared to care for patients, the institutions themselves are hesitant to change. Therefore, a higher-level intervention aimed at changing the USMLE content is seen as the most practical and efficient leverage point to ignite a response from medical schools.

Part II: Policy Level – Nutrition-Related Treatment Recommendations Issued by Professional Medical Organizations

Methods

To address the lack of a robust nutrition component in both medical school and on the USMLE Step exams, the literature review was expanded to include a second part. This second part aims to explore the nutrition-related treatment recommendations put forth by professional medical organizations. These treatment guidelines are meant to advise physicians of the most updated standard of care for treating their patients with obesity. Thus, examining these nutrition-specific recommendations will demonstrate what physicians are expected to know, and therefore what information should be taught and tested on during physician training programs. The published guidelines that were analyzed corresponded to the policy level of the ecological model in Figure 2. Approaching the policy-level can be more complex because of the many direct and indirect pathways of influence it has on the levels beneath it; however, intervening at the policy level offers a larger opportunity for potential change.

Professional treatment recommendations, which appear in various esteemed medical journals, government websites, and on organization websites, were extracted for this review

using Columbia University Libraries' CLIO database and Google Scholar from November 2019 to February 2020. The specific search terms used were "nutrition treatment recommendations for obesity by professional organizations". The journal articles that were chosen for review were those published by professional, medically related organizations that were deemed as reputable stakeholders who have a vested interest within the obesity treatment sphere. Additionally, articles published in English, pertained to children, adolescents, and adults in the United States, and were released between 2005 and 2020 were included. Articles were excluded if they were surrounding pregnancy recommendations, bariatric surgery, pharmacological interventions, or if an updated statement from the same organization was found (with the exceptions of the US Preventative Services Task Force Expert Committee and The Endocrine Society). It is important to note that only nutrition-related recommendations and guidelines were analyzed; to do this, an in-document search for key words like "nutrition", "food", "diet" was used. The final selection included professional guidelines, position statements, and treatment recommendations from the organizations shown below in Figure 3. This figure organizes the sources chronologically from 2005 to 2020.

