NUTRITION COVERAGE ON PART I/STEP 1 AND PART II/STEP 2 OF THE US MEDICAL LICENSING EXAMINATION FOR MEDICAL STUDENTS

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This project is dedicated to my husband and daughter,
Dr. Larry Finkelstein and Jamie,
to my parents Diane and Jerry Hark
and to my in-laws, Marylyn and Leonard Finkelstein,
all of which provided never ending love, support,
and encouragement to further my education and
follow my dreams to become a doctor.

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ABSTRACT

NUTRITION COVERAGE ON STEP 1 AND STEP 2 OF THE US MEDICAL LICENSING EXAMINATION FOR MEDICAL STUDENTS

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Statement of the Problem: The 1985 National Academy of Sciences report, *Nutrition Education in US Medical Schools*, noted that the National Board of Medical Examiners (NBME) who develops the US Medical Licensing Examination (USMLE), should cover basic nutrition knowledge. According to the NBME, the design of the USMLE explicitly intended to include nutrition on the Step 1 and 2 exams. Task forces developed test materials for nutrition and item writing assignments covering nutrition content.

Procedures and Methods: The 1986 June Part I, 1986 September Part II, 1993 June Step 1, and 1993 September Step 2 exams were reviewed to assess nutrition coverage. To determine whether nutrition curriculum affected students' performance on these nutrition items, the scores of students from schools with a required nutrition curriculum were compared to the scores of students from schools that did not have a required nutrition curriculum.

Results: Based on the review process, nutrition coverage increased from 9% on the 1986 Part I exam to 11% on the 1993 Step 1 exam and from 6% on the 1986 Part II exam to 12% on the 1993 Step 2 exam. Based on the content coding, vitamin deficiency questions represented 11% of the nutrition items on the Step 1 exam and 22% on the Step 2 exam. Percent correct subscores for the nutrition and non-nutrition items on the Step 1 and 2 exams were calculated for each examinee. An analysis of covariance was performed on these scores for both the Step 1 and 2 exams. Using the .05 level of significance, students from schools with a required nutrition curriculum scored significantly higher on the Step 1 exam only.

Conclusion: These results indicate that nutrition coverage has increased from 1986 to 1993, corresponding to the NBME claim that nutrition was considered when they were writing questions for the Step exams. Students from schools with a required nutrition curriculum performed better on these nutrition items than students without nutrition exposure only on the Step 1 exam.

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CHAPTER 1

INTRODUCTION

Nutrition education can be defined as the introduction of scientific principles of nutrition, specifically diagnosis and treatment of diseases affecting intake, intestinal absorption, and metabolism of dietary constituents into the clinical practice of medicine (1). Medical nutrition education is directed towards preparing the physician to incorporate nutrition into both the treatment and prevention of chronic illness and to meet the needs of patients and the public (1). These definitions encompasses both a basic understanding of the role of dietary deficiencies, excess, or imbalance in altered metabolism of nutrients and pathogenesis of disease, and the role of dietary modification and specialized nutrients formulations and delivery systems in preventing and treating chronic and acute illnesses (2). Clinical nutrition specifically focuses on the importance of proper diet in the maintenance of health and the interrelationship between diet, nutrient metabolism, and disease.

The status of nutrition in medical education has been described and reviewed by numerous individuals since 1930, and extensively throughout the 1980's and 1990's (2-6). Much of the research regarding content of nutrition in medical curriculum emphasizes the nutrition topics which "should" be taught and where in the curriculum or which residency training programs these topics "should" be integrated (7-9). Much of the nutrition education literature is composed of content suggestions to assess the nutrition knowledge and skills level of medical students, with the assumption that nutrition will be incorporated into medical curriculum and licensure exams.

Statement of the Problem

Because the status of nutrition in medical education over the past several decades has been viewed by nutrition experts as "not improved," obstacles or barriers within the medical education system have been hypothesized (10). These barriers include time constraints in the curriculum, the administrative structure of the basic science and clinical departments/curriculum committees and the subsequent allocation of resources, and the lack of nutrition questions on licensing exams.

Licensing Exams

A recently published background report on the state of nutrition education in medical schools indicated that "no means had been introduced by the National Board of Medical Examiners (NBME) to ensure the inclusion of questions on nutrition and health on the NBME Part I and Part II exams or the Step 1 and 2 United States Medical Licensing Examination since the 1985 National Research Council (NRC) report" (10). The NRC Nutrition in Medical Education Committee and numerous reports since 1985 state that the NBME should create a means by which nutrition questions could be included to assess basic nutrition knowledge. [Physicians seeking licensure to practice medicine in the US are now required to pass the United States Medical Licensing Examination (USMLE), a uniformed pathway to licensure administered by the NBME and the Federation of State Medical Boards (FSMB). The USMLE consists of three Step exams, each Step taken at different points in the educational process of the physician.]

According to Dr. Donald Melnick, Senior Vice President and Vice President, Division of Evaluation Programs at the NBME, there is no justification for the statement that no means had been introduced by the NBME to ensure the inclusion of questions on nutrition and health since 1985 (11). In fact, as described in the background section of this paper, the NBME completely revised the design of the Part I and II exams between 1985 and 1991 to develop a more comprehensive exam. The Comprehensive Part I and Part II Committees' goals were to update the exams to incorporate current high priority issues, specifically social and preventive medicine, which encompassed nutrition topics. These newly designed Step exams were introduced in 1992 from the Comprehensive Part I and Part II Committee designs. According to Dr. Melnick, the Comprehensive Part I and Part II Committees charged with the process of redesigning the exams, explicitly intended to systematically include nutrition content in the exams (11). Gastrointestinal/Nutritional Task Forces were appointed for both the Comprehensive Part I and Part II exams to develop test materials for nutrition content. In addition, item writing assignments for the traditional discipline-oriented committees were systematically assigned items covering nutrition content and asked to submit nutrition related questions depending on the needs of the item pools.

Since it has not been documented whether the NBME has adequately addressed the nutrition competency of medical students, the purpose of the this research project was to assess to what extent nutritional issues were covered on the NBME Part I and Part II exams and the USMLE Step 1 and Step 2 exams. The purpose of this review were to identify the number of nutrition related items, the types of nutrition related items, and how these nutrition items have changed from 1986 to 1993. To determine whether there was a difference in students' knowledge on the nutrition items on the USMLE Step 1 and Step 2 exams dependent upon the nutrition requirement of the medical schools, exam scores of students from schools with required nutrition curriculum were compared to scores of students from schools that did not have a required nutrition curriculum.

Author's Perspective

As a registered dietitian working for the past five years as Director of the Nutrition Education Program at the University of Pennsylvania School of Medicine, I have implemented a required nutrition curriculum for medical students across the medical curriculum. At present, the curriculum includes nutrition components in years one, two, and three, totaling 40 hours, as well as an 18 hour nutrition elective during the first year. The initiative for this research was to determine whether schools requiring medical students enroll in a nutrition course influenced the nutrition knowledge of students. Because the USMLE Step 1 and Step 2 exams are taken by all medical students across the United States wanting to be licensed, it was felt that a nutrition sub-test, using the nutrition questions identified on these exams, would serve as the standardized instrument to test nutrition knowledge.

Chapter Overview

The chapters of the dissertation are organized as follows: Chapter 2, the literature review, includes the history of nutrition in medical education, as well as an analysis of the explanations that have been given regarding why nutrition education has not been implemented consistently in all United States medical schools. This review includes a description of the political structure of medical schools and how this structure impacts the status of nutrition in medical schools. The literature review also includes the research and recommendations that have been written regarding the nutrition content of medical school curriculum.

Chapter 3, the background section of the NBME, summarizes the history and development of the present licensing exams for medical students. This chapter includes information about the development of the comprehensive Part I and Part II exams, the purpose of the exams and the committee process that takes place to develop the exams. In addition, the item format, the development of the content outline, test construction, and exam format are included to give the reader a thorough understanding of the processes that the NBME uses to develop these licensing exams.

The methods section, chapter 4, outlines the specific methods that were utilized to perform the current research. The first part of the project analyzed the nutrition content of the licensing exams using four external nutrition professionals, known for their expertise and interest in medical education. The purpose of this review was to identify the number of nutrition related items, the nature of nutrition related items, and determine how coverage of nutrition changed from 1986 to 1993. This chapter describes the content review, which included preparing the reviewers, developing the coding process, organizing the review, and analyzing the data. Each exam contained approximately 600 to 900 multiple choice type questions/items. Reviewers were asked to code questions that related to nutrition according to the specified categories, normal/abnormal conditions, and system classifications, which are described in detail in the methods section. They were also asked to subjectively rate the nutrition questions according to their importance in clinical medicine on a five point Likert scale: 1) Not important, 2) Low importance, 3) Moderate importance, 4) Important, and 5) Very important.

The second part of the project involved comparing students' performance on the nutrition items on the Step 1 and Step 2 exams from schools that had a required nutrition curriculum to students' scores on the Step 1 and Step 2 exams from school without a required nutrition curriculum. Therefore, this section includes classification and selection criteria for the schools in each group, as well as the selection criteria for the students in each group. In order to perform this type of comparison, psychometric characteristics of the test material were performed and described in this section, as well as the statistical tests that were to be used for the comparison analysis. Psychometric characteristics included the item difficulty, reliability coefficient, and correlation coefficient. Analysis of covariance was the statistical test used in the analysis.

Chapter 5, the results section, lists data from the content review and the comparison analysis. These data include the percentage of nutrition items on the 1986 Part I and Part II and the 1993 Step 1 and Step 2 exams. The percentage of all the category and system codes for all the exams are also given. Mean ratings of the importance in clinical medicine and the percentage of nutrition items assigned by committees are presented. Results of the psychometric characteristics of the exams and the percent correct of nutrition and non-nutrition subscores are listed for the comparison research.

Chapter 6, the discussion section, gives an overview of the results and offers possible explanations for the content review data, as well as the comparison results. This section also interprets the data, and includes the strengths and weaknesses of using the nutrition subscore of a licensing exam to evaluate the nutrition knowledge of medical students. Because the content of a nutrition course in medical school is only one of the many variables that could influences student's performance on nutrition items, factors that may influence student's performance on licensing exams are also discussed.

Considerations

Much of the research regarding content of nutrition in medical curriculum emphasizes the nutrition topics which "should" be taught and where in the curriculum or which residency training programs these topics "should" be integrated. The literature also outlines specific content guidelines which could be used as a guide for developing or improving the nutrition items on licensure exams. The results of this research contradict the nutrition literature which states that "no means had been introduced by the NBME to ensure the inclusion of questions on nutrition and health on the NBME Part I and Part II exams or the USMLE Step 1 and 2 exams since the NRC 1985 report" (10).
However, questions to keep in mind when analyzing these data:

1) Why does the current literature state that nutrition coverage on the Step exams has not increased since 1985?

2) Why have no reports been issued by the NBME to indicate that the revision of the Part exams, which became the Comprehensive Part exams and later the Step exams in 1992, shifted content coverage to systematically included more prevention and nutrition related topics?

3) How much nutrition coverage on a licensing exam for medical students is enough? And because nutrition overlaps with other disciplines, how can the adequacy of nutrition on a licensure exam be defined?

4) Is the coverage of vitamin deficiencies over emphasized considering the incidence of these problems in the US have decreased dramatically since the early 1900's? And if so, why?

5) Is the subscore of nutrition items on a licensing exam an appropriate instrument to evaluate the nutrition knowledge of medical students?

6) Is there adequate nutrition information that medical students need to know in order to be a competent physician? And can this material be integrated into medical curriculum and on licensure exams?

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CHAPTER 2

LITERATURE REVIEW

Background

Nutrition education can be defined as the introduction of scientific principles of nutrition into the clinical practice of medicine (1). Medical nutrition education is directed towards preparing the physician to incorporate nutrition into both the treatment and prevention of chronic illness and to meet the needs of patients and the public (1). Since 1992, preparation to practice medicine includes passing the United States Medical Licensing Examinations (USMLE), administered by the National Board of Medical Examiners (NBME).

Research on medical nutrition education has focused on the current status of nutrition in the medical curriculum; knowledge, skills, and attitudes of medical students, residents, and physicians of nutrition; and the content of nutrition curriculum in medical education and residency training. For the purposes of this paper, it is assumed that the relationship between nutrition and health and disease has been adequately established (2,3).

The status of nutrition in medical education has been described and reviewed by numerous individuals since 1930, and extensively throughout the 1980's and 1990's (4-8). As early as 1950, The American Medical Association (AMA) Council on Food and Nutrition criticized United States medical schools for their lack of commitment to teach nutrition, stating that "nutrition received inadequate recognition, support, and attention in medical education" (9). It was assumed more than 30 years ago that the AMA's recommendations would result in an increase in nutrition in medical education. The AMA committees reconvened in 1962 and 1972, both times to express concern for the lack of any discernible progress in the inclusion of nutrition in medical education (9).

More recently, the National Nutrition Monitoring and Related Research Act of October 1990 stated that by 1991, the secretary of the Department of Health and Human Services, in consultation with the secretaries of agriculture, education, and defense and the director of the National Science Foundation, would submit a report outlining the appropriate federal role in ensuring that United States medical students and physicians in practice have access to adequate training in the field of nutrition and its relationship to health (10). Louis Sullivan, MD, past Secretary of the Department of Health and Human Services, reported in *Skills Necessary for Contemporary Health Professionals*, "health professionals must do more to help patients stay healthy and prevent the onset of disease" (11). Sullivan stressed that health professionals can help promote a "new vision of health care where individuals exert more control over their lives, meaning more empowerment of the individual and a climate of individual responsibility and community service" (11). The specific activities listed for health promotion and disease prevention included adopting better dietary behavior, proper vaccination, regular physical exercise, moderate alcohol use, elimination of illegal drug and tobacco use, and the consistent use of seat belts.

The nations' health objectives for 1990 and 2000, entitled Healthy People 2000, have also been outlined by the Office of Disease Prevention and Health Promotion, United States Department of Health and Human Services. The Healthy People 2000 goals include the following statement about nutrition in medical education: "Nutrition education and counseling should be included in all routine health contacts with health professionals" (12).

Much of the nutrition education literature is composed of content suggestions to assess the nutrition knowledge and skills level of medical students, with the assumption that nutrition will be incorporated into medical curriculum and licensure exams. Position papers have been written by the American College of Physicians and the American Dietetic Association, both strongly supporting the essential role of nutrition in medical education and in medical practice (13,14).

It can be assumed that medicine is a learned profession, whereby medical educators have a responsibility to pass along a certain body of knowledge and a certain code of ethics to their students. The medical profession does however, establish and enforce their own standards. It is also assumed that the health care network is dominated by physicians, with the public turning to physicians for medical advice and consultation, usually for a specific medical problem rather than for preventive care (15). Therefore, physicians hold key roles of power and influence in the medical field because of their ability to diagnose and treat acute and chronic illnesses (15). Based on these assumptions, nutrition advocates claim that physicians should be educated and tested about nutrition as a mechanism to increase preventive care and hence, improve the overall health and well being of their patients (4-9). These proponents argue that nutrition needs to be represented adequately in the medical curriculum and on licensure exams.

But who defines adequacy in the medical curriculum or the assessment of nutrition knowledge on exams and why is nutrition important, such that future doctors should be trained and tested in nutrition? And will nutrition training during medical school and the inclusion of nutrition questions on licensure exams improve the overall health and well being of patients? Because the literature lacks information regarding testing nutrition knowledge in medical school as well as on licensure exams, this review will discuss the political structure of medical schools, as well as the content guidelines for nutrition curriculum which have been purposed to evaluate the nutrition knowledge and skills level of medical students. Research which has assessed medical students', residents', and physicians' attitudes about clinical nutrition, as well as the barriers that have been proposed by nutrition advocates to explain why nutrition has not been adequately integrated into medical school curriculum and licensure exams will also be presented to support this research.

Political Structure

United States medical schools are accredited by the Liaison Committee for Medical Education (LCME), which is composed of representatives from both the American Medical Association (AMA) and the Association of American Medical Colleges (AAMC). Basic science refers to the courses that are taught during the first two years of medical school, such as Biochemistry, Physiology, Anatomy, Pathology, Pharmacology, Histology, Embryology, and Microbiology. The remaining two years of undergraduate medical curriculum are composed of courses and rotations in clinical training, which are taught by clinical faculty usually in hospital settings, affiliated with medical schools. Courses include history taking and physical exam skills, and medicine, surgery, gynecology, psychiatry, and pediatrics clinical rotations. However, a few medical schools do not follow this structured curriculum, with basic science courses taught during the first and second year and clinical rotations required during the third and fourth years. In addition, problem based learning, where students are expected to learn on their own in small group settings has also begun to replace the standard medical curriculum in some medical schools. For the purposes of this discussion, the standard medical curriculum will be highlighted.

It is assumed that medical school basic science and clinical professors are full-time tenured faculty, with primary teaching, research, and patient-care responsibilities. These faculty are also represented on curriculum committees, which are charged with the task of overseeing the curriculum and making recommendations to the deans for basic science and clinical education, with the goal to protect the time their discipline holds in the curriculum (16,17). The literature also implies that department chairmen compare the amount of curriculum time devoted to their field at national meetings and those with more time are admired and envied more than those with less time (17). Since only one of the 126 United States medical schools currently has a separate nutrition department, it can be assumed that most curriculum committees in medical schools do not include nutrition representatives.

To analyze why the current political situation exists, it is helpful to look back at the development of medical education policies and procedures. Abraham Flexner purposed a model for medical education in 1910, much of which is still in existence today, and Flexner is often cited as revolutionizing medical education (18). One of Flexner's numerous recommendations was that medical school faculty affiliate with University based, permanent basic science departments in order to conduct biomedical research which would be the basis for their clinical practice. He outlined a two year core basic science curriculum, followed by two clinical training years, all of which could be taught by the newly appointed full-time basic science and clinical department faculty.

Obviously, his recommendations are still in existence, but why? Several factors have been purposed to explain these phenomena, namely that the medical system was driven by federal research grants making research essential (19,20). Throughout the 1900's the rapid expansion of technology, combined with the emergence of new diseases, allowed medical science to quickly advance (21). At the same time, there were significant increases in funding or allocation of resources for basic scientists, resulting in a dramatic increase in productivity, influence, and awards during the past 50 years (22,23).

As a result, basic science departments in medical schools, which are responsible for teaching during the first two years, grew in power, enabling them to influence curriculum committees and remain as full-time tenured faculty, with primary teaching responsibilities. More recently though, reductions in funding allocations for basic science research have occurred, concurrent with an increase in funding for clinical research and the expansion of clinical departments whose faculty have income generating potential (23,24). Therefore, turf problems may have been created from the altered allocation of resources. The basic science faculty may have been threatened as a result of the decreased funding and possible job insecurity which may follow.

To bridge these gaps, a reform movement to integrate basic sciences with clinical medicine and allot more time to patient communication skills, with emphasis on social and preventive medicine, has continued throughout the 1990's. Integrated curriculum, where material from other courses are presented within each course-such as teaching medical students about a AIDS, and involving Immunology, Physiology, Biochemistry, and Histology faculty is being implemented in medical schools across the country. The goal of an integrated curriculum is that students will maintain knowledge of the basic sciences when that knowledge and skill is displayed in the context of clinical problems. Collaborative and cooperative learning in medical school curriculum has also become very popular. It is believed by many medical school deans that this multidisciplinary or collaborative teaching technique has evolved over the years because of a need to give students a well rounded approach to a massive amount of scientific and clinical material.

In order to measure knowledge and cognitive competence of medical students, a single three step examination program has been established for licensure in the United States. Referred to as the United States Medical Licensing Examination (USMLE), it consists of three-step examinations, each Step taken at different points in the educational process of the physician. According to the National Board of Medical Examiners (NBME) who develops the Step exams, these exams focus on content that is necessary for practice, rather than explicitly on content that has been taught in all medical schools (1). However, there is a close association, if not a parallel to the structure of the Step exams with the standard medical curriculum described above.