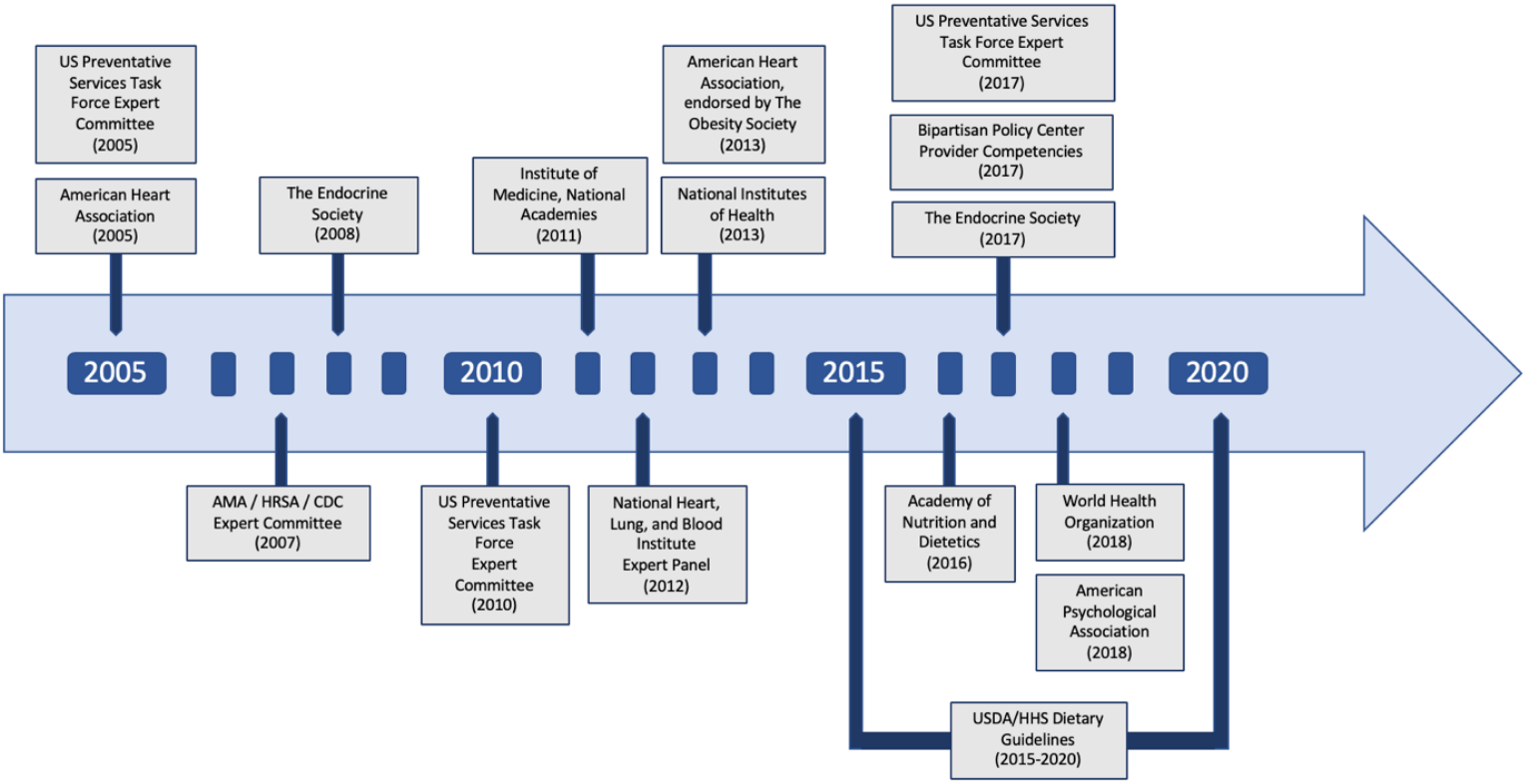

Figure 3. *Timeline of nutrition-related overweight and obesity treatment recommendations and competencies published by professional medical organizations.*

Results

Each document selected was thoroughly reviewed for any recommendations specifically or indirectly relating to nutrition, food choices, or dietary guidance. The findings are summarized in Table 1 below, which indicates the publication year, professional organization who published the guideline or recommendation, and the specific nutrition-related content found in each publication.

Table 1. *Summary of nutrition-related treatment recommendations published by professional medical organizations*

Year Published	Professional Organization	Nutrition-Specific Recommendation
2005	US Preventative Services Task Force Expert Committee	*No nutrition-specific recommendations included.*
2005	American Heart Association	♦ Breastfeeding is the ideal nutrition for children at birth to 6 months ♦ Supports family-based nutrition and behavior-management programs ♦ Dietary management is providing appropriate calorie intake, optimum nutrition for maintenance of health and normal growth, helps develop and sustain healthful eating habits ♦ Dietary Reference Intakes recommended: - *<u>Fat intake:</u>* - 30-40% kcal for children 1-3 years old - 25-35% kcal for children 4-18 years old - 20-35% kcal for adults - Carbohydrate intake: - 45-65% kcal for children and adults - Protein intake: - 5-20% kcal for children 1-3 years old - 10-30% kcal for children 4-18 years old - 10-35% kcal for adults ♦ Estimated energy requirements vary throughout childhood (570-3252 kcal per day for boys, 520-2368 kcal per day for girls, from age 3 months to 16 years) ♦ Foods consumed should be low in… - Saturated fat (less than 10% of daily kcal) - Total fat (about 30% of daily kcal) - Cholesterol (less than 300 mg per day) ♦ Promotes age-appropriate serving sizes including: - 5 servings of fruit and vegetables - 3 servings of milk or dairy - 6 servings of whole-grain products - Dietary fiber (age in years + 5g/day) - Limit intake of salt and sugar ♦ Promotes appropriate food portion sizes, reducing number of meals eaten outside home, planning for

		healthy snacks, offering healthier/lower-calorie food choices, structuring eating times and places for family meals, involving children in meal planning, shopping, gardening, and preparation of food
2007	AMA/HRSA/CDC Expert Committee	♦ Limit consumption of sugar-sweetened beverages ♦ Encourages consumption of diets with recommended quantities of fruits and vegetables (current USDA guidelines (2010) recommended 9 servings per day, varying with age) ♦ Eat breakfast daily ♦ Limit eating out at restaurants, especially fast food, in which the meals include large portion sizes and energy-dense foods ♦ Encourages family meals, parents and children eating together ♦ Limit portion sizes, according to USDA recommendations ♦ Supports eating a diet rich in calcium, high in fiber, balanced in macronutrients - Energy from fat, carbohydrates, and protein should be based on the UDSA Dietary Reference Intakes ♦ Encourages breastfeeding ♦ Limit overall consumption of energy-dense foods
2008	The Endocrine Society	♦ Avoid the consumption of calorie-dense, nutrient-poor foods (Ex. sweetened beverages, sports drinks and juices, most fast food, calorie-dense snacks) ♦ Clinicians should prescribe and support: - Controlling caloric intake through portion control in accordance with the Guidelines of the American Academy of Pediatrics - Reducing saturated fat intake for children older than 2 years old - Increasing the intake of dietary fiber, fruits, vegetables - Eating timely, regular meals, especially breakfast - Avoid constant grazing/snacking during the day, especially after school - Breastfeeding for a minimum of 6 months after birth
2010	US Preventative Services Task Force Expert Committee	*No nutrition-specific recommendations included.*
2011	Institutes of Medicine,	♦ Encourages breastfeeding ♦ Supports a diet rich in nutrient-dense fruits and vegetables, low-fat or nonfat milk and dairy products,

	National Academies	whole grains, low consumption of energy-dense, nutrient-poor foods ♦ Recommends the USDA Dietary Guidelines for specific recommendations ♦ Promotes the consumption of a variety of nutritious foods ♦ Create a healthy eating environment that is responsive to children's hunger and fullness cues - Meals and snacks as a healthy routine - Adults and children sit together and eat the same foods - Allow children to serve themselves, reinforcing portion control - Supporting children's internal cues of hunger and fullness
2012	National Heart, Lung, and Blood Institute Expert Panel	♦ Emphasizes eating a variety of fruits, vegetables, whole grains, low-fat dairy products ♦ Including protein-rich foods, such as lean meats, poultry without skin, seafood, beans and peas, eggs, processed soy products, nuts, seeds ♦ Foods low in saturated fat, trans-fat, cholesterol, sodium, added sugar - Solid fats and added sugars (SOFAS) are considered "discretionary"/ "nonessential" calories (includes snack foods, sugar-sweetened beverages, desserts) - Should not consume more than 100-200 SOFAS calories per day - Sources of SOFAS also include high-fat meats, cookies, cakes, pastries, granola bars, sweetened cereals ♦ Stay within the following daily calorie limits, which vary by age and activity level: - Ages 2-3 = 1,000-1,400 kcal/day - *Female:* - Ages 4-8 = 1,200-1,800 kcal/day - Ages 9-13 = 1,400-2,200 kcal/day - Ages 14-18 and 19-30 = 1,800-2,400 kcal/day - *Male:* - Ages 4-8 = 1,200-2,000 kcal/day - Ages 9-13 = 1,600-2,600 kcal/day - Ages 14-18 = 2,000-3,200 kcal/day - Ages 19-30 = 2,400-3,000 kcal/day ♦ Dietary fiber should come from foods like fruits, vegetables, whole grains, nuts, and legumes instead of from fiber supplements

		♦ Accepts the 2010 Dietary Guidelines from USDA as the appropriate recommendations for diet and nutrition in children 2 years and older
2013	National Institutes of Health	♦ Creating a reduced dietary energy intake - Specify an energy intake target that is less than what is required for energy balance (1,200-1,500 kcal/day for women and 1,500-1,800 kcal for men – needs to be adjusted for by individual's starting weight and physical activity level) - Prescription of an energy deficit of 500-750 kcal/day (or 30%) - Formal energy deficit is not prescribed but lower calorie intake is achieved by restriction/elimination of certain food groups or provision of prescribed foods ♦ Diets of differing forms and structures / other weight loss strategies that are associated with weight loss when a reduced dietary energy intake is achieved - Macronutrient content (higher protein diet) - Carbohydrate and fat quality (low-carbohydrate, low-fat diets) - Nutrient density (low-glycemic load diet) - Amount of energy deficit (low-calorie, macronutrient targets) - Dietary pattern (Mediterranean style, vegetarian/vegan styles, AHA Step 1 diet) - Meal timing - Portion-controlled meal replacements ♦ Pattern of weight loss over time with dietary intervention - Average weight loss is maximal at 6 months, smaller losses maintained for up to 2 years while treatment and follow-up tapers - Weight loss achieved ranges from 4-12 kg at 6-month follow-up - Slow weight regain is observed, with a total weight loss of 4-10 kg at 1 year follow-up and 3-4 kg at 2 years follow-up ♦ Low-fat approaches (30% kcal) - Achieve comparable weight loss at 6-12 months (compared to higher fat diet (40% kal)) - Greater reduction in LDL-C - Lesser reduction in serum triglycerides - Lesser increases in HDL-C

		- Inconsistent evidence regarding blood pressure differences ♦ Higher Protein (25-30%) Approaches - Achieve comparable weight loss (compared to typical protein diet of 15% kcal) - Do not result in more beneficial effects on CVD risk factors ♦ Lower-carbohydrate Approaches (less than 30g/day) - No differences in weight loss at 6 months (compared to calorie-restricted low-fat, or calorie-restricted higher-carbohydrate, lower-protein diets) - Insufficient evidence to comment on CVD risk factor effects ♦ Complex vs. simple carbohydrates - Insufficient evidence to comment on value of substituting simple vs. complex carbohydrates for dietary fat for weight loss ♦ Glycemic Load Dietary Approaches - Both high- and low-glycemic load diets produce a comparable weight loss with similar rate of loss over 6 months ♦ Dietary Pattern Approaches - Variety of calorie-restricted dietary patterns produce weight loss and CVD benefits comparable to energy-restricted, lower-fat dietary patterns ♦ Meal Replacements and Adding Food to Liquid Diets - For women, use of liquid and bar meal replacements is associated with increased weight loss at up to 6 months (longer term evidence is lacking) - Insufficient evidence to comment on value of adding various types of foods to a low-calorie liquid diet ♦ Very Low-Calorie Diet Approaches - Insufficient evidence to comment on the value of liquid protein supplementation following the VLCD induction of weight loss as an aid to weight loss maintenance
2013	American Heart Association, endorsed by The Obesity Society	♦ Prescribe a diet to achieve reduced calorie intake for obese or overweight individuals: - 1,200-1,500 kcal/day limit for women; 1,500-1,800 kcal/day limit for men - 500 kcal/day (women) or 750 kcal/day (men) calorie deficit - One of the evidence-based diets that restricts certain food types (such as high-carbohydrate foods, low-fiber