For example, most students take the USMLE Step 1 exam at the end of the second year of medical school and the Step 2 exam at the end of the fourth year of medical school The Step 1 exam is used "to determine if an examinee understands and can apply important concepts of the basic biomedical sciences, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy" (3). The Step 1 exam covers the general principles of the basic sciences including Biochemistry, Molecular Biology, Genetics, Cell Biology, Immunology, Human Development, Multisystem and Behavioral Processes, Microbiology, Pharmacology, Abnormal Processes, and Quantitative Methods, similar to what is taught in most medical schools during the first two years. The majority of the items on the Step 1 exam assess application of basic science principles to clinical situations, interpretation of pictorial or tabular material, and other problem solving skills, many as posed within the context of a patient vignette. (2) The Step 2 exam is used "to determine if an examinee possesses the medical knowledge and understanding of clinical science considered essential for provision of patient care under supervision, including emphasis on health promotion and disease prevention" (4). The Step 2 examination covers normal growth and development and general principles of care during reproduction, infancy, childhood, adolescence, adulthood, senescence, as well as medical ethics, biostatistics, epidemiology of health and disease, health services delivery, and community dimensions of medical practice, similar to what is taught during the clinical rotations during the third and fourth year of medical school. Questions focus on content that is important for any new graduate to know regardless of area of specialization. (2)

The USMLE Step exams replace the National Board of Medical Examiner (NBME) Part I, II and III exams and the Federation Licensing Examination (FLEX) for licensure. The Federation Licensing Examination (FLEX) was available for state and territorial licensing authorities through the Federation of State Medical Boards (FSMB) since 1968. By 1979, FLEX was administered by all states and also available to foreign medical students since they were excluded from taking the NBME. With the implementation of a uniform exam in 1992, differences in testing between foreign medical graduates and United States graduates could be eliminated by providing a common evaluation system to measure applicants for licensure, regardless of the source of their medical education.

Based on results of an internal study conducted by the NBME in 1983 to evaluate the Part I and Part II exams, recommendations were made to make the exams more "comprehensive, with emphasis placed on concepts deemed important for the current and future practice of medicine, including prevention of disease" (23). Based on these recommendations, comprehensive Part I and Part II Committees were appointed in 1986. The NBME gave these comprehensive Part I and Part II Committees overall responsibility for design of the new exams, including procedures used for test development, administration, scoring, setting standards, score reporting, review and approval of each exam prior to test administration, and provisions for feedback to item writers regarding test material.

The NBME comprehensive Part I and Part II exams were redesigned with multidisciplanary content specifications, to include new content domains, and were implemented in 1991. The purpose was to develop a broad-based, integrated exams used for certification rather than a distinct achievement test in the basic science and clinical disciplines, as were being accomplished on the Part I and Part II exams (23). The percentage of items that required comprehension and reasoning were increased. To allow more time for each question, the total number of items was decreased from 980 to 800 on the Part I exam and from 900 to 800 items on the Part II exam. Beginning in 1988, the NBME and FSMB began to negotiate a partnership for a single, three-step exam for medical licensure. These two licensing exams officially merged in 1992 to create the USMLE as a common evaluation system for medical licensure in the United States. The comprehensive Part I and Part II exams described above were implemented for one year in 1991 and officially become the USMLE Step 1 and Step 2 exams. Step 1 was first administered in June 1992 and Step 2 was first administered in September 1992.

The National Research Council (NRC) Nutrition in Medical Education Committee and numerous reports since 1985 have purposed that separate nutrition courses should be required in every United States medical school, under the auspices of a nutrition department, with a minimum of 25 hours allotted to teach nutrition. In reality though, there are severe limitations in teaching time, as supported by the General Professional Education of the Physician (GPEP) report in 1984 which recommended that faculty evaluate their time and decrease overall lecture time. Specifically the GPEP report recommended that 30 to 50% of the time devoted to lectures be used instead in active learning experiences administered by interdisciplinary, interdepartmental committees, while integrating health promotion and disease prevention information throughout the curriculum rather than as a separate course (24). So the question continues to arise-why do nutrition advocates or proponents of nutrition in medical education continue to argue for separate nutrition courses, with increased lecture time, when schools are moving in the direction of integration and less time devoted to lectures?

Competency Requirements

To clarify, competency refers to an individuals' ability to gain an understanding of certain basic knowledge and to perform certain skills within a particular area of education. For physicians, it can be assumed that medicine is a learned profession and this general knowledge base incorporates human biology, clinical experience, judgment and insight, clinical skills, pathophysiology, basic sciences, psycho-social aspects, and epidemiology (25). It is therefore assumed that the knowledge of medicine is drawn from a variety of disciplines and incorporates both basic science and clinical experience. In addition, it is assumed that physicians, once in practice, will engage in life-long learning in order to "keep up" with the practice of medicine.

Assuming physicians are the primary care providers in our culture, the public usually seeks their advice for specific medical problems (26). Based on these assumptions, advocates recommend incorporating nutrition into undergraduate and graduate medical curriculum as a mechanism to educate future physicians about nutrition. Examples of clinical nutrition knowledge which have been outlined in the literature that physicians should be familiar with encompass the following three main areas:

Clinical Nutrition Knowledge for Physicians

- Maintenance of health of individuals at all stages of development at all ages.
- Knowledge and application of those aspects of diet and nutrition which may have a long-term impact on the prevention and amelioration of chronic diseases.
- Knowledge of the impact of various diseases and their medical treatment on the nutritional status of the patient and the appropriate use of such knowledge in preventing of ameliorating the nutritional disabilities which may result from such disease states and their treatments.

Source: (27)

However, results of several studies comparing 11 schools within the Southeastern Regional Medical-Nutrition Education Network (SERMEN) indicate that there are significant variations in student's knowledge with regards to nutrition (28). The University of Alabama School of Medicine created SERMEN with the intent to conduct medical educational research related to nutrition. By developing a national nutrition test-item bank, which would also be available to all United States medical schools upon request, they believe that the nutrition knowledge and skill level of medical students could be assessed. A physician faculty representative from each of the 11 SERMEN schools rated 41 nutrition topics on their importance in medical practice. From the seven topics unanimously chosen, a 90-item exam was prepared using the nutrition test bank.

Using this exam, the average knowledge of medical students within SERMEN was tested before and after their basic sciences courses, as well as at the conclusion of their undergraduate medical school training. Results indicate that at the midpoint of their education (after the basic sciences) scores were significantly higher (69% correct) than the incoming freshman's scores (53% correct). No significant difference existed between the midpoint and the graduating seniors score (68% correct) (28).

Further investigation of student's nutrition knowledge using this exam revealed that senior medical students' scores varied within each SERMEN school depending on the amount of required nutrition teaching. Students in medical schools with no nutrition training scored the lowest; those in schools that had nutrition integrated into basic science courses scored higher, and those with separate nutrition courses scored the highest (29).

Mlodinow and Connor surveyed physicians and medical students from the California Medical Association San Diego County and the University of California, San Diego School of Medicine using 62 true-false questions to assess nutritional knowledge. 184 family practitioners and general internists and 24 first and second year medical students responded to the questionnaire, a response rate of 40%. Physicians answered 69.2% of the questions correctly, with scores ranging from 47% to 84%. The categories directly or indirectly related to coronary heart disease, which the authors labeled as topics that have been "most heavily researched", received the most correct answers. Topics which the authors labeled as "less investigated", such as diet and cancer and iron absorption, received the least amount of correct responses. The average score for the medical student group was 62.5% correct.

This study also found a significant negative correlation between the number of years since graduation and the physicians' nutritional knowledge. The authors made the assumption that nutrition education in medical schools and residency programs had improved with time-mainly because of the increased emphasis on the curriculum or an increased amount of available data (30).

Another survey, conducted at the University of North Carolina School of Medicine, attempted to assess undergraduate medical students' knowledge about practical implications of dietary research and the degree to which medical students personalize factual learning by integrating it into personal behavior (31). Medical students were asked about three specific areas of diet and cardiovascular disease prevention: knowledge of the link between diet and heart disease, attitudes regarding the adoption of the "prudent diet," and personal dietary behavior. [The prudent diet is defined as one which has been recommended by most national organizations, including the reducing of total fat intake to less than 30% of total calories.] Medical students scored significantly higher than the general public on questions related to fat and cholesterol, but many students had misconceptions about the practical information which would be used in dietary counseling. The study also revealed that medical student's knowledge of dietary information did not generate any changes in their own dietary behavior (31).

Other researchers have attempted to study perceived knowledge about specific topics, the perceived relevance of itemized nutrition skills as well as the respondents' interest in learning more about specific topics (32). Jack and colleagues at Brown University Family Practice Residency Program administered a 33-question nutrition survey to 42 practicing family physicians over an eight-year period, upon entry into their first year of residency. Using a Likert scale of 1 to 5, physicians were asked to self-assess their knowledge and interest in nutritional biochemistry, nutritional therapy, nutrition in critical care, nutrition in the life-cycle, and nutrition in prevention, as well as their desire to learn more about these specific topics. The authors referred to the physicians' self-assessment of knowledge as "confident", stating that physicians were "most" confident about their knowledge of nutrition and prevention and "least" confident about nutritional biochemistry (32). These physicians were also least interested in learning about nutritional biochemistry and most interested in learning about nutrition in the life-cycle.

Follow-up surveys were also given to these physicians once they completed their residency training, indicating that practicing family physicians viewed themselves as more knowledgeable about nutrition than when they were first-year residents. However, their interest level in nutrition had declined as compared to when they began their residency training, with one exception, physicians wanted to learn more about nutrition counseling skills (32).

With regards to the information presented above, most of the data about nutrition knowledge of physicians and medical students were collected through surveys. For the purpose of this discussion, it is helpful to highlight the issues surrounding surveys and the interpretation of these results. The response rate of surveys, particularly among physicians, is typically low. But is a 40% response rate for family practitioners considered high or low? Are the results reliable? Keeping in mind that those who complete this type of a survey may be more interested in nutrition than those who do not respond, the assessment of their nutrition knowledge may be an overestimate. There also appears to have been a wide range of topics included in the surveys, all trying to pinpoint medical students' or physicians' interest and knowledge about nutrition. Perceived knowledge may also be an overestimate, since respondents may not feel comfortable admitting a lack knowledge in a particular area.

Keeping these methodological differences in mind, it is difficult to know who is considered "knowledgeable" in nutrition and who is not. How can one make the assumption that self-assessment of knowledge is an accurate assessment of knowledge? And should medical students who scored 62.5% on a nutrition exam be considered as having "no knowledge" when they answered more than half of the questions correctly?

A larger issue is one of skills assessment, which none of these surveys has addressed. How can medical students' or physicians' nutrition skills be assessed? What are the skills that medical students and practicing physicians should possess to show competency in nutrition? These skills could be related to nutrition assessment as well as nutrition counseling, neither of which have been discussed. Currently, the Liaison

Committee for Medical Education (LCME), the credentialling body within the medical profession, has recommended that medical schools begin to assess students' history taking and physical exam skills using standardized patients, as a way to measure competency other than by a standardized test (33). The NBME is also researching the inclusion of standardized patient cases to assess students' history taking and physical exam skills as another way to test medical students' competency to practice medicine.

Attitudes

To analyze whether medical students', residents' or physicians' attitudes about nutrition impact their medical education or their nutrition counseling skills, the following evidence is presented. Results of several studies comparing the 11 schools within SERMEN indicated that 85% of students were dissatisfied with the quantity of nutrition education and 60% indicated they were dissatisfied with the quality of nutrition education in their medical school curriculum (28). These data parallel the results of the 1993 *AAMC All Schools Survey of Graduating Medical Students*, indicating that 62.5% of graduating medical students felt the amount of time devoted to nutrition instruction was inadequate in their medical school (34).

Additional statements have also been given by the American Medical Student Association (AMSA), which has developed a Task Force on Nutrition and Preventive Medicine, the largest of the twelve permanent task forces of the AMSA, having representatives on most United States medical school campuses. Students from the AMSA have released the following consensus statement: "Next to smoking, diet and nutrition related factors are among the greatest contributors to preventable, premature illness and death in the industrialized world as well as in less-developed countries" (35, 36). The AMSA and American Society for Clinical Nutrition (ASCN) jointly surveyed graduating senior AMSA members, specifically related to their attitudes about nutrition, medicine, and their medical education. 535 student members were randomly selected, of which 119 students responded (20%).

The results indicated that an overwhelming majority of students believe that the current medical education system fails to adequately train students in nutrition, even though students perceive nutrition to be an important subject for physicians. On the other hand, students indicated they were very reluctant to have increased lecture time or additional exams or courses in order to accommodate nutrition due to their already overburdened schedules, requiring a great deal of learning and memorization (35,36). Factors that influenced students' attitudes about nutrition included how seriously the faculty treated nutrition, whether nutrition information was included on exams, whether nutrition would be covered on the USMLE Step exams, the nutrition knowledge of lecturers, and the utilization of nutrition in clinical care.

Is the level of nutrition education in medical school and on licensure exams associated with the amount of nutrition information that is transmitted to patients in practice or the personal dietary habits of physicians? The previously described survey which was conducted at the University of North Carolina School of Medicine included questions about attitudes regarding the adoption of the "prudent diet" and personal dietary behavior. The authors concluded that medical students' knowledge of dietary information did not generate any changes in their own dietary behavior. Instead, dietary behavior was related to student attitudes, such as motivation to change, self-efficacy, helplessness and a perceived unpalatability and inconvenience of a prudent diet (31).

At present, controversy exists whether nutrition education influences the nutrition counseling practices of physicians. Levine and colleagues surveyed 30,000 primary care physicians to investigate their attitudes and practices related to nutrition (37). Respondents were asked to indicate the degree of agreement with each of 35 statements on the use of nutrition in their clinical practice, on a five point Likert scale ranging from "strongly agree" to "strongly disagree." Respondents were also asked to indicate how often they employed each of 50 techniques related to nutrition counseling of their patients, on a similar Likert scale ranging from "always" to "never" employ the technique.

Overall, physicians considered nutrition to be important in clinical practice, greater than 75% agreeing or strongly agreeing with positive attitude statements such as "medical schools and licensure exams should place greater emphasis on nutrition education" and "doctors should spend more time exploring dietary habits during patient evaluation." Also, 75% of the respondents tended to "disagree" or "strongly disagree" with the negative statements about nutrition, such as "nutrition is only important in certain specialties" and "nutrition education is not the responsibility of the physician."

Examples of results related to behavior indicate that physicians who were willing to change their own diets, either to prevent or to help treat their own disease, tended to express favorable attitudes towards nutrition, to determine their patients nutritional status more frequently, and to advise and teach desirable health habits to their patients. In addition, the authors believe that physicians who utilized specific resources to obtain nutrition information, such as nutrition journals and texts, nutrition seminars, and registered dietitians, had a higher favorable attitude score compared to those physicians who obtained their information from popular magazines, radio or television coverage.

Other factors, which the authors believe accounted for differences in nutrition attitudes among physicians, were their affiliation and their age. Physicians who were affiliated with a university tended to have more favorable attitudes about nutrition and were more likely to incorporate nutritional questions into their history and physical examinations, increasing their identification of patients at risk for malnutrition compared with non-university affiliated physicians. Respondents who were under age 45 expressed more favorable attitudes towards nutrition and were more likely to have taken a nutrition course during their own medical training and to use nutrition resources in their practice compared to the physicians who were older than 45 years.

The authors note that those physicians who had taken a nutrition course during their medical training had significantly more favorable attitudes about how diet can affect the health of their patients, as well as expressed a greater confidence in their ability to provide nutrition counseling, compared to those who did not have a course. However, those individuals who had studied nutrition did not use clinical nutrition skills in their practice to a greater degree than those who had not studied nutrition during their training, [which is related to the impact that physicians will have on a patient's health if they are educated and tested about nutrition in the context of preventive medicine (37).]

As stated above in the analysis of the knowledge and skills surveys, the response rate of surveys may effect the interpretation of the results. How much emphasis should be placed on a medical student survey with a 20% response rate, when this was a self-selected group of student members of the Task Force on Nutrition and Preventive Medicine. How do these response rates affect the interpretation of results? And what about the time pressures of medical students, who felt nutrition was important, but were not interested in having additional time devoted to any more courses, not even when they felt "diet and nutrition related factors are among the greatest contributors to preventable, premature illness and death in the industrialized world as well as in less-developed countries" (35,36). And what is the purpose of completing attitudinal surveys, when it has not been documented whether a physicians' attitude about nutrition is correlated with their behavior?

Content

To clarify, clinical nutrition has been defined as the application of that science concerned with the basic knowledge, diagnosis, and treatment of diseases affecting intake, intestinal absorption, and metabolism of dietary constituents (38). This definition encompasses both a basic understanding of the role of dietary deficiencies, excess, or imbalance in altered metabolism of nutrients and pathogenesis of disease, and the role of dietary modification and specialized nutrients formulations and delivery systems in preventing and treating chronic and acute illnesses. Clinical nutrition specifically focuses on the importance of proper diet in the maintenance of health and the interrelationship between diet, nutrient metabolism, and disease. Therefore, it is assumed that the field of nutrition is closely allied with public health and its focus on the prevention of certain diseases and the epidemiological basis of disease.

Much of the research regarding content of nutrition emphasizes the nutrition topics which "should" be taught, where in the medical school curriculum they seemed to be integrated, or in which residency training programs these topics "should" be integrated (39-44). The literature also outlines specific content guidelines assuming again that nutrition is integrated into medical school curriculum, graduate residency programs, and licensure exams. The NRC, ASCN, SERMEN and other institutions have conducted research to assess competencies that United States medical students and residents "should" acquire. The ASCN conducted a series of surveys and a national consensus workshop with medical administrators who had curriculum planning authority to determine the nutrition topics of highest priority for physicians entering practice, regardless of their specialty. The results have been prioritized or ranked and the most important topics fall into the following three levels. Two other categories are used to list additional topics as important or desirable.

Level 1: Obesity, hyperlipidemia, diabetes, pregnancy, electrolytes, and major minerals.

Level 2: Carbohydrates, vitamins, protein, cell growth and immunity.

Level 3: Nutrition assessment and the nutritional management of disease states.

Surveys of faculty representatives from each of the 11 SERMEN schools rated 41 nutrition topics as to their importance for medical practice. They agreed on seven priority topics: nutrition assessment, nutrition in trauma and surgery, obesity, minerals, disorders of the gastrointestinal tract, cell growth in infancy and adolescence, and pregnancy and lactation (45). These same investigators have updated their list and divided the topics into high priority, such as body composition, proteins, carbohydrates, lipids, vitamins, minerals, and hyperlipidemia, and low priority topics such as general aspects of nutrition, primary malnutrition, chemical additives in foods and the effect of food processing on the nutritional value of food (45).

Many of the concerns previously noted regarding research in competency requirements and attitudes also apply to content research because of the use of surveys. When dealing with content issues and prioritizing of topics, each person completing the survey has a different perspective, with varying research interests, different departments with varying allocation of resources, and hence their own agendas. These factors can all impact the outcome of a study, which may partially explain why there is much variation among the respondents, some of whom will never agree. Assuming that the NRC and the ASCN recommendations include preventive aspects of health and disease, standard medical curriculum remains devoted to the diagnosis and treatment of illness rather than prevention. In the past several decades, the majority of medical students learned in acute-care settings, where patients with an illness are usually seen in a hospital setting. Students learn early on how to take a history and physical exam related to specific illnesses, which is often void of questions related to prevention. At the present time, with the increased emphasis on managed care and the attempt to reduce health care costs, hospital stays have been regulated and patient stays are significantly reduced. Therefore, training sites for medical students have begun to be in the ambulatory, or out-patient setting such as doctors' offices. In addition, state, federal and private funding institutions have directed monies toward programs and medical schools that offer students the opportunity to become family practitioners or general internists. The goal of this initiative is to ultimately to reduce health care costs by training more generalized physicians, rather than specialists, who can serve as the primary care physicians for patients.

Nutrition Research Topic

Because the status of nutrition in medical education over the past several decades has been viewed by nutrition experts as "not improved," obstacles or barriers within the medical education system have been hypothesized (39). These barriers included time constraints in the curriculum, the administrative structure of the basic science and clinical departments/curriculum committees and the subsequent allocation of resources and the lack of nutrition questions on the USMLE Step exams developed by the NBME. A recently published background report on the state of nutrition education in United States medical schools indicated that "no means had been introduced by the NBME to ensure the inclusion of questions on nutrition and health on the NBME Part I and Part II exams or the USMLE Step 1 and 2 exams since the NRC 1985 report" (3). The NRC Nutrition in Medical Education Committee and numerous reports since 1985 state that the NBME should create a means by which nutrition questions could be included to assess basic nutrition knowledge.

To clarify, most students take the Step 1 exam at the end of the second year of medical school. This exam is used "to determine if an examinee understands and can apply important concepts of the basic biomedical sciences, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy" (46). Most students take the Step 2 exam during the fourth year of medical school, with the purpose being "to determine if an examinee possess the medical knowledge and understanding of clinical science considered essential for provision of patient care under supervision, including emphasis on health promotion and disease prevention" (47).

According to Dr. Donald Melnick, Senior Vice President and Vice President, Division of Evaluation Programs at the NBME, the NRC report is not justified its statement that no means has been introduced by the NBME to ensure the inclusion of questions on nutrition and health since 1985 (48). In fact, as described in the background section of this paper, the NBME completely revised the blueprints of the exams between 1985 and 1991 to develop a more comprehensive USMLE Step 1 and Step 2 exam (48). The comprehensive Part I and Part II Committees' goals were to update the exams to incorporate current high priority issues, specifically social and preventive medicine, which encompassed nutrition topics. These newly designed Step exams were introduced in 1992 from the comprehensive Part I and Part II Committee designs. According to Dr. Melnick, the comprehensive Part I and Part II Committees charged with the process of redesigning the exams explicitly intended to systematically include nutrition content in the exams (48). Gastrointestinal/Nutritional Task Forces were appointed for both the comprehensive Part I and Part II exams to develop test materials for nutrition content. In addition, item writers for the traditional discipline-oriented committees were systematically assigned items covering nutrition content (23).