		foods, and high-fat foods) in order to create an energy deficit by reduced food intake ♦ Refer to a nutrition professional for counseling
2016	Academy of Nutrition and Dietetics	♦ Treating obesity requires achieving a state of negative energy balance (dietary interventions must decrease consumption of energy) ♦ Emphasized the use of nutrition professionals (like a Registered Dietician Nutritionist) who can provide an individualized diet, including patient preferences and health status to maintain nutrient adequacy and reduced caloric intake ♦ Suggests one of the following caloric reduction strategies: - 1,200-1,500 kcal/day for women; 1,500-1,800 kcal/day for men - Energy deficit of approximately 500 kcal/day (women) or 750 kcal/day (men) - Evidence-based diet that restricts certain types of foods (high-carbohydrate, low-fiber, high-fat) in order to create an energy deficit by reduced food intake ♦ Reports the following with regard to RCT evidence and whether they are supportive or non-supportive for weight loss: - Diets with RCT evidence considered supportive for weight loss: • Decreasing sugar-sweetened beverages • Low-calorie diet • Meal replacement/structured meal plans • Very-low-calorie diet • Low-carbohydrate diet • High protein with energy restriction • DASH with energy restriction • Mediterranean with energy restriction - Diets with RCT evidence considered non-supportive for weight loss: • Increasing fruits and vegetables • Low glycemic index/load without energy restriction - Lacking investigation for weight loss using RCTs: • Decreasing fast food • Energy density • Eating frequency • Timing of eating • Breakfast consumption

		♦ Hypothesized that small behavior changes such as reducing intake of sugar-sweetened beverages may be more sustainable and feasible than larger behavior changes like changing macronutrient composition of diet ♦ Weight loss will not be produced by solely increasing fruit and vegetable intake, rather those need to be consumed in substitution of foods higher in energy density ♦ Replacing caloric beverages with water or diet beverages resulted in weight losses of 2-2.5% during a 6-month period ♦ Recommends avoiding or reducing the frequency of consumption of foods away from home (especially fast food, high in energy density foods, large portion sizes) ♦ Portion control can be accomplished in a variety of different ways - Using packages containing a defined about of energy (complete meals, individual serving sizes) - Portion-controlled utensils, specific serving sizes - Communication strategies, like MyPlate
2017	US Preventative Services Task Force Expert Committee	*No nutrition-specific recommendations included.*
2017	Bipartisan Policy Center Provider Competencies	♦ Demonstrate a working knowledge of obesity as a disease - Evidence-based lifestyle behaviors include dietary intake ♦ Apply the skills necessary for effective interprofessional collaboration and integration of clinical and community care of obesity - With nutrition professionals specifically ♦ Collaborate with community organizations to advocate for nutrition services, programs, and policies that address obesity ♦ Use patient-centered, appropriate language - Language to use: eating habits - Language to avoid: diet, dieting ♦ Provide evidence-based care and services for people with obesity comorbidities (including psychosocial) - Nutrition/eating behaviors specifically, including purging, binge eating, food hoarding
2017	The Endocrine Society	♦ Recommends clinicians prescribe and support healthy eating habits in accordance with the following guidelines put forth by the American Academy of Pediatrics and the USDA:

		- Decreased consumption of fast foods - Decreased consumption of added table sugar and elimination of sugar-sweetened beverages - Decreased consumption of high-fat, high-sodium, processed foods - Consumption of whole fruit rather than fruit juices - Portion control education - Reduced saturated dietary fat intake for children and adolescents (older than 2 years old) - USDA recommended intake of dietary fiber, fruits, vegetables - Timely, regular meals - Avoiding constant grazing/snacking during the day, especially after school and after dinner - Recognizing eating cues in environment, like boredom, stress, loneliness, screen time - Encouraging single portion packaging and improved food labelling (for easier use by consumers)
2018	World Health Organization	♦ Healthy diet helps to protect against malnutrition, NCDs, diabetes, heart disease, stroke, cancer ♦ Emphasizes importance of breastfeeding for heathy growth and longer-term prevention of overweight and obesity later in life ♦ Energy intake should be in balance with energy expenditure; in order to avoid unhealthy weight gain: - Total fat should not exceed 30% of total energy intake (primarily unsaturated fats) - Saturated fats should be less than 10% of total energy intake - Trans-fats should be less than 1% of total energy intake (should eliminate industrially produced trans-fats) - Limit intake of free sugars to less than 10% (ideally 5%) of total energy intake - Limit sodium intake to less than 2 grams/day ♦ For adults, a healthy diet includes: - Fruit, vegetables, legumes (lentils and beans), nuts, whole grains (unprocessed maize, millet, oats, wheat and brown rice) - At least 400 rams (~5 portions) of fruits and vegetables per day (excluding potatoes, sweet potatoes, cassava, other starchy roots)

- Unsaturated fats are found in fish, avocado, nuts, sunflower/soybean/canola/olive oils and are preferable to saturated fats
- Saturated fats are found in fatty meat, butter, palm and coconut oil, cream, cheese, ghee, lard
- Intake of one teaspoon of iodized salt per day

♦ For infants and young children, a heathy diet includes:
- Breastfed exclusively during first 6 months of life
- Breastfed until 2 years old and beyond, with the addition of safe, nutrient-dense foods
- Salt and sugar should not be added to complementary foods