Because the Step exams are taken by all medical students who want to be licensed in the United States, it can be assumed that the NRC Medical Education Committee recommended an increase in nutrition questions on the USMLE Step exams with the anticipation that this would result in an increase in the overall content of nutrition in the undergraduate medical curriculum. However, the NBME clearly states that topics may be covered on the exam that have not been uniformly taught in all medical schools or certain topics that are taught in medical school may not be covered on the USMLE Step exams. These exams are designed to be an independent assessment of what medical students need to know for the practice of medicine. On the other hand, according to Dr. Melnick, the Step exams are updated to "keep pace" with medical curricula and the practice of medicine. To help ensure that the exams are keeping pace with medical curricula and the practice of medicine, content experts who write exam questions for the USMLE are carefully selected to reflect a wide geographic distribution from United States medical schools. Test committee members are represented from Liaison Committee on Medical Education (LCME) accredited medical schools, those in medical practice, and from licensing communities. These test committees are permanent with rotating membership, to maintain turnover. The discipline based test committees which contributed to the development of the NBME comprehensive Part I exam included 56 members from Anatomy, Behavioral Sciences, Biochemistry, Microbiology, Pathology, Pharmacology, and Biostatistics fields. The discipline based test committees which contributed to the development of the NBME comprehensive Part II exam included 48 members from Medicine, Obstetrics and Gynecology, Pediatrics, Preventive Medicine and Public Health, Psychiatry, and Surgery fields.

Task forces, on a variety of disciplines, are ad hoc groups which are phased in and out depending on the topic areas where test materials are needed, based on responses of the review committees. A 40-member multidisciplanary task force contributed to the development of the NBME comprehensive Part I exam and a 48-member task force contributed to the development of the NBME comprehensive Part II exam. These task forces were the same for both exams and consisted of Cardiovascular/Renal, Gastrointestinal/Nutritional, Hematopoietic/Immune, Nervous, Pulmonary, Reproductive/Endocrine and Skin/Musculoskeletal groups.

Topics are assigned to committee members who are instructed to develop items that focus on basic science and clinical topics they deem to be important for the future practice of medicine (1). Based on the recommendations of the comprehensive Part II Test Committee, a "High-Impact Disease List" was developed for use in test construction. The criteria for this list are diseases that are: 1) common, 2) important to recognize because of the consequences, or 3) notable in illustrating basic pathophysiology (49). Item writers use this "High-Impact Disease List" as a guide in order to avoid esoteric topics when developing test questions. Once questions have been developed by item writers, they are returned to the NBME for review and evaluation by test development staff.

In addition, with the revision of the NBME Part I and Part II exams to become the USMLE Step 1 and Step 2 exams, the NBME clearly stated that the exams are intended to be neutral with regards to curriculum process, favoring one instructional approach to any other. "We do not anticipate that schools will need to make any modifications in curriculum as a result of changes introduced as a result of changes introduced in the exams" (48). According to Melnick, the NBME's role is not to "drive curriculum". The NBME staff has found it helpful to distinguish between curriculum goals and curriculum process, defined as the content and skills to be learned versus the courses and methods used to teach. The NBME also distinguishes between the basic sciences that students should be taught and the basic science that examinees should have learned, meaning that each school has the responsibility to determine how to teach, what to teach, and when to teach it (50). In reality though, a close association exists between the topics taught in medical schools and the topics included on the Step exams (50).

Since it has not been documented whether the NBME has adequately addressed the nutrition competency of medical students, the purpose of the current research project was to assess to what extent nutritional issues were covered on the NBME Part I and Part II exams and are covered on the USMLE Step 1 and Step 2 exam. The purposes of this review were to identify the number of nutrition related items, the types of nutrition related items, and how these nutrition items changed from 1986 to 1993. To determine whether there was a difference in students' knowledge on the nutrition items on the USMLE Step 1 and Step 2 exams, a group of students from schools with required nutrition curriculum were compared to a group of students from schools that did not have a required nutrition curriculum. The 1986 NBME Part I and Part II exams were not included in this comparison because too few medical schools incorporated nutrition in the curriculum at that time.

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CHAPTER 3

BACKGROUND

Introduction

Physicians seeking licensure to practice medicine in the US are now required to pass the United States Medical Licensing Exam (USMLE), a uniform pathway to licensure. The USMLE consists of a three-step exam, each Step taken at different points in the educational process of the physician. According to the National Board of Medical Examiners (NBME), these Step exams focus on content that is necessary for practice, rather than explicitly on content that has been taught in all medical schools (1). Topics may be covered on the exam that have not been uniformly taught in all medical schools or certain topics that are taught in medical school may not be covered by the USMLE Step exams. Therefore, these exams are designed to be an independent assessment of what medical students need to know, regardless of whether or not, the topics are taught in all medical schools. In reality though, a close association exists between the topics taught in medical schools and the topics included on the Step exams, primarily because the NBME continually updates these exams to reflect current practices of medicine (2). Since this research project involved the 1993 Step 1 and Step 2 exams and not the Step 3 exam, only these two exams will be discussed.

The USMLE Step exams replace the NBME Part I, II, & III and the Federation licensing examination (FLEX) was available for state and territorial licensing authorities through the Federation of State Medical Boards (FSMB) since 1968. By 1979, FLEX was administered by all states and also available to foreign medical students since they were excluded from taking the NBME. With the implementation of a uniform exam, differences in discrimination in testing between foreign medical graduates and US graduates could be eliminated by providing a common evaluation system to measure applicants for licensure, regardless of the source of their medical education (3). In addition, a uniform exam will create a national basis for interstate endorsement permitting increased mobility of physicians from state to state (4). Beginning in 1988, NBME and FSMB began to negotiate a partnership for a single three Step exam for medical licensure. The two licensing exams officially merged in 1992 to create the USMLE, a common evaluation system for measuring knowledge and cognitive competence of all applicants for medical licensure in the US.

Prior to the introduction of the USMLE Step 1 and Step 2 exams in June 1992, the NBME administered the Part I and Part II exams. These exams were intended to measure the understanding of scientific principles and the foundation of medical knowledge an examinee should possess in the basic biomedical and clinical sciences (5). The NBME Part I exam questions incorporated seven disciplines and the NBME Part II exam incorporated six disciplines. These subjects on the NBME Part I exam were Anatomy, Behavioral Sciences, Biochemistry, Microbiology, Pathology, Pharmacology, and Physiology. The subjects on the NBME Part II exam were Medicine, Obstetrics and Gynecology, Pediatrics, Preventive Medicine and Public Health, Psychiatry, and Surgery.

Based on results of an internal study conducted by the NBME in 1983 to evaluate the NBME Part I and Part II exams, recommendations were made to make the exams more "comprehensive, with emphasis placed on concepts deemed important for the current and future practice of medicine, including prevention of disease" (3). Based on these recommendations, comprehensive Part I and Part II Committees were appointed in 1986. The NBME gave these comprehensive Part I and Part II Committees overall responsibility for the design of the new exams, including procedures used for test development, administration, scoring, standard setting, reporting, review and approval of each exam prior to test administration, and provisions for feedback to item writers regarding test material.

The NBME comprehensive Part I and Part II exams were redesigned with multidisciplanary content specifications, to include new content domains, and were implemented in 1991. The purpose was for broad-based, integrated exams used for certification rather that distinct achievement tests in the basic science and clinical disciplines, as were being accomplished on the Part I and Part II exams (2). The percentage of items that required comprehension and reasoning was increased. To allow more time for each question, the total number of items was decreased from 980 to 800 on the Part I exam and from 900 to 800 items on the Part II exam. These NBME comprehensive Part I and Part II exams officially became the USMLE Step 1 and Step 2 exams which were first administered in 1992.

Item Format

The NBME Part I, Part II and the USMLE Step 1 and Step 2 exams consist of multiple choice questions. The NBME Part I and Part II exams each contained approximately 900-980 items and the USMLE Step 1 and Step 2 exams each contain approximately 800 items. The current Step exams differ from the Part exams with respect to item format. Based on content and psychometric research findings, true-false and K-type items have been eliminated from the exams. K-type items can be defined as multiple true false selections, where students determine which answers are correct and are asked to select the total number of correct answers. Currently, the exam questions include the one-best answer type, selecting from five options. The stems of the items are often longer than previous exams and include more complete patient vignettes. Patient scenarios, followed by several one-best-answer type questions are frequently utilized.

Content Outline

Material covered by the Step exams are guided by content outlines. Content outlines for the USMLE Step 1 and Step 2 exams were developed by the comprehensive Part I and Part II Committees. Oversight committees also convene periodically to review the content outlines and exams and may make recommendations for changes. These content outlines, along with 120 sample test items, are available to medical school faculty and students who register for the exams. These content guide books also include a general blueprint of the exam, with the percentage of items indicated for each of the major headings, the purpose of the exam, general instructions, item formats, and laboratory value tables. Prior to the NBME comprehensive Part I and Part II exams, separate content outlines for each discipline dictated the questions, written by separate test committees (5,6).

Test Construction

The USMLE Composite Committee oversees evaluation objectives and content outlines for the Step exams. The development of the Step exams is a shared responsibility among several committees. The respective Step Committee for each exam has overall responsibility for the design of the exam program and the standards that are set for passing the exam. The Step Committees review and approve their respective exams prior to test administration and provide feedback to item-writing groups regarding test material. Test material development committees write and review test items and recommend changes in test content (7). Content experts who serve on test committees write exam questions for the USMLE Step exams. These content experts are carefully selected by the NBME to reflect a wide geographical distribution from US medical schools, and personal demographic variables such as gender and race. Test committee members are represented from academic, practice, and licensing communities from Liaison Committee on Medical Education (LCME) accredited medical schools, those in medical practice, and from licensing committees. These test committees are permanent with rotating membership, to maintain turnover. The discipline-based test committees which contributed to the development of the NBME comprehensive Part I exam included 56 members from Anatomy, Behavioral Sciences, Biochemistry, Microbiology, Pathology, Pharmacology, and Physiology fields. The discipline based test committees which contributed to the development of the NBME Comprehensive Part II exam included 48 members from Medicine, Obstetrics and Gynecology, Pediatrics, Preventive Medicine and Public Health, Psychiatry, and Surgery fields.

Task forces, on a variety of disciplines, are ad hoc groups which are phased in and out depending on the topic areas where test items are needed, based on responses of the review committees. A 40-member multidisciplanary task force contributed to the development of the NBME comprehensive Part I exam and a 48 member task force contributed to the development of the NBME comprehensive Part II exam. These task forces were the same for both exams and consisted of Cardiovascular/Renal, Gastrointestinal/Nutritional, Hematopoietic/Immune, Nervous, Pulmonary, Reproductive/Endocrine and Skin/Musculoskeletal groups.

Two-day workshops are held throughout the year at the NBME to teach item writers how to construct multiple choice questions for the exams. Topics are assigned to committee members who are instructed to develop items that focus on basic science and clinical topics they deem to be important for the future practice of medicine (1). The assignments for the item writers are based on the content outline and the number and type of questions that are needed have a sufficient numbers of items in the item pool are periodically deleted need to be replaced.

Based on the recommendations of the comprehensive Part II Test Committee, a "High-Impact Disease List" was developed for use in test construction. The criteria for this list are diseases that are 1) common, 2) important to recognize because of the consequences, or 3) notable in illustrating basic pathophysiology (1). Items writers use this "High-Impact Disease List" as a guide in order to avoid esoteric topics when developing test questions. Once questions have been developed by item writers, they are returned to the NBME for review and evaluation by test development staff. Test committee meetings are held throughout the year, to review and approve these annotated questions developed by the item writers. Each question is read aloud and critiqued by committee members during these test committee meetings. In addition, all individual Committee Chairs meet to review and approve any questions that had been previously approved by the individual test committees, as a quality control mechanism (2).

Other quality control measures that are implemented include pre-testing all final items within an unscored section of an exam before an item is used as an actual scored item (2). Scored items are referred to as live items, versus those that are no longer used are referred to as retired items. Difficulty level and discrimination indices are calculated on pre-tested items to analyze statistical data before an item becomes live. Key validation is an additional method to ensure quality control. Key validation is a statistical review of all live once they have been scored for each administered exam to detect significant differences in question response from previous test administration. Key validation serves to detect typographical errors that occur during the publishing process or correct responses to questions that may have changed over time.

Exam Format

The NBME Part I and Part II exams were both two-day exams consisting of six test booklets of multiple-choice questions (A-F). Students were allotted a total of 13 hours for the Part I exam and 12 hours to complete the Part II exam. The current USMLE Step 1 and Step 2 exams are both two day exams consisting of four test booklets of multiple choice questions (A-D). Students are given a total of 12 hours for Step 1 and 12 hours to complete Step 2.

Most students take the USMLE Step 1 exam at the end of the second year of medical school, which is offered in June and September. The Step 1 exam is used "to determine if an examinee understands and can apply important concepts of the basic biomedical sciences, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy" (5). The Step 1 exam covers the general principles of the basic sciences including Biochemistry, Molecular Biology, Genetics, Cell Biology, Immunology, Human Development, Multisystem and Behavioral Processes, Microbiology, Pharmacology, Abnormal Processes, and Quantitative Methods. A majority of the items on the Step 1 exam assesses application of basic science principles to clinical situations, interpretation of pictorial or tabular material, and other problem solving skills, many as posed within the context of a patient vignette. (2)

Instead of constructing the exam according to seven separate disciplines, the 1993 Step 1 exam is constructed from an integrated content outline that organizes basic science material along the following three dimensions:

1) System
2) Process
3) Organizational Level

Within each of these dimensions, different topics or major headings represent a certain percentage of the exam. This way the exam not only tests on traditionally defined disciplines, made up by the test committees, but also interdisciplinary topics such as genetics, immunology, nutrition, aging, and molecular and cellular biology. The percentages of these heading are listed in the content outline booklet dimensions blueprint (Appendicies 1 and 2). Since the development of the above content outline, the organizational level dimension has been dropped from the blueprint which is used to select exam questions for each administration. The issues of the organizational level are still considered, but the NBME found that building exam questions using the three dimensional matrix was too complex.

Most students take the USMLE Step 2 exam during the fourth year of medical school, which is offered in March/April and August/September. The Step 2 exam is used "to determine if an examinee possesses the medical knowledge and understanding of clinical science considered essential for provision of patient care under supervision, including emphasis on health promotion and disease prevention" (6). The Step 2 exam covers normal growth and development and general principles of care during reproduction, infancy, childhood, adolescence, adulthood, senescence, as well as medical ethics, biostatistics, Epidemiology of health and disease, health services delivery, and community dimensions of medical practice. Questions focus on content that is important for any new graduate to know regardless of area of specialization. (2)

Instead of constructing the exam according to six separate disciplines, the Step 2 exam is constructed from an integrated content outline that organizes clinical science material along the following three dimensions:

1) Physician Task
2) Population Groups
3) Disease Process

According to the content outline, the first set of physician tasks, *Promoting Health and Health Maintenance*, encompasses the assessment of risk factors, appreciation of pertinent epidemiological data, and the application of primary and secondary preventive measures, as well as an understanding of community aspects of disease, the sociocultural and economic impact of disease treatment, and principles of environmental, occupational, home, and recreational health. *Understanding Mechanisms of Disease* encompasses pathophysiology and includes etiology, pathogenesis, pathology, contributing sociocultural factors, natural history, clinical course, associated findings, complications, severity of illness, and intended or unintended effects of therapeutic interventions.

Establishing a Diagnosis pertains to intervention of history and physical findings and the results of laboratory imaging and other studies to determine the most likely diagnosis or the most appropriate next step in diagnosis. The last physician task, *Applying Principles of*

Management, relates to chronic and acute care, ambulatory as well as inpatient care, and ethical, legal, economic, and social-family community considerations in management. These items focus on aspects of care that are especially germane to the supervised practice of medicine (1). Within each of these dimensions, different topics or major headings represent a certain percentage of the items on an exam. The percentages of these heading are listed in the content outline booklet dimensions blueprint. Since the development of the above content outline, the population group dimension has been dropped from the blueprint to build for examining. The issues of the population groups are still balanced, but the NBME found that in building an exam, a three-dimensional matrix was too complex.

Nutrition Research Topic

To try to understand why the status of nutrition in medical education has not improved in the past decade, several leading experts have described obstacles or barriers to offer solutions to increase nutrition in medical curriculum (8,9). A recently published background report of the state of nutrition education in US medical schools indicated that "no means had been introduced by the NBME to ensure the inclusion of questions on nutrition and health on the USMLE Step exams since the National Academy of Sciences 1985 report" (7).

However, according to Dr. Donald Melnick, Senior Vice President and Vice President, Division of Evaluation Programs at the NBME, this statement is not justified. As described above, the NBME completely revised the design of the exam between 1985 and 1991 to make a more comprehensive exam (11). The Comprehensive Committees' goals were to update the exams to incorporate current high priority issues, specifically social and preventive medicine, which encompassed nutrition topics. These newly designed Step exams were introduced in 1992 from the comprehensive Part I and Part II Committee designs. According to Dr. Melnick, the comprehensive Part I and Part II

Committees charged with the process of redesigning the exams explicitly intended to systematically include nutrition content in the exams (11). Gastrointestinal/Nutritional Task Forces were appointed for both the comprehensive Part I and Part II exams to develop test materials for nutrition content. In addition, item writing assignments for the traditional discipline-oriented committees included items covering nutrition content.

Since it has not been documented whether the NBME has been able to adequately address the nutrition competency of medical students, the purpose of the current research project was to assess to what extent nutritional issues were covered on the NBME Part I and Part II exams and are covered on the USMLE Step 1 and Step 2 exams. The purposes of this research were to identify the number of nutrition related items, the nature of nutrition related items, and how coverage of nutrition changed from 1986 to 1993. To determine whether there was a difference in students' scores on the nutrition items on the Step 1 and Step 2 exams, a group of students from schools with a required nutrition curriculum were compared to a group of students from schools that did not have a required nutrition curriculum. The 1986 Part I and Part II exams were not included in this comparison because too few medical schools incorporated nutrition in the curriculum at that time.

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CHAPTER 4

METHODS

To assess the extent of nutritional issues covered on the NBME Part I and Part II exams and the USMLE Step 1 and Step 2 exams, the 1986 June Part I, 1986 September Part II, 1993 June Step 1, and 1993 September Step 2 exams were reviewed by five nutrition professionals, known for their expertise and interest in medical education. The purpose of this review were to identify the number of nutrition related items, the nature of nutrition related items, and determine how coverage of nutrition changed from 1986 to 1993. These reviewers were individuals who develop and instruct nutrition courses at their respective medical schools. The reviewers were Sarah Morgan, MD, from the University of Alabama School of Medicine at Birmingham, Robert Kushner, MD, from the Chicago Medical School, Donald Hensrud, MD from the Mayo Medical School in Rochester, Minnesota, and Eleanor Young, PhD, RD, from the University of Texas Health Science Center. The investigator also participated in the review process concurrent with the invited experts.

To determine whether there was a difference in students' performance on the nutrition items on the Step 1 and Step 2 exams depending on their required nutrition curriculum, the scores of students from schools with required nutrition curriculum were compared to the scores of students from schools that did not have a required nutrition curriculum. The 1986 Part I and Part II exams were not included in this comparison because too few medical schools incorporated nutrition in the curriculum at that time.

Preparation and Training of Reviewers

To prepare for the review process, which was held on December 5, 6, and 7, 1994, the printed content outlines for the 1986 Part I and Part II and the 1993 Step 1 and Step 2 exams were used to identify the nutrition related topics. These content outlines are printed yearly for students and list all the possible topics that could be covered on the exams as well as the emphasis accorded general grouping of these topics on each exam (Appendices 1 and 2). Since nutrition is a minor heading, the percentage of nutrition questions is not presented in the content outline blue print. Content outlines for the 1986 Part I and Part II and the 1993 Step 1 and Step 2 exams were mailed to the four reviewers. They were asked to identify the topics which they felt were related to nutrition. Once the content outlines were returned from all four reviewers, their responses were combined with the investigator's identification of nutrition items and a list of topics which related to nutrition was developed.