♦ Practical advice on maintaining a heathy diet:
- Include vegetables in meals, eating raw fruits and vegetables as snacks
- Steaming or boiling instead of frying when cooking
- Replace butter/lard/ghee with soybean/canola/corn/safflower/sunflower oils
- Eat reduced-fat dairy foods, lean means, trimming visible fat from meat
- Limit consumption of baked and fried foods, and pre-packaged snacks and foods that contain industrially produced trans-fats
- Be aware of salt content and sodium intake (processed foods like ready meals, processed meats such as bacon, ham, salami, cheese, salty snacks)
- Limit high-sodium condiments (bouillon, stock cubes, soy sauce, fish sauce) when cooking and preparing foods
- Check nutrition labels for sodium content
- Increase consumption of potassium (can mitigate negative effects of elevated sodium consumption on blood pressure)
- Limit sugary snacks, candies, sugar-sweetened beverages (carbonated or non-carbonated soft drinks, fruit or vegetable juices, liquid and powder concentrates, flavored water, energy and sports drinks, ready-to-drink tea/coffee, flavored milk drinks)

♦ How to promote healthy diets (encouraging consumer demand):
- Promoting consumer awareness of healthy diet
- Educating children, adolescents, and adults about nutrition and healthy dietary practices
- Encouraging culinary skills

		- Supporting point-of-sale information, nutrition labelling that facilitates consumer understanding - Providing nutrition and dietary counseling at primary health-care facilities
2018	American Psychological Association	*No nutrition-specific recommendations included.*
2015-2020	US Department of Agriculture and Health and Human Services	♦ The Guidelines: - Follow a healthy eating pattern across the lifespan (appropriate calorie level to help achieve and maintain a healthy body weight, support nutrient adequacy, reduce risk of chronic disease) - Focus on variety, nutrient density, and amount - Limit calories from added sugars and saturated fats and reduce sodium intake - Shift to healthier food and beverage choices - Support healthy eating patterns for all ♦ A healthy eating pattern includes: - Variety of vegetables from all subgroups (dark green, red, orange, legumes (beans and peas), starchy - Whole fruits - Whole grains - Fat-free or low-fat dairy (milk, yogurt, cheese, fortified soy beverages) - Variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), buts, seeds, soy products ♦ A healthy eating pattern limits: - Consume less than 10% of calories per day from added sugars - Consume less than 10% of calories per day from saturated fats - Consume less than 2,300 mg per day of sodium - Limit alcohol consumption to 1 drink per day for women and 2 drinks per day for men ♦ Emphasizes that health professionals understand how layers of influence intersect to shape a person's food choices (socio-ecological model for food decisions) - Includes social and cultural norms and values, systems/organizations/businesses and industries, personal settings, individual factors ♦ Implementation of MyPlate to promote healthy eating styles maintainable for lifetime

- Make half your plate fruits and vegetables, focus on whole fruits, vary your veggies, vary your protein routine, make half your grains whole grains, move to low-fat or fat-free milk or yogurt, drink and eat less sodium, saturated fat, added sugars

♦ Professionals working with individuals can…
- Help them become more aware of their eating patterns and identify areas to make improvements (like modifying recipes or food selections)
- Teach skills like gardening, cooking, meal planning, label reading
- Suggest ways to model healthy eating behaviors for friends and family members

♦ Data Tables including:
- Estimated calorie needs per day by age, sex, and physical activity level
- Healthy U.S.-style eating pattern: recommended amounts of food from each food group at 12 calorie levels
- Daily nutritional goals for age-sex groups based on dietary reference intakes and dietary guidelines recommendations
- Tables that list food sources containing important specific nutrients (potassium, calcium, vitamin D, dietary fiber)

The nutrition-specific recommendations varied widely across the professional organizations. Some offered detailed calorie and macronutrient breakdowns according to age group, while others cited general guidelines, like eating breakfast daily and limiting consumption of sugar-sweetened beverages. Although there appears to be a lot of material to grasp from, it is understandable that physicians may feel underwhelmed by the practicality of the information provided. For example, it seems unlikely a physician would have time to educate patients on specific nutrient percentages. On the other hand, suggesting generalized "treatments" like avoiding fast food or increasing consumption of fruits and vegetables appears to be vacant and ineffective. With such a wide spectrum of recommendations, the knowledge gaps faced by physicians and medical educators is therefore expected.

In order for both the USMLE and medical school administrators to better use the published treatment recommendations to educate their students, the recommendations were analyzed and subsequently organized into Table 2. This table outlines the most prevalent nutrition-related recommendations appearing in the selected publications. From this extracted information, specific nutrition-related competencies can be suggested for integration into the USMLE exams. Note that Table 3 below provides a clarifying key for the abbreviated organization names that appear in the outer-most column of Table 2.

Table 2. *Most prevalent nutrition-related treatment recommendations*

Recommendation	Number of Times Mentioned	Organizations that Mentioned Recommendation
Encourages breastfeeding from birth to at least 6 months old	5	AHA, AMA/HRSA/CDC, ES (2008), IOM, WHO
References to/the support of the Dietary Intakes and/or Dietary Guidelines	6	AHA, AMA/HRSA/CDC, IOM, NHLBI, ES (2017), USDA
Provides estimated energy requirements (may vary depending on age, sex, activity level)	3	AHA, NHLBI, USDA
Mentions portion control/serving sizes	7	AHA, AMA/HRSA/CDC, IOM, N&D, ES (2017), WHO, USDA
Supports the limitation of fast food and/or energy-dense foods	6	AMA/HRSA/CDC, ES (2008), IOM, N&D, ES (2017), USDA
Suggests limits on fat (saturated fat, total fat, trans fat)	6	AHA, ES (2008), NHLBI, ES (2017), WHO, USDA
Suggests limits on cholesterol	4	AHA, NHLBI, WHO, USDA
Suggests limits on salt and sodium	4	AHA, NHLBI, WHO, USDA
Suggests limits on sugar and sugar-sweetened items	7	AHA, AMA/HRSA/CDC, NHLBI, N&D, ES (2017), WHO, USDA

Suggests increases or inclusion of dietary fiber	5	AHA, AMA/HRSA/CDC, ES (2008), NHLBI, ES (2017)
Encourages healthful dietary behaviors, including the consumption of fruits, vegetables, whole grains, lower-fat dairy options, a variety of lean protein options	8	AHA, AMA/HRSA/CDC, ES (2008), IOM, NHLBI, ES (2017), WHO, USDA
Encourages a "family" element or approach	3	AHA, AMA/HRSA/CDC, IOM
Encourages eating meals at home/limit eating meals outside of home	3	AHA, AMA/HRSA/CDC, N&D
Emphasizes the importance of consuming breakfast	2	AMA/HRSA/CDC, ES (2008)
Suggests avoiding grazing/snacking	2	ES (2008), ES (2017)
References providers prescribing an energy deficit specifically by: - Specification of an energy intake target that is less than what is required for energy balance (1,200-1,500 kcal/day for women and 1,500-1,800 kcal for men – needs to be adjusted for by individual's starting weight and physical activity level) - Prescription of an energy deficit of 500-750 kcal/day (or 30%) - Formal energy deficit is not prescribed but lower calorie intake is achieved by restriction/elimination of certain food groups or provision of prescribed foods	3	NIH, AHA/TOS, N&D
Mentions referral to a nutrition professional	3	AHA/TOS, N&D, BPC
Supports the education and recognition of internal eating cues	2	IOM, ES (2017)
Provides specific food suggestions/examples	3	NHLBI, WHO, USDA
Mentions meal timeliness/regularity	4	AHA, ES (2008), IOM, ES (2017)

Table 3. *Abbreviated Organization Name Key*

Abbreviation	Organization (Date)
AHA	American Heart Association (2005)
AMA/HRSA/CDC	AMA/HRSA/CDC Expert Committee (2007)
ES (2008)	The Endocrine Society (2008)
IOM	Institutes of Medicine, National Academies (2011)
NHLBI	National Heart, Lung, and Blood Institute Expert Panel (2012)
NIH	National Institutes of Health (2013)
AHA/TOS	American Heart Association, endorsed by The Obesity Society (2013)
N&D	Academy of Nutrition and Dietetics (2016)
BPC	Bipartisan Policy Center (2017)
ES (2017)	The Endocrine Society (2017)
WHO	World Health Organization (2018)
USDA/HHS	US Department of Agriculture and Health and Human Services (2015-2020)

CALL-TO-ACTION PROPOSAL

Part I: Selection of Professional Nutrition-Related Recommendations

There are multiple factors to take into consideration when proposing monumental changes for standardized examinations. Beyond the internal politics of the exam organizations, there is an obvious administrative burden to alter test materials, disseminate the information, and expected pushback from already-time-constrained medical school educators. Although change is slow-moving and would need the support and compliance of many actors, the significance of improving provider education in the field of nutrition is paramount.

Proposing numerous additions to the USMLE would be unreasonable and unlikely to ignite change. Thus, I am suggesting to only incorporate the most prevalent recommendations to be translated into competencies to add to the USMLE. In order to determine which recommendations to use, I ordered the recommendations from Table 2 in descending order, with the most prevalent recommendation at the top, and the least at the bottom (Table 4).

Then, I chose the recommendations that appeared in the top 30% (6/20), or those that were mentioned in 6 or more publications, as the most important to translate into exam competencies. The selected recommendations are highlighted in yellow in Table 4 below.