Coding of Items

The next step in the planning process was to develop coding sheets that would be used by the reviewers to classify nutrition during the review process. After reviewing two test booklets of the actual 1987 June Part I, September Part II, 1992 June Step 1, and September Step 2 exams, the investigator developed exams similar to the actual exams that would be used for the study. One coding sheet was developed for all four exams in order to simplify the review process. All the codes were listed on every page of the coding sheets and the reviewers were given the criteria for this rating during the training process (Appendix 3). Based on this review, it was also determined that only items specifically intended to test nutrition knowledge should be coded as related to nutrition. Therefore, if a question contained a distracter in the answer that related to nutrition, it was not coded as a nutrition question unless the stem of the question was intended to test students' nutrition knowledge.

Coding was organized similar to the way the NBME structures the content outline, for both the Step 1 and Step 2 exams. Several of the general headings that are used for the Step 1 exam were adopted as categories and the systems that are used to classify the Step 2 exams were adopted as the systems for the review. By structuring the coding for the nutrition items with similar headings and subheadings used by the NBME, the coding process was simplified. However, the current research classifications did not follow the NBME definitions within each of these codes for all the nutrition related items. In addition, a few codes were added under the system list to account for questions that did not fall into a specific system, such as biochemistry and vitamin deficiency. The vitamin deficiency system code was also recorded with another system code if the question alluded to a particular system. An "other" option was also added to the category and system lists to account for questions that could not be coded into any other category or system.

The category codes consisted of the following:

1) Growth and development
2) Metabolic, physiological and regulatory mechanism and function
3) Lifestyle, life-cycle, and health maintenance
4) Mechanism of disease
5) Diagnosis of disease
6) Principle of disease management
7) Other (for questions that could not be coded 1 through 6)

The organ system codes consisted of the following:

1) Biochemistry and cellular respiration
2) Hematopoietic, blood
3) Nervous system and special senses
4) Skin and connective tissue
5) Musculoskeletal
6) Respiratory
7) Cardiovascular
8) Intestinal
9) Renal
10) Reproduction, pregnancy, childbirth
11) Endocrine
12) Infectious
13) Neoplasm
14) Immunological
15) Vitamin deficiency
16) Other (for questions that could not be coded 1 through 15)

Once an item was identified as nutrition related, it was coded for a category; whether it pertained to a normal or abnormal scenario; and organ system most likely described. If an item did not pertain to nutrition, the reviewers were asked to leave the space under the nutrition related column blank. If they were unsure, they were asked to put a question mark in the nutrition related column and code the question as they would a nutrition related item. Wording examples within each category code were also identified from the nutrition items on the 1987 and 1992 exams, and were used to help train the reviewers about the coding process.

The reviewers were also asked to subjectively rate the nutrition questions according to their importance in clinical medicine on a five point Likert scale: 1) Not important, 2) Low importance, 3) Moderate importance 4) Important, and 5) Very important.

The reviewers were instructed to base their importance in clinical medicine criteria on the frequency that the clinical scenario discussed in the question is seen by them during a usual week. They were also asked to base their response on the prevalence of the specific disease or its associated morbidity and mortality. The reviewers were not given case examples within each scale of importance in clinical medicine in advance. Since each test booklet contained deleted or experimental items which were not scored, these items were not reviewed. Therefore, separate coding sheets were developed for each test booklet within the four exams.

Prior to the actual review process on December 5, 6, and 7, 1994, the investigator trained the reviewers about the coding process that would be implemented when they arrived at the NBME. To facilitate prior training of four national reviewers, sample tests, each consisting of 46 questions were developed to simulate the Part I, Part II, Step 1, and Step 2 exams. These training tests were organized from retired item test booklets and from 1986 and 1993 content outline sample items. The nutrition items were coded in advance by the investigator to develop a sample test that would represent nutrition items within each category code. Nutrition related items were interspersed throughout each exam to give the reviewers an opportunity to individually identify and code these items in advance. Correct answers for all items were provided to the reviewers. They were given specific instructions on how to code the questions and a list of wording examples within each category, based on the investigators prior review of NBME 1987 Part I and Part II exams and 1992 Step 1 and Step 2 exams (Appendix 4).

For the coding of the sample tests, the actual coding sheets that were to be used at the NBME were also used in order to familiarize the reviewers with the category and system codes. The reviewers were also sent the final list of nutrition topics from the content outline that the group considered to be related to nutrition. They were encouraged to refer to this list when reviewing the sample test and when they were unsure whether a question was related to nutrition. The reviewers were asked to record their start and ending time to estimate the amount of time required to code these items when they arrived at the NBME.

The results of this training review process were tallied and the differences were evaluated and compared with the investigator's prior coding. Each reviewer was called individually to discuss items that were coded differently from the investigator or the majority of the reviewers (Appendix 8).

Results of the sample test coding completed in advance as part of the training process were used to further inform the reviewers of case examples within each scale of the importance in clinical medicine rating. These examples were also discussed during the orientation of the review process on December 5, 1994 to assist the reviewers with consistency regarding these classifications (Appendix 6).

Additional feedback from two of the reviewers indicated that several important nutrition topics were not addressed, such a nutrition support. Therefore, during the actual review process, the reviewers were given the opportunity to indicate the topics which they felt were not adequately addressed and those topics which they felt were covered in excess after finishing each of the four tests (Appendix 12).

Prior to arriving at the NBME, the reviewers were mailed the tallied results of the sample test which included all their responses. The final agreed upon questions and the subsequent codes that the investigator determined were related to nutrition were listed. An additional list was developed for the biochemistry items related to nutrition, because several of the reviewers consistently coded all biochemistry items as related to nutrition. It was decided by the investigator, based on the responses of the content outlines, that human and microbial biochemical and molecular genetics, cell biology, immunological processes and human development were biochemistry topics not related to nutrition (Appendix 5).

Based on the time responses of the sample test, it was estimated that two and one half days were necessary to review the 1986 June Part I exam, September Part II exam, the 1993 June Step 1 exam, and the September Step 2 exam. The first hour of the review process on December 5 was devoted to reviewing the codes that were in disagreement on the sample tests and the coding guidelines. The second half of the third day was planned for the reviewers to discuss the items that were not unanimously agreed upon, since 100% agreement had to be reached on every nutrition related item prior to the completion of the review process.

Organization

The organization of the actual review, which was held on December 5, 6 and 7, 1994, was structured in advanced in the following manner. The NBME Part I and II exams consist of six test booklets (A through F), and the USMLE Step 1 and 2 exams consist of four test booklets (A through D). To control for test fatigue and the learning curve factor that may occur when individuals are asked to review exam items, each reviewer was started on a different test booklet within each exam. The corresponding coding sheet for each test booklet, indicating the deleted items which should be skipped, was inserted into the appropriate test booklet in advance. Each coding sheet also contained a color coded sticker on the cover page, along with the reviewers' name and a place to keep a record of their start and completion time of that specific test booklet. All exam booklets were placed in corresponding color coded folders, where Yellow = Part I, Green = Part II, Red = Step 1, and Blue = Step 2.

This method ensured that the correct coding sheet was used with the correct test booklet, since each test booklet contained different numbers of scored items. This procedure also allowed the investigator to tract the amount of time spent by each reviewer on each exam booklet. The reviewers were also provided with answer keys for all the items. Since the four reviewers and the investigator worked at different speeds, by the end of the first day, it was decided that the morning of the second day would be spent discussing the nutrition items on the 1986 Part I exam. These discussions also occurred in the morning and afternoon of the third day of the review process.

The process that was used to discuss each exam consisted of tallying the five reviewers' responses and looking for differences in coding. The group discussed every question where there was a discrepancy about whether the item related to nutrition. A reviewer who had indicated "yes," the item was related to nutrition, when the majority of the group had not, was asked to explain why he/she thought this question was related to nutrition. The group may have been convinced, by the one reviewer, to code the question as nutrition related, based on the content outline and previous coding decisions, or the reviewer reconsidered his/her response and the question was re-coded as nutrition related. This same procedure was used for items where the majority of the reviewers thought the question related to nutrition but one or two reviewers did not. In this case, a reviewer may have inadvertently skipped the question, or had a reason for not coding the question as nutrition related.

For the items that were agreed upon as nutrition related, the next step was to come to a final consensus about all the categories, normal/abnormal, and system codes for each item. As the coding process progressed and the group was asked to come to a consensus over the three days, the coding became more consistent. When the reviewers' importance in clinical medicine responses were tallied and the results indicated greater than a three point difference, the question was discussed by the group. For example, when one reviewer had rated an item as "1" (not important) and another reviewer had rated the item as "4" (important) or "5" (very important), these items were brought to the attention of the group. The reviewer that coded the question, either higher or lower than the others, was asked if he/she wanted to increase, decrease or not change his/her response. Reviewers who did not code a question and subsequently changed their response were also asked to rate each question for its importance in clinical medicine.

Content Analysis

Analyses were performed on the final agreed upon ratings in the importance in clinical medicine section in several ways. To investigate how the relevance/importance of nutrition related items varied from the Step 1 to Step 2 exams and from 1986 to 1993, the ratings were averaged to obtain a mean importance score for each nutrition question, based on the reviewers' subjective opinion. These importance scores for each item were totaled and averaged based on the total number of items for each exam. In addition, data was generated about the individual reviewers' mean score for each exam, as well as the frequency of using the one to five scale within each exam. No statistical analyses were performed on these data.

Since the nutrition items identified on the exam were written by various committees, information about the committees that wrote each nutrition question was obtained. These data were also combined with the importance in clinical medicine ratings of the nutrition questions according to each committee for the Part I and Part II and the Step 1 and Step 2 exams to evaluate the changes over time.

Performance Comparisons by Nutrition Curriculum

Classification/Selection Criteria of Schools

In order to assess any impact nutrition curriculum has on test scores, the scores of students from schools with required nutrition curriculum were compared to the scores of students from schools without a required nutrition curriculum, on the USMLE 1993 June Step 1 and September Step 2 exams. The Association of American Medical Colleges (AAMC) Curriculum Directories for the past five academic years were used to identify medical schools with required nutrition curriculum since 1990-91 (1-5). AAMC Curriculum Directories were reviewed from 1990 to ensure that students taking the Step 2 exam in September 1993 would have been exposed to the nutrition curriculum in 1990, particularly when nutrition was offered during the first year of medical school. If a medical school had a nutrition curriculum since 1991-92 and offered the nutrition curriculum in the second year of medical school, they were included in the required nutrition group because students taking the Step 2 exam in 1993 would have taken the nutrition course.

An additional criterion for inclusion into the required nutrition curriculum group was that students from these schools were required to take the NBME Part I and II exams or the USMLE Step 1 and 2 exams for the past five academic years as recorded in the AAMC Curriculum Directories. If taking these exams was optional, a high percentage of students traditionally take the exams. It was felt that either the NBME requirement, or a high percentage of students that would have taken the exams would assure the stability over several years in the level of motivation of students to perform well on the tests. Since there are two administrations of the Step 1 and 2 exams each year, the NBME requirements do not assure that a high percentage of students at each school included would have taken the June 1993 Step 1 or the September 1993 Step 2 exams. This was particularly true for the Step 2 exam, since at many schools, a portion of the class waits until the spring of their senior year to take the exam.

A possible weakness in the selection process using the NBME requirement to keep in mind is that students from schools where the NBME or USMLE is required for graduation consistently score higher on the exams than students from schools that require the students to record a score on the exam but not as a requirement for promotion or graduation. However, one might expect this variable to have the same impact on nutrition an non-nutrition scales.

After reviewing examinee counts at all US medical schools, it was decided to include schools in the analysis if 60% or more of the class took the June 1993 Step 1 and the September 1993 Step 2 exams. Based on these requirements, 18 medical schools for Step 1 and 12 medical schools for Step 2 met these inclusion criteria. Two additional schools were included in the required nutrition curriculum group for Step 2 because nutrition had been integrated into a course where over half of the course hours are devoted to nutrition. For the purposes of this research, the groups of schools that have a required nutrition curriculum will be referred to as Group A.

The AAMC Curriculum Directories were also used to select schools that did not have a nutrition curriculum or a nutrition elective for the past five academic years to identify schools which offered minimal nutrition exposure. For the purposes of this research, this group of schools that did not have a required nutrition curriculum or a nutrition elective will be referred to as Group B. Schools in Group B were also required to take the NBME Part I and Part II or the USMLE Step 1 and Step 2 exams for the past five academic years. If taking these exams was optional, at least 60% of more of the class had to have taken each of the exams. Based on these requirements, 14 medical schools met these inclusion criteria for Step 1 and 6 medical schools for the Step 2 exam (Appendix 10).

Since a large group of medical schools was not included in Groups A or B, it was decided to look at the performance of these students on nutrition items as well. This third group, referred to as Group C, consisted of students from all other US medical schools that did not fall into Groups A or B. These Group C schools were ones in which, according to the AAMC Curriculum Directories, there had been no required nutrition curriculum since 1990 but nutrition electives have been offered for all or part of the five year period

Eight medical schools were excluded from any analyses for the following reasons. If the school had a required nutrition curriculum, but not consistently since 1990-91, they were excluded from all analyses. If the medical school did not have an adequate number of students who took the 1993 Step 1 exam in June and/or the 1993 Step 2 exam in September (>60%), they were excluded. One school was also excluded because its required nutrition curriculum was stated in the AAMC Curriculum Directory as integrated into a biochemistry course. It was assumed that the majority of medical schools incorporate nutritional issues into biochemistry courses and this would not constitute a separate nutrition curriculum. The NBME exam requirement, or the number of students traditionally taking the exams, was not reviewed for Group C schools. Using the criteria described above for inclusion into Groups A and B, the groups are follows:

Step 1 Exam: (June 1993)
Group A: 18 medical schools with required nutrition curriculum (n=2195)
Group B: 14 medical schools with out nutrition curriculum and nutrition elective (n=1527)

Step 2 Exam: (September 1993)
Group A: 12 medical schools with required nutrition curriculum (n=1327)
Group B: 6 medical schools with out nutrition curriculum and nutrition elective (n=495)

Selection Criteria of Students

In order to simplify the process of selecting students scores for the comparison between Groups A and B, a reference group was used. The NBME maintains data on reference examinees who are first-time takers, and have taken the Step 2 exam in their second year of medical school and the Step 2 exam in their fourth year of medical school.

In addition to the above inclusion criteria, students were only selected to Groups A, B, and C if they were "first time takers." First time takers are defined as students who have not previously taken the exam. The purpose of using only first time takers in the analyses were to maintain consistency when comparing across schools. By only selecting first time takers, a variable which could effect item data which used students' performance was controlled.

School Match Simulation

Because Groups A,B, & C described above contained different numbers of schools with varying class sizes and students with varying levels of medical knowledge, an attempt was made to control for these factors by simulating schools for Step 1 and schools for Step 2. A decision was made to use students from Group C schools to match students with Group A schools to generate a closely matched group. The following simulated school selection process was implemented using students' non-nutrition score.

A raw score frequency distribution was generated for the non-nutrition scores for the 2195 examinees in Group A on the Step 1 exam and the 1327 examinees in Group A on the Step 2 exam. These frequency distributions contained the exact number of students at every score on the non-nutrition items recorded on the Step 1 and Step 2 exams. Using the randomly sequenced pool of students from Group C, a matched group was selected for each exam in the following manner. For the Step 1 exam, 2195 students' scores were selected from the randomly sequenced pool that were identical or closest frequency distribution on the non-nutrition items. If the exact score or the appropriate number of students at each score were not available, the next closest score was selected, alternating between higher and lower scores for consistency. The same process was completed for the Step 2 examinees, which required 1327 scores to match the frequency distribution.

To develop the simulated schools, scores data were grouped to match the non-nutrition score distribution for each school in Group A for the Step 1 and Step 2 exams. Based on this process, 18 simulated schools for Step 1 and 14 simulated schools for Step 2 were identified consisting of an almost identical matched mean score on the non-nutrition items for both exams. Using these data, the mean nutrition scores were calculated for the simulated schools on the Step 1 and Step 2 exams (Appendix 11).

Psychometric Characteristics of Test Material

An item analysis was performed on the nutrition and non-nutrition items that were identified on the June 1993 Step 1 and September 1993 Step 2 exams to determine the difficulty of the items. The reliability coefficient was calculated to determine whether these items could be used as a single measure of nutrition knowledge for comparison of groups.

Item Difficulty Index/Percent Correct: The percent correct of each item of the 1986 Part I and II exams and the 1993 Step 1 and Step 2 exams were calculated using data from reference groups maintained by the NBME. These reference groups consist of 12,029 examinees for the Part I exam, 7293 examinees for the Part II exam, 14,257 examinees for the Step 1 exam, and 8928 examinees for the Step 2 exam. The mean percent correct was calculated based on the number of reference group examinees who answered each question correctly, divided by the total number of reference group examinees who took the test. The percent correct value was determined for the nutrition and non-nutrition items.

Reliability Coefficient: The reliability coefficient is used to describe the item consistency or stability of test scores and reflects the extent to which a test is free of error variance. Error variance is defined as the sum effect of the chance differences between persons that arise from factors associated with a particular measurement (6). Reliability coefficients are expressed as values between .00 and 1.00, with 1.00 indicating perfect reliability. The closer the reliability coefficient is to 1.00, a test is generally more free of error variance and is a measure of the true differences among persons in the dimension assessed by the test. (6) The more homogeneous the group of examinees, the lower the reliability coefficient. Other factors that may affect reliability of the test include the length of the test, the content sampling of the test, wording of the questions, and the persons' mood during the test. In order to perform statistical analyses on subscores, it is important to evaluate the subscore reliability before proceeding with further analysis.

For the purposes of this research, the reliability coefficient was calculated for the nutrition and non-nutrition item subscores only on the Step 1 and Step 2 exams. These scores will be compared using a coefficient of internal consistency, the Kuder-Richardson method of rational equivalence. This procedure analyzes individual test items and uses a single administration of the test and does not require the calculation of a correlation coefficient. The following is the KR-20 formula used to calculate the reliability of the nutrition and non-nutrition item subscores from the June 1993 Step 1 exam and the September 1993 Step 2 exam. The KR-20 formula is based on the number of items (n), the item difficulty (p), and the variance of the test scores (s^2). (q=1 - p) (6)

$$\text{KR-20 Reliability coefficient} = \frac{n}{n-1}\left[1 - \frac{\text{sum }(p)(q)}{s^2}\right]$$

Based on the results of the reliability coefficient, it was determined that the reliability of the nutrition subscore on the Step 1 and Step 2 exams were high enough to perform additional statistical comparisons.

Correlation: Correlation (r) between the score on the nutrition items and the score on the non-nutrition items within Groups A, B, and C were performed. The purpose of the correlation was to determine the degree of the relationship between the nutrition and non-nutrition scores from students in the three groups (6).

$$r = \frac{\text{sum } (x)(y)}{\text{square root of the (sum of } x^2\text{)(sum of } y^2\text{)}}$$

(x=nutrition score, y=non-nutrition score)

If the relationship is perfectly positive, the correlation coefficient will be 1.00. If there is no relationship, the correlation coefficient will be zero. Correlation coefficients ranging from .2 to .35 show a slight relationship between the variables. Correlation coefficient results ranging from .65 to .85 make group predictions possible that are accurate enough for most purposes. In this situation, the correlation coefficient helps to understand how students perform on the nutrition items compared to the non-nutrition items on the 1993 Step 1, and Step 2 exams.

However, even if these two scores are highly correlated, a cause and effect relationship can not be stated. For example, a high correlation between the nutrition and non-nutrition score can mean that the nutrition score is a determinant of the non-nutrition score; that the non-nutrition score is a determinant of the nutrition score; that a third variable determines both the nutrition and non-nutrition score, or that the relationship between the two is merely an artifact. (6) The results of this measure will be interpreted in the context of the entire exam. Because the correlation equation is related to the reliability of the measure, a correlation correction for attenuation due to the unreliability of test was calculated. The corrected correlation equation is based on the correlation result divided by the square root of the reliability of the nutrition and non-nutrition value multiplied together.

A corrected correlation was calculated based on the reliability results for the Step 1 and Step 2 exams.

$$\text{Corrected } r = \frac{\text{Correlation result}}{\text{square root of the (nutrition KR-20)(non-nutrition KR-20)}}$$

Statistical Analyses for Group Comparisons:

In order to determine whether there was a difference in students' scores on the nutrition items from schools that had a required nutrition curriculum compared with schools that did not, the following analyses were performed.

1) Nutrition subscores for Group A were compared to Group B using an analysis of covariance as a statistical control. The non-nutrition subscore was used as the covariate.

2) The total Group A mean subscores were compared to the total simulated Group C mean subscores using an analysis of covariance as a statistical control. The non-nutrition subscore was used as the covariate.

Comparisons

Raw scores and percent correct subscores for the nutrition and non-nutrition items on the 1993 Step 1 and Step 2 exams were calculated for each examinee in the study. Mean percent correct scores for examinees in Groups A, B, and simulated Group C described above were then calculated by school and by total group. The percent correct scale was used in order to calculate and compare meaningful differences between nutrition and non-nutrition scores. Use of such a difference score is one way to control for differences in ability or general level of medical knowledge when comparing the performance of schools or other groups on nutrition items.

It was understood that in comparing students across groups, larger schools may influence the comparison to a greater degree than smaller schools. For this reason, in addition to the total mean differences of schools in Groups A and B, a straight average of the school mean differences was calculated for Groups A and B by dividing the sum of the school means by the total number of schools in each group.

Analysis of Covariance

The analysis of covariance is used to determine whether mean scores differ significantly from each other. The covariate in this analysis is the non-nutrition score. Analysis of covariance reduces the effect of initial group differences statistically by making compensating adjustments to the means of the two groups that are being compared. (6) The major assumptions underlying the analysis of covariance is the homogeneity of the group variances and homogeneity of regression. In this case, the test controlled for the non-nutrition subscore as a measure of ability or general medical knowledge in order to test the hypothesis that the nutrition curriculum influence students' scores on the nutrition items.

An analysis of covariance was performed on these scores for both the Step 1 and 2 exams. The test compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of schools with out a nutrition elective or nutrition curriculum (Group B) for both the Step 1 and Step 2 exams. Analysis of the Step 1 exam included 18 schools in Group A compared to 14 schools in Group B. Analysis of the Step 2 exam included 12 schools in Group A compared to 6 schools in Group B.

Methods References

1) AAMC Curriculum Directory 1990-1991 Association of American Medical Colleges. Washington, DC.

2) AAMC Curriculum Directory 1991-1992 Association of American Medical Colleges. Washington, DC.

3) AAMC Curriculum Directory 1992-1993 Association of American Medical Colleges. Washington, DC.

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6) Borg WR, Gall MD, Educational Statistics- An Introduction. 4th Edition. Longman, New York, 1983.

7) US Medical Licensing Examination 1993 Step 1 General Instructions, Content Outline, and Sample Items. National Board of Medical Examiners 1993. Philadelphia, PA. National Board of Medical Examiners, 1993.

8) US Medical Licensing Examination 1993 Step 2 General Instructions, Content Outline, and Sample Items. National Board of Medical Examiners 1993. Philadelphia, PA. National Board of Medical Examiners, 1993.

CHAPTER 5

RESULTS

To assess the extent of nutritional issues covered on the NBME Part I and Part II exams and the USMLE Step 1 and Step 2 exams, the 1986 June Part I, 1986 September Part II, 1993 June Step 1, and 1993 September Step 2 exams were reviewed by five nutrition professionals, known for their expertise and interest in medical education. The purposes of this review were to identify the number of nutrition related items, the nature of nutrition related items, and determine how coverage of nutrition changed from 1986 to 1993.

These reviewers were individuals who develop and instruct nutrition courses at their respective medical schools. The reviewers were Sarah Morgan, MD, from the University of Alabama School of Medicine at Birmingham, Robert Kushner, MD, from the Chicago Medical School, Donald Hensrud, MD from the Mayo Medical School in Rochester, Minnesota, and Eleanor Young, PhD, RD, from the University of Texas Health Science Center. The investigator also participated in the review process concurrent with the invited experts.

Nutrition items, or coverage on nutrition has increased from 1986 to 1993 (Table 1). Nutrition coverage on the Part I exam represented 9% of the scored items, increasing to 11% in 1993 on the Step 1 exam. Nutrition coverage on the Part II exam also increased from 6% in 1986 to 12% of the scored items on the 1993 Step 2 exam.

TABLE 1
NUTRITION ITEMS ON THE 1986 PART AND 1993 STEP EXAMS

	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
% of the scored items	9	11	6	12

The majority of the nutrition questions on the Part I/Step 1 exams were classified as metabolic/physiological mechanisms of disease, representing 60% of the nutrition items in 1986 and 56% in 1993 (Table 2). Nutrition questions relating to the diagnosis of disease on the Step 1 exam increased from 8% in 1986 to 17% of the nutrition questions in 1993. On the other hand, nutrition questions that were coded as diagnosis of disease on the Step 2 exam represented the majority of the nutrition questions, at 55% in 1986, decreasing to 46% in 1993.

TABLE 2
PERCENTAGE OF NUTRITION ITEMS WITHIN EACH CATEGORY CODE

	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
Growth/development	2	1	6	3
Metabolic mechanism	60	56	8	1
Health maintenance	1	1	8	10
Mechanism of disease	15	12	11	11
Diagnosis of disease	8	17	55	46
Disease management	13	12	11	29
Other	0	0	2	0
Total percent	100	100	100	100

The results of the system classifications indicate that most of the nutrition questions on the Part I (58%) and Step 1 (59%) were coded as Biochemistry, corresponding to the metabolic/physiologic codes described above (Table 3). There was a modest increase in the number of questions relating to the health maintenance coding of the nutrition questions, from 8% in 1986 to 10% in 1993. Since the intent of the Part I/Step 1 exams are to test student's basic science knowledge, which nutritional biochemistry and metabolism are a significant component, these results are not surprising.

TABLE 3 PERCENTAGE OF NUTRITION ITEMS WITHIN EACH SYSTEM CODE				
	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
Biochemistry	58	59	8	4
Hematopoietic	6	4	2	4
Nervous system	5	3	8	1
Connective tissue	0	2	0	0
Musculoskeletal	1	0	0	6
Respiratory	0	1	0	1
Cardiovascular	1	1	6	14
Intestinal	11	7	15	15
Renal	4	7	13	4
Pregnancy	2	1	9	8
Endocrine	4	3	6	4
Infectious	1	1	4	0
Neoplasm	1	0	4	13
Immunological	0	0	0	0
Vitamin deficiency	6	11	12	22
Other	0	3	13	8
Total percent	100	100	100	100

Other changes worth noting are the increased percentage of nutrition items that were related to vitamin deficiencies. On the 1986 Part I exam, vitamin deficiencies represented 6% of the nutrition items, increasing to 11% of the nutrition items on the 1993 Step 1 exam. An even greater increase is seen in the nutrition items devoted to vitamin deficiencies on the Part II/Step 2 exams. In 1986, 12% of the nutrition items related to vitamin deficiencies, increasing to 22% which were coded as vitamin deficiencies on the 1993 Step 2 exam. Other changes on the Step 2 exam occurred within the cardiovascular system, representing 6% of the nutrition items in 1986 and 14% of the nutrition items in 1993. The nutrition questions that were coded in the renal category decreased from 13% in 1986 to 4% in 1993.

Nutrition questions were also classified as either normal or abnormal, depending on the context of the question (Table 4). Based on the coding process, 63% of the nutrition items were coded as normal on the 1986 Part I exam, similar to the 57% of the nutrition items which were coded as normal on the 1993 Step exam. As expected on the Part II/Step 2 exams, the percentage of nutrition items that were coded as abnormal dominated, with 89% of the items on the 1986 Part II exam and 92% on the 1993 Step 2 exam.

TABLE 4

PERCENTAGE OF NUTRITION ITEMS WITHIN NORMAL/ABNORMAL CODES

	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
Normal	63	57	11	8
Abnormal	37	43	89	92
Total percent	100	100	100	100

In addition to the above classifications, the reviewers were asked to subjectively rate the nutrition questions according to their importance in clinical medicine on a five point Likert scale, rating on the frequency that the clinical scenario is seen by them during a usual week. Ratings in the Importance in Clinical Medicine section consisted of the following: 1) Not important, 2) Low importance, 3) Moderate importance, 4) Important, and 5) Very important.

Analyses were performed on the final agreed upon ratings in the importance in clinical medicine section in several ways. To investigate how the relevance/importance of nutrition related items varied from the Step 1 to Step 2 exams and from 1986 to 1993, the ratings were averaged to obtain a mean importance score for each nutrition question, based on the reviewers' subjective opinion. These importance scores for each item were totaled and averaged based on the total number of items for each exam. In addition, data was generated about the individual reviewers' mean score for each exam as well as the frequency of using the one to five scale within each exam.

Since the nutrition items identified on the exam were written by various committees, information about the committees that wrote each nutrition question was obtained (Tables 5 and 6). These data were also combined with the importance in clinical medicine ratings of the nutrition questions from the review panel to evaluate the changes over time. Nutrition questions written by the Medicine Committee increased from 21% on the Part II exam to 36% on the Step 2 exam. The percentage of nutrition questions submitted by the Public Health/ Preventive Medicine Committee also increased on the Part II/Step 2 exams from 6% in 1986 to 19% in 1993. On the other hand, pediatric nutrition related questions decreased from 45% in 1986 to 21% in 1993.

TABLE 5

PERCENTAGE OF NUTRITION ITEMS AND IMPORTANCE* IN CLINICAL MEDICINE RATINGS ASSIGNED BY REVIEW PANELS

	1986 PART I	IMPORTANCE	1993 STEP 1	IMPORTANCE
Anatomy	7	2.4	0	
Physiology	10	3.8	15	3.3
Biochemistry	58	3	56	2.8
Pathology	12	4.3	15	4
Microbiology	1	3.8	0	3.8
Pharmacology	11	4.1	9	3.7
Behavioral Science	1	3.8	5	3.5
		Total=3.3		Total=3.1

*5=Very important, 4=Important, 3=Moderate importance, 2=Low importance, 1=Not important

TABLE 6

PERCENTAGE OF NUTRITION ITEMS AND IMPORTANCE* IN CLINICAL MEDICINE RATINGS ASSIGNED BY REVIEW PANELS

	1986 PART II	IMPORTANCE *	1993 STEP 2	IMPORTANCE *
Medicine	21	3.7	36	3.9
Surgery	15	3.4	10	3.8
Obstetrics/Gynecology	4	3	7	3.9
Pub Health/Prev Med	6	4.1	19	3.9
Pediatrics	45	3.7	21	3.4
Psychiatry	9	3.5	7	3.9
		Total=3.6		Total=3.7

*5=Very important, 4=Important, 3=Moderate importance, 2=Low importance, 1=Not important

When mean importance ratings were analyzed based on the test committee that wrote the items on the 1986 Part I exam, ratings ranged from 2.4 (Anatomy) to 4.3 (Pathology), where '5' was very important. Nutrition items which were written by the Biochemistry Committee on the Part I exam, representing the largest number of nutrition items (58%), were rated 3.0 by the reviewers, indicating that these questions were moderately important. The importance of the nutrition items submitted by the Biochemistry Committee declined to 2.8 on the 1993 Step 1 exam. The mean importance of the nutrition items submitted by the individual committees on the 1993 Step 2 exam was also interesting. On the whole, the nutrition questions submitted by all the Test Committees, with the exception of Pediatrics, were rated as either 3.8 or 3.9, indicating that they were important in clinical medicine. However, the importance ratings declined from 4.7 on the 1986 Part II exam to 3.4 on the 1993 Step 2 exam.

Based on the final consensus of the average of five reviewers for each nutrition related item, importance in clinical medicine ratings for the nutrition items did not change significantly from 1986 to 1993. Specifically, importance rating on the nutrition items on the 1986 Part I exam were 3.3%, decreasing to 3.1% in 1993 on the USMLE Step 1 exam.

Importance ratings on the nutrition items on the 1986 Part II exam increased from 3.6% in 1986 to 3.7% on the 1993 Step 2 exam. Mean importance rating by each reviewer indicated that three of the reviewers mean ratings of the nutrition items were 3.5, while two of the reviewers mean rating was 3.2. Since only five judges participated, the sample size was too small to perform statistical analyses.

TABLE 7
MEAN IMPORTANCE IN CLINICAL MEDICINE RATINGS OF NUTRITION ITEMS BY REVIEWERS

	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
Reviewer 1	3.2	3.3	3.7	4.0
Reviewer 2	3.6	3.3	3.6	3.7
Reviewer 3	3.0	2.8	3.5	3.9
Reviewer 4	3.4	3.2	3.8	3.7
Reviewer 5	3.2	2.9	3.5	3.4
Mean by Exam	3.3	3.1	3.6	3.7

5=Very important, 4=Important, 3=Moderate importance, 2=Low importance, 1=Not important

Performance Comparisons by Nutrition Curriculum

To determine whether there was a difference in students' performance on the nutrition items on the Step 1 and Step 2 exams depending on their exposure to nutrition, the scores of students from schools with required nutrition curriculum were compared to the scores of students from schools that did not have a required nutrition curriculum. The 1986 Part I and Part II exams were not included in this comparison because too few medical schools incorporated nutrition in the curriculum at that time. The criteria for inclusion into Groups A, B, and simulated Group C have been described in the methods Section.

Psychometric Characteristics of Test Material

An item analysis was performed on the nutrition and non-nutrition items that were identified on the June 1993 Step 1 and September 1993 Step 2 exams to determine the difficulty of the items. The reliability coefficient was calculated to determine whether these items could be used as a single measure of nutrition knowledge for comparison of groups.

Item Difficulty / Percentage Correct Index: (Table 8) The percent correct of each item of the 1986 Part I and II exams and the 1993 Step 1 and Step 2 exams were calculated using data from reference groups maintained by the NBME. These reference groups consist of 12,029 examinees for the Part I exam, 7293 examinees for the Part II exam, 14,257 examinees for the Step 1 exam, and 8928 examinees for the Step 2 exam. The percent correct of the nutrition items was separated out and compared to the percent correct of the non-nutrition items. Results of this analysis show that the nutrition item percent correct increased from 1986 to 1993. The percent correct of the nutrition items on the 1986 Part I exam was 65%, increasing to 70% on the 1993 Step 1 exam. The percent correct value of the nutrition items on the 1986 Part II exam also increased from 64% in 1986 to 72% on the 1993 Step 2 exam. The percent correct of the non-nutrition items increased slightly from 1986 to 1993 for Step 1 and decreased for Step 2. The percent correct of the non-nutrition items on the 1986 Part I exam was 64% and 67% on the USMLE 1993 Step 1 exam. The percent correct of the non-nutrition items on the 1986 Part II exam was 66% in 1986 and 62% on the 1993 Step 2 exam.

TABLE 8

PERCENTAGE OF REFERENCE GROUP EXAMINEES WHO ANSWERED ITEMS CORRECTLY

	1986 Part I	1993 Step 1	1986 Part II	1993 Step 2
NUTRITION ITEMS	65	70	64	72
	sd=20	sd=20	sd=15	sd=19
NON-NUTRITION	64	67	66	62
ITEMS	sd=20	sd=19	sd=a8	sd=28
TOTAL EXAM	64	67	66	63
	sd=20	sd=19	sd=18	sd=28
Total reference group	n=12,029	n=14,257	n=7293	n=8928

Reliability Coefficient: (Table 9) The reliability coefficient is used to describe the item consistency or stability of test scores and reflects the extent to which a test is free of error variance. For the purposes of this research, the reliability coefficient was calculated using the Kuder-Richardson method (KR-20) of rational equivalence for the nutrition and non-nutrition subscores only on the 1993 Step 1 and Step 2 exams.

Based on the KR-20 calculations on the nutrition and non-nutrition items, reliability of the nutrition items were higher on the 1993 Step 1 than the Step 2 exam. KR-20 values for the nutrition items on the 1993 Step 1 exam were .80, and to .60 on the Step 2 exam. Reliability coefficients of the non-nutrition items for the 1993 Step 1 to the Step 2 exams were similar to each other. KR-20 values for the non-nutrition items on the 1993 Step 1 and Step 2 exams were .96 and .93 respectively.

TABLE 9
RELIABILITY COEFFICIENTS OF NUTRITION AND NON-NUTRITION SUBSCORES (KR-20)

	1993 Step 1	1993 Step 2
NUTRITION ITEMS	0.80	0.60
NON-NUTRITION	0.96	0.93
ITEMS		
Total reference group	n=14,257	n=8928

Correlation: (Table 10) Correlation analyses between the score on the nutrition items and the score on the non-nutrition items within Groups A and B and the total reference group were performed. The purpose of the correlation was to determine the degree of the relationship between the nutrition and non-nutrition scores of students in the three groups.

Based on the correlation calculations on the entire reference group and the students in Groups A and B on the nutrition and non-nutrition items for the 1993 Step 1 to the 1993 Step 2 exam the results are as follows. The correlation coefficients corrected for attenuation are shown in parentheses. For the entire reference group on the Step 1 exam, the correlation coefficient was .79 (.90). For the 1993 Step 1 exam the correlation coefficient was .80 (.92) for Group A and .79 (.90) for Group B. For the entire reference group on the 1993 Step 2 exam, the correlation coefficient was .73 (.98). For the Step 1 exam, the correlation coefficient was .74 (.99) for Group A and .68 (.91) for Group B.

TABLE 10

CORRELATION COEFFICIENTS OF NUTRITION NON-NUTRITION SUBSCORES (r)

	1993 Step 1	Corrected r	1993 Step 2	Corrected r
GROUP A	0.80	0.92	0.74	0.99
GROUP B	0.79	0.90	0.68	0.91
TOTAL GROUP	0.79	0.90	0.73	0.98
Total reference group	n=14,257		n=8928	

Statistical Analyses for Group Comparisons

Based on the results of the reliability coefficient, it was determined that the reliability of the nutrition subscore on the Step 1 and Step 2 exams were high enough to perform additional statistical comparisons. In order to determine whether a nutrition curriculum had an impact on nutrition scores, the nutrition scores of students who attended schools that had a required nutrition curriculum (Group A) were compared with scores of students from schools that did not have a required nutrition curriculum or a nutrition elective (Group B).

Raw scores and percent correct subscores for the nutrition and non-nutrition items on the 1993 Step 1 and Step 2 exams were calculated for each examinee in the study. Mean percent correct scores for examinees in Groups A, B, and simulated Group C described above were then calculated by school and by total group. The percent correct scale was used in order to calculate and compare meaningful differences between nutrition and non-nutrition scores. Use of such a difference score is one way to control for differences in ability or general level of medical knowledge when comparing the performance of schools or other groups on nutrition items.

It was understood that in comparing students across groups, larger schools may influence the comparison to a greater degree than smaller schools. For this reason, in addition to the total mean differences of schools in Groups A and B, a straight average of the school mean differences was calculated for Groups A and B by dividing the sum of the school means by the total number of schools in each group.

The mean percent correct scores on the 1993 Step 1 nutrition items for the schools included in Group A were 69.6%, 68.7% for Group B, and 69.3% for simulated schools in Group C. Percent correct scores on the 1993 Step 1 non-nutrition items for the schools included in Group A were 66.1% exam, 66.1% for Group B, and 66.1% for simulated schools in Group C. The difference between the mean nutrition and non-nutrition scores for the schools included in Groups A was 3.6%, 2.7% for Group B, and 3.2% for simulated schools in Group C. Looking at the individual school data in Group A for the Step 1 exam, the mean percent differences between the nutrition and non-nutrition scores ranged from 1.28% to 5.54%. The range of scores in Group B on the Step 1 exam were from -.16% to 6.21%. The straight average of the mean differences, based on the 18 schools in Group A, was 3.80%, compared to the weighted average of 3.57%. In Groups B, based on 14 schools, the straight average was 2.95% compared to the weighted average of 2.68%.

Mean percent correct scores on the 1993 Step 2 nutrition items for the schools included in Group A were 71.2%, 72.2% for Group B, and 70.9% for simulated schools in Group C. Mean percent correct scores on the 1993 Step 2 non-nutrition items for the schools included in Group A were 60.3%, 61.5% for Group B, and 60.3% for simulated schools in Group C. The difference the mean nutrition and non-nutrition scores for the schools included in Group A was 10.8%, 10.7% for Group B, and 10.5% for simulated schools in Group C. For the individual school data in Group A for the Step 2 exam, the mean percent differences between the nutrition and non-nutrition scores ranged from

9.46% to 14.43%. The range of scores in Group B on the Step 2 exam were from 8.85% to 12.46%. The straight average of the school mean differences, based on the 12 schools in Group A, was 11.16%, compared to the weighted average of 10.84%. In Group B, based on 6 schools, the straight average was 11.18% compared to the weighted average of 10.7%.

Analysis of Covariance

Because the mean scores on the nutrition and non-nutrition items were highly correlated, an analysis of covariance was performed on these scores for both the 1993 Step 1 and 2 exams. The test compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of schools with out a nutrition elective or nutrition curriculum (Group B) for both the Step 1 and Step 2 exams. Analysis of the Step 1 exam included 18 schools in Group A compared to 14 schools in Group B. Analysis of the Step 2 exam included 12 schools in Group A compared to 6 schools in Group B. The test also compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of simulated schools (Group C) for both the Step 1 and Step 2 exams. Analysis of the Step 1 exam included 18 schools in both Groups A and C. Analysis of the Step 2 exam included 12 schools in both Groups A and C (Table 11).