Table 4. *Ordered nutrition-related treatment recommendations, from highest number of times mentioned in selected professional guidelines to the least number of times mentioned.*

Recommendation	Number of Times Mentioned	Organizations that Mentioned Recommendation
Encourages healthful dietary behaviors, including the consumption of fruits, vegetables, whole grains, lower-fat dairy options, a variety of lean protein options	8	AHA, AMA/HRSA/CDC, ES (2008), IOM, NHLBI, ES (2017), WHO, USDA
Mentions portion control/serving sizes	7	AHA, AMA/HRSA/CDC, IOM, N&D, ES (2017), WHO, USDA
Suggests limits on sugar and sugar-sweetened items	7	AHA, AMA/HRSA/CDC, NHLBI, N&D, ES (2017), WHO, USDA
References to/the support of the Dietary Intakes and/or Dietary Guidelines	6	AHA, AMA/HRSA/CDC, IOM, NHLBI, ES (2017), USDA
Supports the limitation of fast food and/or energy-dense foods	6	AMA/HRSA/CDC, ES (2008), IOM, N&D, ES (2017), USDA
Suggests limits on fat (saturated fat, total fat, trans fat)	6	AHA, ES (2008), NHLBI, ES (2017), WHO, USDA
Suggests increases or inclusion of dietary fiber	5	AHA, AMA/HRSA/CDC, ES (2008), NHLBI, ES (2017)
Encourages breastfeeding from birth to at least 6 months old	5	AHA, AMA/HRSA/CDC, ES (2008), IOM, WHO
Suggests limits on cholesterol	4	AHA, NHLBI, WHO, USDA
Suggests limits on salt and sodium	4	AHA, NHLBI, WHO, USDA
Mentions meal timeliness/regularity	4	AHA, ES (2008), IOM, ES (2017)

Provides estimated energy requirements (may vary depending on age, sex, activity level)	3	AHA, NHLBI, USDA
Encourages a "family" element or approach	3	AHA, AMA/HRSA/CDC, IOM
Encourages eating meals at home/limit eating meals outside of home	3	AHA, AMA/HRSA/CDC, N&D
References providers prescribing an energy deficit specifically by: - Specification of an energy intake target that is less than what is required for energy balance (1,200-1,500 kcal/day for women and 1,500-1,800 kcal for men – needs to be adjusted for by individual's starting weight and physical activity level) - Prescription of an energy deficit of 500-750 kcal/day (or 30%) - Formal energy deficit is not prescribed but lower calorie intake is achieved by restriction/elimination of certain food groups or provision of prescribed foods	3	NIH, AHA/TOS, N&D
Mentions referral to a nutrition professional	3	AHA/TOS, N&D, BPC
Provides specific food suggestions/examples	3	NHLBI, WHO, USDA
Emphasizes the importance of consuming breakfast	2	AMA/HRSA/CDC, ES (2008)
Suggests avoiding grazing/snacking	2	ES (2008), ES (2017)
Supports the education and recognition of internal eating cues	2	IOM, ES (2017)

Part II: Nutrition-Related Competencies to be Added to USMLE

The top six recommendations were then translated into competencies that could be integrated into the USMLE material. Since the exam already uses a competency-based structure, maintaining this format should make the uptake of additional competencies seamless. For each competency, there is an informative title followed by a descriptive definition, shown in Figure 4 below. This definition clearly outlines the relevant knowledge and skills students should be able to demonstrate on both the exam and when interacting with

patients. These competencies give the USMLE administrators an evidence-based outline for the generation of new exam content, questions, and patient-based scenarios.