TABLE 11

PERCENT CORRECT OF NUTRITION AND NON-NUTRITION SUBSCORES ON STEP 1 EXAM

	NUTRITION* SCORE	NON-NUTRITION SCORE	PERCENT DIFFERENCE
GROUP A	69.6	66.1	3.6
n=2195	sd=10.5	sd=8.5	sd=6.3
GROUP B	68.7	66.1	2.7
n=1527	sd=10.7	sd=8.0	sd=6.6
SIMULATED GROUP C	69.3	66.1	3.2
n=2195	sd=10.8	sd=8.5	sd=6.6

*Analysis of covariance results comparing nutrition scores of Groups A and B and A Simulated C both indicate a significant difference. ($p<.05$)

The level of significance for the comparisons on the Step 1 exam was less than .001, indicating the students' scores in Group A are significantly different than the students' scores in Group B. The level of significance for the comparisons on the Step 1 exam for the comparison of Group A with the simulated Group C was less than .04, indicating that the students' scores in Groups A were significantly different from the students' scores in the simulated Groups C.

The level of significance for the comparisons on the Step 2 exam was .769, indicating that the students' scores on the Step 2 exam were not significantly different than the students' scores in Group B. The level of significance for the comparisons on the Step 2 exam was .113, indicating that the students' scores in Group A were not significantly different from the students' scores in the simulated Group C (Table 12).

TABLE 12

PERCENT CORRECT OF NUTRITION AND NON-NUTRITION SUBSCORES ON STEP 2 EXAM

	NUTRITION* SCORE	NON-NUTRITION SCORE	PERCENT DIFFERENCE
GROUP A	71.2	60.3	10.8
n=1327	sd=7.9	sd=6.4	sd=5.8
GROUP B	72.2	61.5	10.7
n=495	sd=7.3	sd=5.3	sd=5.4
SIMULATED GROUP C	70.9	60.3	10.5
n=1327	sd=7.9	sd=6.4	sd=5.2

*Analysis of covariance results comparing nutrition scores of Groups A and B and A Simulated C do not indicate a significant difference. ($p<.05$)

Results References

1) *AAMC Curriculum Directory 1990-1991* Association of American Medical Colleges. Washington, DC.

2) *AAMC Curriculum Directory 1991-1992* Association of American Medical Colleges. Washington, DC.

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CHAPTER 6

DISCUSSION

To assess the extent of nutrition is covered on the NBME Part I and Part II exams and the USMLE Step 1 and Step 2 exams, the 1986 June Part I, 1986 September Part II, 1993 June Step 1, and 1993 September Step 2 exams were reviewed with five nutrition professionals. The purpose of this review was to identify the number of nutrition related items, the nature of nutrition related items, and how coverage of nutrition changed from 1986 to 1993.

Because this review involved category, normal/abnormal, and system classifications that were derived by the author for the purposes of this research, it is possible to identify the nature of the nutrition coverage and how specific content changed over time. Although these classification are similar to how the NBME content outline is organized, the author's coding of nutrition items may vary from the item writing committees' definitions and content outline classifications of the same items. It can be assumed though, according to the NBME staff, that the nutrition coverage on the 1993 USMLE Step 1 and 2 exams are similar to the current 1995 exam. But one must keep in mind that this research was only completed on exams from two years, 1986 and 1993. Analysis from another year may be different.

Nutrition items, or coverage on nutrition has increased from 1986 to 1993 (Table 1). Nutrition coverage on the Part I exam represented 9% of the scored items, increasing to 11% in 1993 on the USMLE Step 1 exam. Nutrition coverage on the Part II exam also increased from 6% in 1986 to 12% of the scored items on the 1993 Step 2 exam. The increase in nutrition items is modest on the Step 1 exam compared to the increase of nutrition items on the Step 2 exam.

The majority of the nutrition questions on the Part I/Step 1 exams were classified as metabolic/physiological mechanisms of disease, representing 60% of the nutrition related items in 1986 and 56% in 1993 (Table 2). Nutrition questions relating to the diagnosis of disease on the Step 1 exam increased from 8% in 1986 to 17% of the nutrition questions in 1993. On the other hand, nutrition questions that were coded as diagnosis of disease on the Step 2 exam represented the majority of the nutrition questions, at 55% in 1986, decreasing to 46% in 1993. There was a modest increase in the number of questions relating to the health maintenance coding of the nutrition questions, from 8% in 1986 to 10% in 1993. The results of the system classifications indicate that most of the nutrition questions on the Part I (58%) and Step 1 (59%) were coded as Biochemistry, corresponding to the metabolic/physiologic codes described above (Table 3). Since the intent of the Part I/Step 1 exams are to test student's basic science knowledge, which nutritional Biochemistry and metabolism are a significant component, these results are not surprising.

Other changes worth noting are the increased percentage of nutrition items that were coded as vitamin deficiencies. On the 1986 Part I exam, vitamin deficiencies represented 6% of the nutrition items, increasing to 11% of the nutrition items on the 1993 Step 1 exam. An even greater increase is seen in the nutrition items devoted to vitamin deficiencies on the Part II/Step 2 exams. In 1986, 12% of the nutrition items related to vitamin deficiencies, increasing to 22% which related to vitamin deficiencies on the 1993 Step 2 exam. Other changes on the Step 2 exam occurred within the cardiovascular system, representing 6% of the nutrition items in 1986 and 14% of the nutrition items in 1993. One factor which may account for these changes is the scientific and medical community's increased recognition of nutrition's role in the management and treatment of hypercholesterolemia. Also, because heart disease is the number one killer in the US and hypercholesterolemia has been associated with an increased risk, cholesterol metabolism questions may have increased, primarily from the Medicine Committee. And since cholesterol metabolism was identified as a Biochemistry topic that should be coded as nutrition, most questions relating to cholesterol metabolism on the Step 2 exam tend to be in the context of a medical problem and would have been coded as a nutrition related question in the cardiovascular system.

The nutrition questions that were coded in the renal category decreased from 13% in 1986 to 4% in 1993, which may be due to changes in the Committee members who were writing the questions or the fact that the Step exams are more integrated. For example, the reviewers for this research determined that items relating to basic renal physiology should not be coded as a nutrition question unless the question was intending to test nutrition knowledge which included sodium, potassium, and calcium metabolism. These isolated topics tended to be less prevalent on the Step exams compared to the Part exams, due to the integration of topics such as renal nutrition.

Nutrition questions were also classified as either normal or abnormal, depending on the context of the question. Based on the coding process, 63% of the nutrition items were coded as normal on the 1986 Part I exam, similar to the 57% of the nutrition items which were coded as normal on the 1993 Step exam. As expected on the Part II/Step 2 exams, the percentage of nutrition items that were coded as abnormal dominated, with 89% of the items in 1986 and 92% in 1993 (Table 4).

To account for the increase in nutrition coverage from 1986 to 1993 on both the Step 1 and Step 2 exams, one explanation could be the revision and redesign of the USMLE Step 1 and Step 2 exams between 1985 and 1991 to be a more comprehensive exam which systematically included nutrition topics. Beginning in 1988, the NBME and the Federation of State Medical Boards (FSMB) began to negotiate a partnership for a single three Step exam for medical licensure. The two licensing exams officially merged in 1992 to create the US Medical Licensing Examination (USMLE), a common evaluation system for measuring knowledge and cognitive competence of all applicants for medical licensure in the US. These newly designed Step exams were introduced in 1991 from the comprehensive Part I and Part II Committee designs. The comprehensive Committees' goals were to update the exams to incorporate current high priority issues, specifically social and preventive medicine, which encompassed nutrition topics. Gastrointestinal/Nutritional Task Forces were appointed for both the comprehensive Part I and Part II exams to develop test materials for nutrition content. For example, nutrition task forces were given item writing assignments to fulfill the increased nutrition questions pool on account of the revised content outline. Once the task forces completed their item writing assignments for nutrition questions, they no longer participated.

For the 1993 exams, item writing assignments for the traditional discipline-oriented committees were also systematically assigned items covering nutrition content. Similar to other subjects during the development of an integrated exam, nutrition questions were submitted by various committees from a variety of disciplines. The disciplines which submitted nutrition questions on the Part I/Step 1 exams were Anatomy, Behavioral Sciences, Biochemistry, Microbiology, Pathology, and Pharmacology. On the Part I/Step 1 exams, the majority of the nutrition items were written by the Biochemistry Committee (Table 5). The disciplines which submitted nutrition questions on the Part II/Step 2 exams were Medicine, Obstetrics and Gynecology, Pediatrics, Preventive Medicine and Public Health, Psychiatry, and Surgery. The majority of the nutrition questions on the Part II exam were written by the Pediatrics Committee, however the Medicine Committee submitted the majority of nutrition questions on the Step 2 exam (Table 6). Nutrition questions written by the Medicine Committee increased from 21% on the Part II exam to 36% on the Step 2 exam. The percentage of nutrition questions submitted by the Public Health/ Preventive Medicine Committee also increased on the Part II/Step 2 exams from 6% in 1986 to 19% in 1993. On the other hand, pediatric nutrition related questions decreased from 45% in 1986 to 21% in 1993.

Other factors that may influence the amount and types of nutrition questions include the item format. The NBME Part I, Part II and the USMLE Step 1 and Step 2 exams consist of multiple choice questions. The NBME Part I and Part II exams each contained approximately 900-980 items and the newly designed USMLE Step 1 and Step 2 exams each contain approximately 800 items. The Step exams differ from the Part exams with respect to item format. Currently, the exam questions include the one-best answer type, selecting from five options. The stems of the items are often longer than previous exams and include more complete patient vignettes. Patient scenarios, followed by several one-best-answer type questions are frequently utilized. Because nutrition is a topic that can be integrated and asked within the frame of several other topics, it is possible that the nutrition coverage increased as well as other topics simultaneously within the same question while attempting to shorten the exam and integrate disciplines. And according to Dave Swanson, PhD, NBME Step 1 Committee Chair, the Step exams are continually evolving, specifically the use of clinical vignettes, which represented 20% of the exam questions in 1991 with the goal of 50% by 1995.

Integrated exams assess students' ability to integrate concepts and knowledge from a variety of disciplines, similar to what will be expected from them when they become physicians. These exams frame nutrition as a topic that crosses over many disciplines which is assumed to be integrated into the medical curriculum. It is important to keep in mind though that with an integrated exam, disciplines such as nutrition, cardiology, nephrology, biochemistry and gastroenterology overlap. Essentially, all the systems that the nutrition questions were coded as could also be coded by those specialties if they performed a similar review at the NBME. However, for the purpose of determining the percentage of nutrition items on the exams, it is helpful to keep in mind that if another group of medical experts reviewed these same exams, they may code the same questions that were coded in this study as nutrition entirely different depending on the criteria that was established.

In addition, certain questions are easier to write than others, for example questions related to vitamin deficiencies. But if one of the purposes of the comprehensive exams are to incorporate more prevention and health promotion, do vitamin deficiencies fall into this classification? According to the current literature, the majority of vitamin deficiencies occur in the third world, with hypovitaminosis as the leading cause of blindness. In the US population, vitamin deficiencies usually present concurrent with chronic alcoholism or as a complication of enteral or parenteral nutrition support. One could argue though that medical students should be knowledgeable of vitamin deficiencies in order to prevent or treat these problems, but these diseases are rarely seen in the out-patient settings. Since more and more medical schools are moving in the direction of teaching students in ambulatory settings, the types of nutrition related questions, according to the content outline, should cover the nutritional manifestations, management, and prevention of the most common chronic diseases. For example, risk factors for heart disease, cancer, diabetes, and cancer as well as the nutritional management of these diseases. Issues related to nutritional assessment and counseling of individuals at high risk for malnutrition, such as the elderly, also reflect the competencies that medical students should acquire (1).

Importance Ratings

In addition to the above classifications, the reviewers were asked to subjectively rate the nutrition questions according to their importance in clinical medicine on a five point Likert scale, where '1' is not important and '5' is very important. Analyses were performed on the final agreed upon ratings in the importance in clinical medicine section in several ways. To investigate how the relevance/importance of nutrition related items varied from the Step 1 to Step 2 exams and from 1986 to 1993, the ratings were averaged to obtain a mean importance score for each exam, from the reviewers' subjective opinion. Using these data and the Committee data that wrote the nutrition items on the Step 1 and Step 2 exams, the mean importance of the nutrition questions were also calculated for each committee (Tables 5 and 6).

Based on the final consensus of the average of five reviewers for each nutrition related item on each exam, importance in clinical medicine ratings for the nutrition items did not change significantly from 1986 to 1993 (Table 7). Specifically, mean importance ratings on the nutrition items on the 1986 Part I exam were 3.3%, decreasing slightly to 3.1% in 1993 on the Step 1 exam. Mean importance ratings on the nutrition items on the 1986 Part II exam increased slightly from 3.6% in 1986 to 3.7% on the 1993 Step 2 exam. Importance ratings by each reviewer indicated that three of the reviewers' mean ratings of the nutrition items were 3.5, while two of the reviewers mean ratings were 3.2.

Mean importance ratings were analyzed based on the test committee that wrote the items on the 1986 Part I exam. Ratings ranged from 2.4 (Anatomy) to 4.3 (Pathology), where '5' was very important. Nutrition items which were written by the Biochemistry Committee on the Part I exam, representing the largest number of nutrition items (58%), were rated 3.0 by the reviewers, indicating that these questions were moderately important. The importance of the nutrition items submitted by the Biochemistry Committee declined to 2.8 on the 1993 Step 1 exam, which is surprising considering the integrated exam from multidisciplanary fields. The mean importance of the nutrition items submitted by the individual committees on the 1993 Step 2 exam was also interesting. On the whole, the nutrition questions submitted by all the Test Committees, with the exception of Pediatrics, were rated as either 3.8 or 3.9, indicating that they were important in clinical medicine. However, the importance ratings written by the Pediatrics Committee declined from 4.7 on the 1986 Part II exam to 3.4 on the 1993 Step 2 exam. It is important to keep in mind though that the ratings of pediatric nutrition items in 1993 was still high at 3.4 and the mean for the entire set of nutrition items on the Step 2 exam was 3.7, increased from 3.6 in 1986.

Interpretation of these results indicates that the overall importance or relevance of the nutrition items that were identified on all the exams was greater than 3.0, deeming them as moderately important. As expected, the relevance of the nutrition items was greater on the Part II/Step 2 exams, since the Step 2 exam is used "to determine if an examinee possesses the medical knowledge and understanding of <u>clinical science</u> considered essential for provision of patient care under supervision, including emphasis on health promotion and disease prevention" (4).

Additional evidence which would support the Step 2 exam as being more clinically relevant was the recommendations of the comprehensive Part II Test Committee to develop a "High-Impact Disease List" for use in test construction. The criteria for this list are diseases that are: 1) common, 2) important to recognize because of the consequences, or 3) notable in illustrating basic pathophysiology (1). Items writers use this "High-Impact Disease List" as a guide in order to avoid esoteric topics when developing test questions.

On the other hand, the Step 1 exam is used "to determine if an examinee understands and can apply important concepts of the basic biomedical sciences, with special emphasis on principles and mechanisms underlying health, disease, and modes of therapy." However, the revised exam clearly states that the majority of the items on the Step 1 exam assesses application of basic science principles to clinical situations within the context of a patient vignette, which may account for the changes in the that were seen on the Step 1 and Step 2 exams (5).

Interpretation

The results of the current research contradict the nutrition literature which states that "no means had been introduced by the NBME to ensure the inclusion of questions on nutrition and health on the NBME Part I and Part II exams or the USMLE Step 1 and 2 exams since the NRC 1985 report" (2). The NRC Nutrition in Medical Education Committee and numerous reports since 1985 state that the NBME should create a means by which nutrition questions could be included to assess basic nutrition knowledge. Based on this research project, the NBME process to revise the Comprehensive Part I and Part II exams to increase nutrition coverage, as previously described, most likely contributed to the increase in nutrition coverage, mostly seen on the Step 2 exam.

But why does the current literature state that nutrition coverage on the Step exams has not increased since 1985? Firstly, the NBME was most likely not approached by nutrition professionals to conduct a research project of this type and no internal research had been performed by the NBME to investigate nutrition coverage on the Part or Step exams. In addition, no reports have been issued by the NBME to indicate that the revision of the Part exams, which became the Comprehensive Part exams and later the Step exams in 1992, shifted content coverage to systematically included more prevention and nutrition related topics. According to Dr. Melnick, Senior Vice President at the NBME, "the discussions related to the shift in content coverage were not made public because the focus of the Comprehensive and Step exams were to be a broadly based interdisciplinary exam, rather than a subject test as in the past" (3). The NBME staff placed most emphasis on the integration of topics and categories and less emphasis on separate topics, such as nutrition, especially when presenting at national meetings.

Once again, this brings up the same issue that many nutrition advocates portray in the literature which is the need to have separate nutrition departments, separate nutrition courses, and separate nutrition lectures in medical school. These recommendations do not consider the current trend, as supported by the GPEP report, to integrate topics and limit lecture time. The NBME recognized that nutrition is an important topic which should be covered by the USMLE and made its own attempt to systematically incorporate nutrition into the content outline and the item writing assignments, all within the context of an integrated exam. The question remains though, how much nutrition coverage on a licensing exam for medical students is enough? Also, because nutrition overlaps with other disciplines, how can the adequacy of nutrition on a licensure exam be defined? Since the NBME is continually being petitioned by organizations to include more topics and place more emphasis on the topic that certain groups are representing, the definition of how much is enough become subjective. And there is no definitive answer, according to Dr. Melnick, who believes it becomes a matter of balancing out all the topics that are deemed necessary to include on the exam based on the content outline (3). In addition, it is important to keep in mind the displacement issue, meaning if nutrition is increased, what other topics are going to be displaced?

Considering all these factors, the current percentage of questions that are represented by nutrition on the Step 1 and Step 2 USMLE seems adequate if one takes into account all the other topics that medical students are expected to know. However, as questioned above, why were there so many questions on vitamin deficiencies and why did the percentage of vitamin deficiency questions increase when the incidence of vitamin deficiencies in the US have decreased dramatically since the early 1900's? Are vitamin deficiencies considered esoteric or not? According to the diseases of high impact list, the disease must be common. The most common vitamin deficiency described on the exams are folate and vitamin B_{12} deficiencies, secondary to alcohol abuse. Although anemia due to these deficiencies are frequently seen in the clinical setting, this topic was addresses several times in several different contexts, which may explain why the reviewers included thiamin in the topics that were covered in excess on the Step 2 exam (Appendix 7). As discussed in the NBME background section, the development of the comprehensive exams, which became the Step exams in 1992, emphasized concepts deemed important for the current and future practice of medicine, including prevention of disease. The NBME

Comprehensive Part I and Part II exams were redesigned with multidisciplanary content specifications, to include new content domains, which systematically included nutrition.

To help answer the question of how common and clinically relevant are vitamin deficiencies, a MEDLINE computer search was performed using the term vitamin deficiency. The search included the etiology, pathology, diagnosis, and management of vitamin deficiencies and identified 180 articles on the topic. Of those 180 articles, 130 were about foreign countries' problems with hypovitaminosis of vitamin A, E, D or K as well as zinc and selenium deficiencies. Titles of articles in the US relating to vitamin deficiencies pertained to abnormalities relating to nutrition support or problems in high risk population such as the homeless, the elderly, and the adolescent population. Articles which discussed classic symptoms of diseases, such as scurvy, which were being asked on the Part and Step exams were only cited in the *Journal of History of Medical and Allied Science.*

Therefore, based on the content of the nutrition items, are the Step exams the ideal domain to test the nutrition knowledge of medical students? In addition, during the review of the nutrition items, informal remarks were made by several of the reviewers that none of the information they teach is not even covered on the current Step exams. So what is the value of the instrument that was used to answer the question of whether medical students from schools with required nutrition curriculum perform better on these nutrition items? This also brings up another point, which centers around the review process itself. Using an external group of nutrition professionals to reviewer exams has strengths and weaknesses. By utilizing a group of reviewers with expertise in nutrition education, similar to the investigators', the study relied on more than one individuals' opinion with regards to identifying and coding the nutrition items. This process invited a discussion for each item that one of the reviewers coded as nutrition, where the others did not. A discussion also ensureds for every nutrition item that the reviewers did not code exactly the same. And since most of the time there was never full agreement in the coding of the nutrition questions, even after an extensive training and orientation to the review process, it became apparent how much was gained from the review process itself. Furthermore, the clinical experience of the group varied, which was composed of three physicians and two dietitians. All three of the physicians were part of a nutrition support service in their institutions and as a result, the final decision in coding if there was a discrepancy, was usually determined by the physicians.

An interesting occurrence that was noticed by the investigator during the review process was a competition to finish between the two male reviewers. The three female reviewers were more than one hour behind in coding and one of the female reviewers needed more time than the others and skipped lunch to finish coding. It is understandable that everyone works at their own pace, but did the competition amongst the men and the pressure to finish coding amongst the women influence the accuracy of the coding process? Because all the questions had to be discussed, it was apparent on the last day that the group, as a whole, particularly the females, were rushing through the review process. Several of the reviewers also responded in their follow-up communication to the investigator, that if they were to complete this process over again they recommend allotting four days instead of three. Originally four days were allotted for the review process but the physicians' schedules did not permit participation for more than three days.

Performance Comparisons by Nutrition Curriculum

Item Difficulty / Percentage Correct Index: (Table 8) The percent correct of each item of the 1986 Part I and II exams and the 1993 Step 1 and Step 2 exams were calculated using data from reference groups maintained by the NBME. These reference groups consist of 12,029 examinees for the Part I exam, 7293 examinees for the Part II exam, 14,257 examinees for the Step 1 exam, and 8928 examinees for the Step 2 exam. The percent correct of the nutrition items was separated out and compared to the percent correct of the non-nutrition items. Results of this analysis show that the nutrition item percent correct increased from 1986 to 1993. The percent correct of the nutrition items on the 1986 Part I exam was 65%, increasing to 70% on the 1993 Step 1 exam. The percent correct value of the nutrition items on the 1986 Part II exam also increased from 64% in 1986 to 72% on the 1993 Step 2 exam. The percent correct of the non-nutrition items increased slightly from 1986 to 1993 for Step 1 and decreased for Step 2. The percent correct of the non-nutrition items on the 1986 Part I exam was 64% and 67% on the USMLE 1993 Step 1 exam. The percent correct of the non-nutrition items on the 1986 Part II exam was 66% in 1986 and 62% on the 1993 Step 2 exam.

Therefore, students on the whole, performed better on the nutrition items on both the Step exams compared with the Part exams. Several factors could explain this, but students' ability is probably the single most important factor to account for the differences in these difficulty indices from 1986 to 1993. According to the NBME, the pool of students that were applying to medical schools had significantly declined in the mid 1980's and medical school admissions' acceptance standards on a national basis may have declined. More recently, the number of students applying to medical schools is at an all time high again, with over 7000 students applying to the University of Pennsylvania School of Medicine for 150 places in 1993. Therefore, the timing of the exams with relation to the student pools most likely contributed to the improvement in these students' performances.

Other factors that may explain the increased items answered correctly on the Step exams are that the item writing committees could have written easier nutrition questions for the 1993 exam compared to the 1986 exam. Also, since these committee members and previous nutrition task forces, were asked to write so many more nutrition items to fill the pool for the Comprehensive Exam redesign, the nutrition questions could have been easier.

Another factor that may account for students' performing better on the nutrition items on the Step exams is more integration of nutrition topics throughout the exam in the context of many disciplines. As a results, the nutrition questions may have been more esoteric in the past and students would not have scored as high. Therefore students could be performing better on these items because they are not isolated questions as on the Part exams as supported by the corrected correlation values, which indicates that students who perform well on the nutrition items also perform well on the entire exam.

Reliability Coefficient: The reliability on the nutrition score for the Step 2 exam was lower than the nutrition score on the Step 1 exam. Because the reliability measure incorporates the number of nutrition items into the equation, two results can only be compared if the total items are somewhat close in number. Because the Step 1 exam contained 75 items and the Step 2 exam contained 72 items, the number of items does not explain the differences that were seen on the Step 2 exam. According to Sue Case, PhD, NBME Step 2 Senior Evaluation Officer, lower reliability results on the Step 2 exam are frequently seen by individual subjects, including nutrition, which may be explained by the structural changes within the medical curriculum in the third and fourth years. Students rotate through clinical clerkships during their third and fourth years, with varying clinical exposures, experiences, faculty expectations, and evaluation methods. Therefore consistency across schools begins to deteriorate based on the variations in the quality of education during this period. For example, students from certain medical schools may be rotating through various hospital or clinical sites, all of which have different instructors who have their own teaching styles, agendas, and interest in students. In addition, because students do not specialize until they reach the third year of their education, the first two years are much more homogeneous with regards to areas of interest. After students reach the clerkships, they begin to develop interests and focus their learning on the areas where they plan to specialize or apply to a residency program. Therefore, students taking the Step 2 exam are not as homogeneous a group compared to those students taking the Step 1 exam. Typically, students score better on certain items than others on the Step 2 exam due to these specialization and variations in the third and fourth year medical curriculum, which may not cover all the material that is being tested on the Step 2 exams.

Correlation: Based on the correlation calculations on the entire reference group and the students in Groups A and B on the nutrition and non-nutrition items for the 1993 Step 1 to the Step 2 exam the results are as follows. The number that follows the results in parentheses are the corrected correlation coefficients. For the entire reference group on the Step 1 exam, the correlation coefficient was .79 (.90). For the 1993 Step 1 exam in Group A the correlation coefficient was .80 (.92) and for Group B .79 (.90). For the entire reference group on the 1993 Step 2 exam, the correlation coefficient was .74 (.98). For the Step 2 exam in Group A the correlation coefficient was .74 (.99) and for Group B .68 (.91).

It is apparent from these corrected correlation due to attenuation, that the results of the nutrition and non-nutrition subscores are highly correlated. Again, this is to be expected, since cognitive measures are usually correlated. When students are preparing to take the test they tend to study all the topics and therefore, those that perform well on the total exam tend to perform well on the individual topics such as nutrition. In other words, students who know a lot in one area tend to know a lot in another area. This is true for both the Step 1 and Step 2 exams, which indicates that there is not a difference in the structure of knowledge, which includes nutrition, on the Step 1 and Step 2 exams.

Statistical Analyses for Group Comparisons

Analysis of Covariance

Because the mean scores on the nutrition and non-nutrition items were highly correlated, an analysis of covariance was performed on these scores for both the 1993 Step 1 and Step 2 exams. The test compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of schools with out a nutrition elective or nutrition curriculum (Group B) for both the Step 1 and Step 2 exams. The test also compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of simulated schools (Group C) for both the Step 1 and Step 2 exams (Tables 11 and 12).

Because the mean scores on the nutrition and non-nutrition items were highly correlated, an analysis of covariance was performed on these scores for both the 1993 Step 1 and 2 exams. The test compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of schools with out a nutrition elective or nutrition curriculum (Group B) for both the Step 1 and Step 2 exams. Analysis of the Step 1 exam included 18 schools in Group A compared to 14 schools in Group B. Analysis of the Step 2 exam included 12 schools in Group A compared to 6 schools in Group B. The test also compared the students' mean score on nutrition items from schools with required nutrition curriculum (Group A), compared to students' mean score on nutrition items from the group of simulated schools (Group C) for both the Step 1 and Step 2 exams. Analysis of the Step 1 exam included 18 schools in both Groups A and C. Analysis of the Step 2 exam included 12 schools in both Groups A and C (Table 11).

The level of significance for the comparisons on the Step 1 exam was less than .001, indicating the students' scores in Group A are significantly different than the students' scores in Group B. The level of significance for the comparisons on the Step 1 exam for the comparison of Group A with the simulated Group C was less than .04, indicating that the students' scores in Groups A were significantly different from the students' scores in the simulated Groups C.

The level of significance for the comparisons on the Step 2 exam was .769, indicating that the students' scores on the Step 2 exam were not significantly different than the students' scores in Group B. The level of significance for the comparisons on the Step 2 exam was .113, indicating that the students' scores in Group A were not significantly different from the students' scores in the simulated Group C (Table 12).

The significant differences that were seen between Groups A and B and Groups A and simulated C both indicate that students from schools with a required nutrition curriculum perform better on the nutrition related items than students from schools with out nutrition exposure. The fact that a school has a nutrition elective did not influence these results, which may be due to the variations in the number of students that take nutrition electives at certain schools. Student enrollment in nutrition electives range from 10 students to 40 students and these electives are usually offered during the first or second year, which may explain why a greater difference was seen between the nutrition and non-nutrition scores across Groups A, B, and simulated Group C on the Step 1 exam. For example, the greatest difference in scores on the nutrition and non-nutrition items was seen in Group A on the Step 1 exam (3.6), with Groups C to follow (3.2) and Groups B, without any nutrition exposure having the smallest difference (2.6).

Factors that could contribute to these results are that all 18 required nutrition curriculum schools in Group A teach nutrition in the first or second year of medical school. Therefore, the students' formal exposure to nutrition mainly occurs during the first two years of medical school. As stated above regarding the homogeneity of the students that take the Step 1 exam, their performance tends to be higher in general on specific topics such as nutrition, which could also explain the difference. No significant differences were seen on any of the comparisons within the Step 2 exam. One could argue that nutrition is not formally taught in the third year by any medical school that was listed in the analysis, and so assuming nutrition is a type of topic that is integrated into many fields, particularly medicine, students "catch up" in terms of their knowledge.

Factors that influence students' scores on licensure exams include the selectivity process of the school and the admissions recruitment policies and procedures. For example, pre-matriculation variables include a minimum Medical College Admission Test (MCAT) score and a minimum grade point average for acceptances. Other schools are looking for students who are interested in primary care, possibly because they receive state reimbursement and are looking to increase the number of primary care graduates. Schools which have a strong research component may utilize more basic science researchers to interview students. The demographic, geographic, and curriculum differences that are seen across schools are also important to consider when interpreting data.

Conclusion

Much of the research regarding content of nutrition in medical curriculum emphasizes the nutrition topics which "should" be taught and where in the curriculum or which residency training programs these topics "should" be integrated (6-12). The literature also outlines specific content guidelines which could be used as a guide for developing or improving the nutrition items on licensure exams. The NRC, ASCN, SERMEN and other institutions have conducted research to assess competencies that US medical students and residents "should" acquire. The ASCN conducted a series of surveys and a national consensus workshop with medical administrators who had curriculum planning authority to determine the nutrition topics of highest priority for physicians entering practice, regardless of their specialty. The results have been prioritized or ranked and the most important topics fall into the following three levels.

Level 1: Obesity, hyperlipidemia, diabetes, pregnancy, electrolytes, and major minerals.

Level 2: Carbohydrates, vitamins, protein, cell growth and immunity.

Level 3: Nutrition assessment and the nutritional management of disease states.

Surveys of faculty representatives from each of the 11 SERMEN schools rated 41 nutrition topics on their importance for medical practice, agreeing on seven priority topics which were nutrition assessment, nutrition in trauma and surgery, obesity, minerals, disorders of the gastrointestinal tract, cell growth in infancy and adolescence, and pregnancy and lactation (13). These same investigators have updated their list and divided the topics into high priority, such as body composition, proteins, carbohydrates, lipids, vitamins, minerals, and hyperlipidemia and low priority topics such as chemical additives in foods and the effect of food processing on the nutritional value of food (13).

It is important to keep in mind that the NRC Medical Education Committee recommended an increase in nutrition questions on the USMLE Step 1 and Step 2 exams most likely with the anticipation that this would result in an increase in the overall content of nutrition in undergraduate medical curriculum. However, the NBME clearly states that topics may be covered on the exam that have not been uniformly taught in all medical schools or certain topics that are taught in medical school may not be covered by the USMLE Step exams. These exams are designed to be an independent assessment of what medical students need to know, regardless of whether or not the topics are taught in all medical schools. On the other hand, the NBME does attempt to update its exams to "keep pace" with medical curriculum and the practice of medicine. To help ensure that the NBME is keeping pace with medical curriculum and the practice of medicine, content experts who write exam questions for the USMLE are carefully selected by the NBME to reflect a wide geographic distribution from US medical schools.

But why do so many of the nutrition questions on the Step 2 exam (22%) cover vitamin deficiencies? Maybe the age of the individuals on the item writing committees influenced the outcome of topics related to nutrition. When the physicians who are writing the questions were in training, vitamin deficiencies may have been the only nutrition exposure they received. If age is discounted, maybe the nutrition education that the individual on the item writing committee assigned to nutrition received during their medical training was typical of most practicing physicians. This would not be surprising, since only 18 of the 126 medical schools have a required nutrition curriculum, as previously described in detail. Also, when a physician thinks of nutrition, vitamins or vitamin deficiencies may be the first topic that comes to mind. This could be because most medicine textbook only include a nutrition chapter, which primarily pertains to vitamin deficiencies. One explanation for this may be the fact that diseases or disorders relating to vitamin deficiencies are one of the many medical successes of this century. Because of these discoveries, vitamin deficiencies have essentially been eliminated due to the wide variety of food available for consumption in the US and fortification of food with vitamins, such as A and D in milk.

Based on the schools comparison data, it appears that required nutrition curriculum in medical school during the first and second year may influence the score on the nutrition items on the Step 1 exam but to a small degree. There was no difference in the scores of students from medical schools with and without required nutrition curriculum on the Step 2 exam. But keep in mind that a nutrition course is only one of the many variables that could effect the nutrition knowledge of a medical student. Any even if the nutrition course is the primary factor that influences student's nutrition knowledge, there are many variations among courses that should also be considered. For examples, the quality of the instructor, the intensity of the course, the number of hours, competency measures and evaluation methods, as well as the content of the course. These variations were addressed in this study and would need to be considered in future research of medical students' performance on nutrition exams. It is apparent from Appendix 10, which lists the schools in Groups A and B, that the number of hours and the year the course was offered in the medical school varied tremendously.

With all of this considered, as well as the results of the research, does this mean that nutrition curriculum does not influence how students perform on the nutrition questions, primarily on the Step 2 exams? And, are these results sustainable such that they have a practical significance? Does this mean that nutrition should not be taught in US medical schools because students with required nutrition curriculum do not perform significantly higher on licensing exams? Not necessarily because the curriculum in US medical schools may not be designed or intended to specifically prepare students to answer the nutrition questions on the Step exams.

In addition, as stated previously, the nutrition subscore that was used as the actual test that was measuring students' knowledge is also in question. So the questions remains- is the nutrition test that was generated from reviewing the items a valid test of nutrition knowledge of medical students based on what they are learning in medical school? As stated earlier, the general consensus of the physician reviewers was that most of the information they are currently teaching in medical school nutrition courses were not covered on the 1993 Step exams. So assuming that the nutrition items on the exam are covered in other courses such as Biochemistry, Physiology, Pathophysiology and the Clinical Clerkships, are these exams testing the nutrition knowledge that medical students should be expected to know? Most likely they are not. With such a high percentage of vitamin deficiency items, combined with the reviewers' comments that what they teach in medical school is not covered on the exams, it is unlikely that the licensing exam is the best indicator of medical students' knowledge of nutrition.

Therefore, even though the current research does not offer strong evidence to support the need to teach nutrition in medical school, the investigator is still convinced that teaching nutrition in medical school and urging physicians to incorporate nutrition into their everyday history taking and counseling process is necessary. To support my position, I offer the following questions. How much emphasis should be placed on the licensing exam for physicians- meaning that I do not feel it should be the only indicator of nutrition knowledge of medical students, even though the nutrition content has increased, primarily on the Step 2 exam. And why did the NBME increase the amount of nutrition questions on the Step 1 and the Step 2 exams. There was a 22.5% increase number coverage on the Step 1 exam from 1986 and a 100% increase in nutrition coverage on the Step 2 exam from 1986. Whether nutrition advocates agree with the specific content or not, the NBME is clearly paying more attention to nutrition.

And is there adequate nutrition information that medical students need to know in order to be a competent physician and can this material be integrated into medical curriculum and on licensure exams? Based on the investigator's five years experience developing the Nutrition Education Program for medical student at the University of Pennsylvania School of Medicine, my answer is yes.

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Appendix 1

Blueprint Dimensions for the USMLE Step 1 Exam

Appendix 1-Blueprint Dimensions for the USMLE Step 1 Exam

1) **System**

40-50%	General Principles
50-60%	Individual Organ System Hematopoietic and Lymphoreticular Nervous system and special senses Skin and connective tissue Musculoskeletal Respiratory Cardiovascular Gastrointestinal Renal/Urinary Reproductive Endocrine

2) **Process**

45-55%	Normal
45-55%	Abnormal

3) **Organizational Level**

15-25%	Personal/Group Multilevel
50-65%	Organ/Tissue Cell/Subcellular Molecular
15-25%	Nonhuman Organisms Exogenous Substances

Appendix 2

Blueprint Dimensions for the USMLE Step 2 Exam

Appendix 1-Blueprint Dimensions for the USMLE Step 2 Exam

1) Normal Conditions and ICD-9-CM Categories

10-15%	Normal Growth and Development and General Principles of Care
85-90%	Individual Organ System or Types of Disorders Infectious and Parasitic Diseases Neoplasms Immunological Disorders Diseases of Blood/Blood Forming Organs Mental Disorders Diseases of the Nervous and Special Senses Cardiovascular Disorders Diseases of the Respiratory System Nutritional and Digestive Disorders Gynecological Disorders Renal, Urinary, and Male Reproductive System Disorders of Pregnancy, Childbirth, and the Puerperium Disorders of the Skin and Subcutaneous Tissues Disorders of the Musculoskeletal System and Connective Tissue Endocrine and Metabolic Disorders Congenital Abnormalities Conditions pertaining to the Perinatal Period Symptoms, Signs, and Ill-Defined Conditions Injury and Poisoning

2) Physician Task

15-20%	Promoting Health and Health Maintenance
35-40%	Understanding Mechanisms of Disease
25-30%	Establishing a Diagnosis
10-15%	Applying Principles of Management

3) Population

40-50%	Age Specific Prenatal/Perinatal Infant/Child Adolescent Adults Geriatric
10-15%	Family and Community
45-50%	Unspecified

Appendix 3

Examples of Exam Coding Sheets

Category Code:

1) Growth and development
2) Metabolic/physiological and regulatory mechanisms
3) Lifestyle, life cycle, health and health maintenance
4) Mechanisms of disease
5) Diagnosis of disease
6) Principles of disease management
7) Other

Normal or Abnormal:

1) Normal
2) Abnormal

System Code:

1) Biochemistry
2) Hematopoeitic
3) Nervous senses
4) Connective tissue
5) Musculoskeletal
6) Respiratory
7) Cardiovascular
8) Gastrointestinal
9) Renal
10) Reproductive
11) Endocrine
12) Infectious
13) Neoplasm
14) Immunological
15) Other

Importance in Clinical Medicine: **Scale: 1 to 5**

1) Least important
5) Most important

	A	B	C	D	E
1			N A		1 2 3 4 5
2			N A		1 2 3 4 5
3			N A		1 2 3 4 5
4			N A		1 2 3 4 5
5			N A		1 2 3 4 5
6			N A		1 2 3 4 5
7			N A		1 2 3 4 5
8			N A		1 2 3 4 5
9			N A		1 2 3 4 5
10			N A		1 2 3 4 5
11			N A		1 2 3 4 5
12			N A		1 2 3 4 5
13			N A		1 2 3 4 5
14			N A		1 2 3 4 5
15			N A		1 2 3 4 5
16			N A		1 2 3 4 5
17			N A		1 2 3 4 5
18			N A		1 2 3 4 5
19			N A		1 2 3 4 5
20			N A		1 2 3 4 5
21			N A		1 2 3 4 5
22			N A		1 2 3 4 5
23			N A		1 2 3 4 5
24			N A		1 2 3 4 5
25			N A		1 2 3 4 5
26			N A		1 2 3 4 5
27			N A		1 2 3 4 5
28			N A		1 2 3 4 5
29			N A		1 2 3 4 5
30			N A		1 2 3 4 5
31			N A		1 2 3 4 5
32			N A		1 2 3 4 5
33			N A		1 2 3 4 5
34			N A		1 2 3 4 5
35			N A		1 2 3 4 5
36	deleted item	deleted item	deleted item	deleted item	deleted item
37			N A		1 2 3 4 5
38			N A		1 2 3 4 5
39			N A		1 2 3 4 5
40			N A		1 2 3 4 5
41			N A		1 2 3 4 5
42			N A		1 2 3 4 5
43			N A		1 2 3 4 5

Appendix 4

Review Process Coding Guidelines

REVIEW PROCESS/CODING TASK GUIDELINES

1) Nutrition:

Task: Is the question related to nutrition? YES, NO or ? (uncertain).

Only questions that are specifically designed to test nutrition knowledge or that have a nutrition related correct answer should be coded as a YES. If one of the distracter answers relates to nutrition, the question generally should not be coded as a YES or ? because the question was not intended to test nutrition knowledge.

Codes: The nutrition codes are: YES, NO or ? (uncertain). If a question is not related to nutrition (NO), leave the nutrition column blank and move on to the next question. If the question is related to nutrition or you are uncertain, write either YES or ? in the column.

Guideline: Any question that you code as Yes or ? should be categorized in each of the columns (described below). Also, any question that you code as Yes or ? should be circled in the test book so that we can double check your response, if necessary.

2) Content Area:

Task: What area best describes the content of the question?

Codes: The content category codes are:

1) Growth and development
2) Metabolic/physiological and regulatory mechanisms
3) Lifestyle, life cycle, health and health maintenance
4) Mechanisms of disease
5) Diagnosis of disease
6) Principles of disease management
7) Other

Guideline: The category codes are listed on each coding sheet. Wording examples within each category are attached, and should be referred to while reviewing the questions. One example question within each category is also attached and should be reviewed prior to beginning the review process.