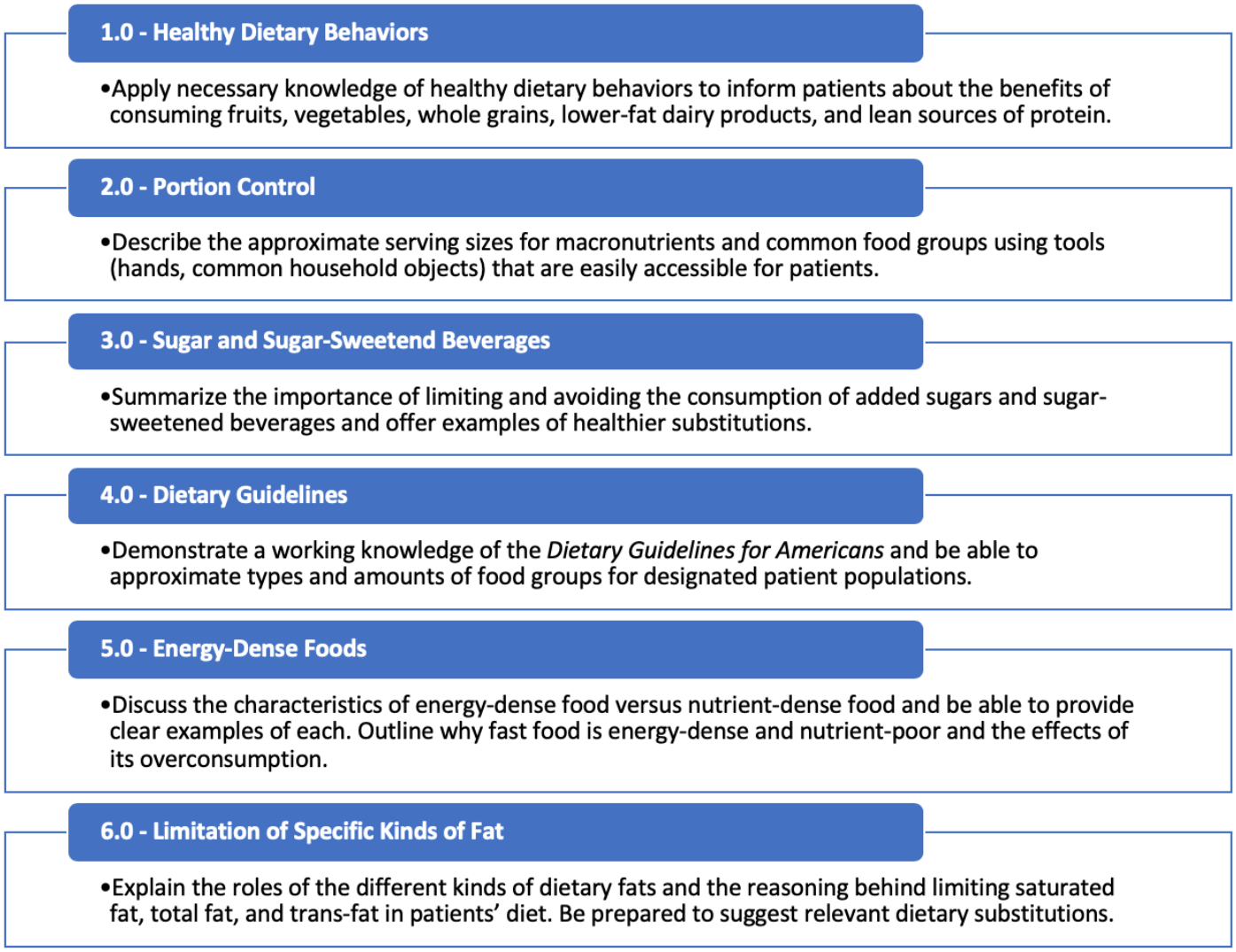

Figure 4. *Recommended nutrition-related competencies to be added to the USMLE, derived from the most prevalent nutrition-related treatment recommendations published by professional medical organizations.*

DISCUSSION

Limitations

There are several limitations to this thesis that are important to consider, especially when implementing the recommended nutrition-related competencies. First, the confidential nature of the specific test questions that appear on the USMLE significantly hinders my and previous researcher's understanding of nutrition-related content. The information put forth in this thesis regarding the content of the USMLE has been extracted from literature that relied on restricted, generalized exam information, competencies, and test preparation materials. Without having access to the exam itself, only assumptive statements and recommendations could be made.

Next, specific medical school curricula is not publicly available; instead, only general topics or systems-based structures are released. Other academic researchers have found this challenging as well and have instead examined indirect pathways that elude to what is taught during medical training. For example, the studies that this thesis used attempted to capture nutrition-related curricula based on student attitudes and perceptions and surveys administered to the staff of certain medical institutions. Similar to the test questions on the USMLE, explicit curriculum present in medical schools was unavailable so this thesis relied on secondary accounts extracted from the literature.

Other constraints to the competencies put forth by this thesis were the selection of professional organizations and the determination of relevant treatment recommendations to translate into competencies. There are numerous medical organizations that publish treatment-related guidelines for obesity; however, for clarity and simplification, certain criteria had to be

used in order to narrow down the number of documents that recommendations were to be extracted from. Thus, even though the professional organizations and recommended competencies included are believed to be representative of the current landscape of nutrition-related treatments available, the findings are by no means entirely comprehensive.

Directions for Future Research

As the disease burden faced by today's patient population continues to evolve, encompassing more chronic conditions related to obesity, it is imperative that medical education prepares future physicians accordingly. This thesis highlights the current literature explaining that overall, there is a huge gap of knowledge regarding nutritional treatments among medical students and providers. The causes for this have been outlined as the lack of nutrition on medical examination and within medical education. Therefore, the areas that need to be further investigated are the outcomes of pilot interventions aimed at remedying this neglect of nutrition.

For example, the Keck School of Medicine of USC recently developed a hands-on preclinical culinary nutrition course (Pang et al, 2019). The medical students and faculty partnered with multiple community organizations to create a course that teaches students practical skills and knowledge that they can both integrate into their own lives as well as pass on to their future patients (Pang et al, 2019). Culinary medicine courses and programs are beginning to surface at several other schools around the country as well. Even though this is a step in the right direction, comprehensive and applicable nutrition education should not be elective, but rather mandatory. If these types of programs are shown to be effective, then

perhaps medical institutions will be more inclined to include nutrition competencies in their curriculums, and the USMLE will adapt to test students on them as well.

CONCLUSION

Numerous studies have clearly documented that nutrition is neglected in medical education. Whether it be the lack of adequate curriculum-hours dedicated to nutrition during medical school, or the resulting negative perceptions of students regarding their ability to counsel patients about nutrition, the evidence highlights the need for intervention. Due to the slow and resistant institutional change seen within medical schools, who align their curricula with the USMLE Step examinations, this thesis instead focuses on updates that need to happen with the examination content, not the medical schools themselves. Following the compilation and analysis of nutrition-related treatments for obesity published by selected professional medical organizations, six nutrition-related competencies were recommended to be added to the USMLE. The intension of integrating these nutrition-related competencies is that medical schools will be obligated to update their curriculum to include a more comprehensive nutrition component. By taking an upstream approach, specifically at a policy level, medical students will become better trained to counsel their future patients about nutrition, which is imperative considering the ever-growing obesity epidemic.

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