Select only one category. If a question does not fit into any of these categories, use code 7 (other) and write in the key word or heading directly in the column that would identify the question. Again, only nutrition questions that are coded as YES or ? based on the criteria in #1 should be categorized.

Biochemistry questions, (usually coded in category 2: Metabolic/physiological and regulatory mechanisms) should strictly relate to nutrition, rather than everything under the biochemistry umbrella. The biochemistry topics that we had agreed upon as listed on the following page:

Biochemistry topics RELATED to nutrition are:

Energy Metabolism; metabolic sequences and regulation:

Generation of energy from carbohydrates, fatty acids, and nonessential amino acids. Glycolysis, glycogenolysis, pentose phosphate pathway, TCA cycle, electron transport, oxidative phosphorylation. The storage of energy: gluconeogenesis, glycogenesis, fatty acid and triglyceride synthesis.

Metabolic pathways of small molecules and control mechanisms:

Biosynthesis and degradation of purines, pyrimidines, common nucleotides.

Biosyntheses and degradation of lipids, cholesterol, bile acids, steroid hormones and prostoglandins. Biosynthesis and degradation of porphyrines, vitamins, amino acids and simple carbohydrates. Structure, properties, and function of cellular constituents.

Proteins; amino acids structure and properties; structure of proteins.

Carbohydrates and lipids; structure, properties and function of simple saccharides; common polysaccharides, simple and complex lipids; biosynthesis of polysaccharides.

Biochemistry topics NOT RELATED to nutrition are:

Human and microbial biochemical and molecular genetics.

Cell biology, immunologic processes and human development

3) **Normal/Abnormal:**

Task: Is the question related to a normal or abnormal process?

Codes: Code N for normal and A for abnormal. (Circle answer)

Guideline: All disease related questions are abnormal processes.

4) **System:**

Task: The system codes are listed on each coding sheet. They are self-explanatory,
but some questions may have multiple system codes or not fit within a system code.

Codes:

1) Biochemical processes and cellular respiration
2) Hematopoeitic, blood forming organs
3) Nervous and special senses
4) Skin/connective tissue
5) Musculoskeletal
6) Respiratory
7) Cardiovascular
8) Gastrointestinal
9) Renal
10) Reproductive, pregnancy and childbirth
11) Endocrine
12) Infectious
13) Neoplasm
14) Immunological
15) More than one system code: use above codes
16) Other

Guideline: Select only one system code for each question, based on the majority of signs or symptoms given for that one system. If you cannot narrow it to one code, use code 15 and write in all codes that apply. If no system matches, use code 16 (other) and write in the key word or heading directly in the column that would identify the question.

5) **Importance:** This is the column/coding category process that needs your input. In order to prevent this process from being entirely subjective, we need to establish some criteria for coding the question's importance/relevance in clinical medicine for coding. Your responses will allow us to come up with a consensus that can be used during the actual review process. For example, how would importance be related to:

How often the problem presents itself within your week?
Mortality or morbidity of the problem?
In-patient or out-patient clinical setting?
Your own perspective or areas of interest?

Task: How important is this problem in clinical medicine?

Coding: Can you list below problems, issues or cases that are examples of what represents each rating on the scale from the most important clinical problems (5) versus the least important clinical problems (1)? We will discuss these together also. For the enclosed exams, circle the code (1 through 5) that corresponds to your problem list below.

WORDING EXAMPLES WITHIN EACH CATEGORY FOR REVIEWERS

Remember, ask yourself whether the question was intended to test nutrition knowledge

Category Code:

1) Growth and Development:

- Only if question or answer relates to nutrition, not general growth questions
- Includes normal pregnancy questions

2) Metabolic/physiological and Regulatory Mechanisms and Functions:

- Most biochemistry questions coded in the category
- Metabolic consequence of a surgical resection for healthy individuals

3) Lifestyle, Life Cycle, Health and Health Maintenance:

- Risk factors related to disease prevention that include nutrition
- Lead poisoning prevention
- Compliance issues related to nutrition
- Normal changes associated with aging (life cycle) if related to nutrition
- Epidemiological factors that relate to a disease including nutrition

4) Mechanisms of Disease:

- Defect occurs in which metabolic pathway
- Disease will result in this situation if the answer is nutrition related
- Surgical procedure/treatment causes changes that effect nutritional status
- Pathological or metabolic process of a vitamin deficiency
- Consequence of a disease related to nutrition
- Disease process most likely the result of or because of a nutrition problem

5) Diagnosis of Disease:

- Appropriate further investigation should be...
- Most likely cause of the disease when signs/symptoms are given
- Most likely diagnosis when signs/symptoms are given
- What is the next step in the care of the patient if related to nutrition
- Disease given which relates to nutrition, asked for signs and symptoms

6) Principles of Management:

- Drug nutrient interactions
- Patient has specific disease, what care should be administered
- Patient has specific disease, what should they be advised to do
- Situation given, appropriate immediate care or initial management
- Situation given, appropriate to advise the patient to...

7) Other: rarely used

Appendix 5

Biochemistry Topics Related to and Not Related to Nutrition

Biochemistry Topics RELATED to Nutrition:

Energy Metabolism; metabolic sequences and regulation:

Generation of energy from carbohydrates, fatty acids, and nonessential amino acids. Glycolysis, glycogenolysis, pentose phosphate pathway, TCA cycle, electron transport, oxidative phosphorylation. The storage of energy: gluconeogenesis, glycogenesis, fatty acid and triglyceride synthesis.

Metabolic pathways of small molecules and control mechanisms:

Biosynthesis and degradation of purines, pyrimidines, common nucleotides.

Biosyntheses and degradation of lipids, cholesterol, bile acids, steroid hormones and prostoglandins. Biosynthesis and degradation of porphyrines, vitamins, amino acids and simple carbohydrates. Structure, properties, and function of cellular constituents.

Proteins; amino acids structure and properties; structure of proteins.

Carbohydrates and lipids; structure, properties and function of simple saccharides; common polysaccharides, simple and complex lipids; biosynthesis of polysaccharides.

Biochemistry topics NOT RELATED to nutrition are:

Human and microbial biochemical and molecular genetics.

Cell biology, immunologic processes and human development

Appendix 6

Case Examples for Importance in Clinical Medicine Coding Scale

Case Examples for the Importance in Clinical Medicine Category: (as defined by the reviewers)

5) **Very Important**
Diagnosis of malnutrition
Risk factors associated with cardiovascular disease
Diagnosis of pernicious anemia
Dietary treatment of PKU
Vitamin management of alcohol abuse

4) **Important**
Treatment of megaloblastic anemia
Causes of decreased absorption of calcium in the small intestine
Causes of food poisoning
Appropriate prenatal care
Diagnosis of PICA in children
Symptoms causing hypoglycemia secondary to GI surgery
Diagnosis and dietary treatment for steatorrhea
Treatment of metabolic disorders such as PKU
Diagnosis and treatment of iron deficiency in children and adults
Fatty acid transported to the liver via albumin
Mechanism to maintain cholesterol levels without dietary cholesterol intake
Results of increased insulin
Major contributor to increased renal excretion
Metabolic consequences of drug nutrient interaction such as methotrexate and folate

3) **Moderately Important**
Use of low-residue diet
Lead and iron poisoning anecdote
Mechanism involved in seafood allergic reaction
Oxidation of glucose in the muscle when fatty acid utilization is increased
Neurons depend on glucose for energy
Starvation results in increased gluconeogenesis
Biochemical properties of LDL-cholesterol
Maple syrup urine disease caused by deficiency of certain amino acid

2) **Low Importance**
Graphic portrayal of food poisoning outbreak
Insulin effects on gluconeogenesis

1) **Not Important**
Enzymatic reaction of free energy
Conversion of cysteine to alanine
Glycerol backbone of phospholipids
Internalization of protein involves which amino acids

Appendix 7

Tallied Results of the Sample Training Tests

Y= Yes, Nutrition related
R= Reviewer
FC=Final Code
N= Normal
A= Abnormal

PART I

ITEM	NUTRITION						CATEGORY						NORM/ABNORM						SYSTEM						IMPORTANCE				
	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5
1	Y	Y	Y	Y	Y	Y	2	2	2	3	4	2	N	N	N	N	N	N	1	1	7	7		1	3	4	3	4	
2	Y	Y		Y	Y	Y	5	5		5	5	5	A	A		A	A	A	2	2		2	2	2	4	4		5	5
3	Y	?	Y	Y	Y	Y	5	4	3	3	4	4	A	A		A	A	A	13	15	15	15	13	13	3	4	3	3	4
4				?	?					4	4					A	A					2	2					3	5
5																													
6																													
7	Y	Y	Y	Y	Y	Y	5	5	5	1	2	5	A	A	A	A	A	A	1	1	3	1	1	1	3	5	4	4	5
8																													
9					Y						2						A						2						5
10				Y	Y					5	3					A	A					12	12					5	4
11																													
12																													
13																													
14				Y	Y					4	4					A	A					3	3					5	4
15					Y						2						A						3						4
16																													
17	Y		?	?			2		2	2			N		N	N			1		1	1			2		3	2	
18	Y			Y			2			2			N			N			9			1			2			4	
19				Y	Y					4	4					A	A					9	9					3	5
20	Y		Y	Y	Y	Y	3		3	4	3	3	A		A	A	A	A	7		7	7	7	7	4		5	5	2
21	Y	Y	Y	Y	Y	Y	2	2	2	2	2	2	N	N	N	N	N	N	1	1	1	1	1	1	2	3	3	4	3
22	Y	Y	Y	Y	Y	Y	7	2	2	2	2	2	N	N	N	N	N	N	1	1	1	1	1	1	3		5	5	5
23																													
24																													
25	?		Y	Y		Y			2	2		2			N	N		N			1	1		1			1	1	
26	Y	Y	Y	Y		Y	2	2	2	2		2	N	N	A	N		N	1	1	11	11		1	2	4	2	3	
27	Y	Y	Y	Y	Y	Y	2	2	4	4	1	4	A	N	A	A	A	A	1	1	1	1	1	1	2	4	3	5	5
28	Y	Y	Y	Y	Y	Y	2	2	2	5	2	2	N	N	N	A	N	N	16	1	9	16	1	16	1		2	4	3
29																													
30	Y		Y	Y	Y	Y	2		4	4	2	4	A		A	A	A	A	3		3	3	1	3	4		4	4	4
31				?						3						N						16						5	
32																													
33	Y	Y	Y	Y	Y	Y	7	7	2	2	2	2	N	N	N	N	N	N	1	16	1	1	1	1	3	4	4	4	3
34	Y	Y	Y	Y	Y	Y	2	2	2	2	2	2	N	N	N	N	N	N	1	1	7	1	1	1	2	4	2	5	4
35	Y	Y	Y	Y	Y	Y	2	2	2	2	2	2	N	N	N	N	N	N	1	1	1	1	1	1	2	4	2	5	5
36	Y	Y	Y	Y	Y	Y	4	4	4	5	4	7	A	A	A	A	A	A	7	7	7	7	1	14	5		5	5	5
37	Y	Y	Y	Y	Y	Y	4	4	4	5	4	4	A	A	A	A	A	A	7	7	7	7	1	7			4	5	5
38																													
39																													
40																													
41	Y		Y	Y	Y	Y	2		4	4	2	4	A		A	A	A	A			1	15	3	3	2		3	4	5
42	Y		Y	Y	Y	Y	2		2	2	2	2	N		N	N	N	N	1		11	1	1	1	1		1	1	3
43	Y	Y	Y	Y	Y	Y	4	4	5	5	5	5	A	A	A	A	A	A	1	1	1	1	1	1	2		2	3	5

	PART II																												
ITEM	NUTRITION						CATEGORY						NORM/ABNORM						SYSTEM						IMPORTANCE				
	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5
1																													
2																													
3				?	Y					5	4					A	A					11	10					3	3
4	?		Y	?					7	7					A	A					15	15					3	3	
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													
13	Y	Y	Y	Y	Y	Y	5	5	5	4	7	5	A	A	A	A	A	A	16	16	16	16	16	16	4	5	5	5	5
14	Y	Y	Y	Y	Y	Y	5	5	5	4	7	5	A	A	A	A	A	A	16	16	16	16	16	16	4	5	5	5	4
15																													
16	Y	Y	?	Y		Y	6	6	5	6		6	A	A	A	A		A	16	8	8			8	3	2	3		
17																													
18																													
19	Y		?	?			3				3		A			A			15		15				3	2			
20																													
21	Y	Y	Y	Y	Y	Y	5	4	5	5	4	5	A	A	A	A	A	A	12	15	8	12	12	12	4	4	4	3	3
22																													
23	Y		Y	Y		Y	7		6	3		6	A		A	A		A	16		16	8		16	3		4	2	
24																													
25																													
26																													
27	Y			?	Y		3			3	7		N			N	N		16			16	16		3			2	?
28	?				Y		3				7		A				A		6						4				
29	Y	Y	Y	Y	Y	Y	2	2	6	6	6	6	A	A	A	A	A	A	1	16	1	1	1	1	4	4	4	4	5
30	Y		?	Y	Y	Y	5		4	3	4	4	A		A	A	A	A	12		8	16	12	12	2		3	2	4
31																													
32																													
33																													
34	Y	Y	Y	Y	Y	Y	1	3	1	1	1	1	N	N	N	N	N	N	10	10	10	10	16	10	4	4	4	5	5
35																													
36																													
37																													
38	Y	Y	Y	Y	Y	Y	3	4	3	3	4	3	A	A	A	A	A	A	7	16	7	16	7	7	5	4	4	3	4
39																													
40																													
41																													
42		Y	Y					1	2				N	N					10	10						3	4		
43	Y	Y	Y	Y		Y	3	5			4	5	A	A			A	A		2			2	2		4			5

STEP 1																													
ITEM	NUTRITION						CATEGORY						NORM/ABNORM						SYSTEM						IMPORTANCE				
	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5	FC	R1	R2	R3	R4	R5
1																													
2																													
3																													
4				Y	Y					5	3					A	A					12	12					5	5
5				Y						2						N						1						1	
6	Y	Y	Y	Y	Y	Y	2	2	2	2	2	2	N	N	N	N	N	N	1	1	1	1	6	1	3	4	1	4	5
7																													
8																													
9	Y	Y		Y	Y	Y	5	5		5	5	5	A	A		A	A	A	2	2		2	2	2	5	4		5	4
10																													
11																													
12																													
13																													
14	Y	Y	Y	Y	Y	Y	4	2	4	4	2	4	A	A	A	A	A	A	1	1	1	1	1	1	2	2	1	3	4
15																													
16																													
17	Y		Y	Y	Y		2		2	7	6		N		A	N	N		15		15	8	6		2		2	4	4
18																													
19	Y		Y	Y	Y	Y	3		3	3	4	3	A		A	N	N	A	7		7	7	3	7	4		1	4	3
20	Y		?	Y			7		7	3			N		N	N			15		15	15			2		1	4	
21																													
22	Y		Y	Y	Y	Y	2		2	2	4	2	N		N	N	A	N	1			1	1	1	1			2	1
23	Y	Y	Y	Y	Y	Y	6	2	6	6	4	6	N	N	A	A	A	A	1	1	13	2	2	1	4	4	2	4	4
24																													
25																													
26	Y	Y	?	Y	Y	Y	2	2	2	2	6	2	N	N	N	N	A	N	1	1	1	1	3	1	2	3	1	1	2
27	Y	?	Y	Y	Y	Y	4	4	4	4	4	4	A	A	A	A	A	A	12	14	14	14	2	14	3		3	5	4
28																													
29			Y	?	Y				4	6	3				A	A	A				3	3	2				4	3	3
30	Y	Y	Y	Y		Y	2	2	2	2		2	N	N	N	N		N	1	1	1	1		1	2	3	2	3	
31	Y		Y	Y	Y	Y	2		2	2	2	2	N		N	N	N	N	9		9	9	2	9	4		1	4	2
32																													
33	Y			?			2			4			N			A			9			9			3			4	
34																													
35				?	Y					4	4					A	A					8	7				4	2	
36																													
37	Y	Y	Y	Y	Y	Y	2	2	2	3	2	2	N	N	N	N	N	N	1	1	7	8	1	1	4	4	4	5	5
38				?						2						N						9						3	
39	Y		Y	Y	Y	Y	2		2	2	2	2	N		N	N	N	N	3		3	3	1	3			3	3	5
40																													
41	Y	Y	Y	Y	Y	Y	4	2	4	1	2	4	A	A	A	A	A	A	1	1		1	1	1	3	3	2	4	1
42	Y	?		Y		Y	2	2		2		2	N	N		N		N	11	15		11		1	4				4
43	Y	Y	Y	Y	Y	Y	6	2	6	1	6	6	A	A	A	A	A	A	1	1		1	1	1	5	3	5	5	2

STEP 2

ITEM	NUTRITION R1	R2	R3	R4	R5	FC	CATEGORY R1	R2	R3	R4	R5	FC	NORM/ABNORM R1	R2	R3	R4	R5	FC	SYSTEM R1	R2	R3	R4	R5	FC	IMPORTANCE R1	R2	R3	R4	R5
1																													
2																													
3			Y	Y	Y				5	1	4				A	A	A				10	3	3				5	4	5
4			?	?	Y				4	5	4				A	A	A				8	8	8				4	3	5
5	Y	Y	Y	Y	Y	**Y**	5	4	5	5	5	**5**	A	A	A	A	A	**A**	12	8	8	12	12	**8**	4	4	4	4	4
6				?	Y					6	6					A	A					15	2					3	5
7																													
8					Y						6						A						2						5
9					Y						2						A						4						4
10					Y						4						A						2						4
11																													
12	Y		Y	Y	Y		5		7	7	3		A		A	A	A		15		15	3	3		4		4	3	4
13			Y	Y	Y				7	7	3				A	A	A				15	3	3				5	3	4
14																													
15					Y						5						A						2						4
16	?	?	Y	?	Y		5	4	5	5	6		A	A	A	A	A		2	2	2	2	8		4	4	4	4	5
17																													
18	Y			Y	Y		5			5	4		A			A	A		8			8	11		4			4	3
19																													
20	Y		Y		Y	**Y**	3		3		4	**4**		A		A	N	**A**	7		7	7	2		5		5	5	3
21																													
22																													
23																													
24																													
25	Y				Y		5				5		A				A		2				2		3				3
26	?		Y	?					5	5					A	A					10	11					4	3	
27																													
28	Y		Y		Y	**Y**	5		5		6	**5**	A		A		A	**A**	11		8		2	**8**	4		4		4
29					?						4						A						7						4
30	Y	Y	Y	Y	Y	**Y**	6	6	6	5	6	**6**	A	A	A	A	A	**A**	8	8	8	8	9	**8**	4	4	5	4	5
31	Y	Y	Y	Y	Y	**Y**	6	6	6	6	6	**6**	A	A	A	A	A	**A**	15	7	3	3	3	**3**	5	4	5	5	4
32																													
33	Y	Y	Y	Y	Y	**Y**	4	4	4	4	4	**4**	A	A	A	A	A	**A**	9	9	9	9	9	**9**	4		4	5	5
34	?				Y						4						A						11						4
35	?				Y						4						A						11						4
36	?				Y						4						A						2						5
37																													
38																													
39				Y	?					6	5					A	A					8	12					4	3
40	Y	Y	Y	Y	Y	**Y**	5	5	5	5	5	**5**	A	A	A	A	A	**A**	2	2	2	2	2	**2**	4	4	4	4	4
41	Y	Y	Y	Y	Y	**Y**	6	6	6	6	6	**6**	A	A	A	A	A	**A**	15	1	3	3	2	**3**	5	4	5	4	4
42	Y	Y	Y	Y	Y	**Y**	6	6	6	6	6	**6**	A	A	A	A	A	**A**	2	2	2	2	3	**2**	4	4	5	5	4
43	Y	Y	Y	Y	Y	**Y**	6	6	6	6	6	**6**	A	A	A	A	A	**A**	2	2	2	2	8	**2**	4	4	4	5	5

Appendix 8

Test Distribution Schedule

TEST BOOKLET DISTRIBUTION

Goals: All reviewers will review all exam booklets.

Exam books will be given out in the following order.

Day 1

Reviewer 1/5	Part I Book A Part I Book B Part I Book C Part I Book D Part I Book E Part I Book F Step 1 Book A Step 1 Book B Step 1 Book C Step 1 Book D
Reviewer 2	Part I Book B Part I Book C Part I Book D Part I Book E Part I Book F Part I Book A Step 1 Book B Step 1 Book C Step 1 Book D Step 1 Book A
Reviewer 3	Part I Book C Part I Book D Part I Book E Part I Book F Part I Book A Part I Book B Step 1 Book C Step 1 Book D Step 1 Book A Step 1 Book B
Reviewer 4	Part I Book D Part I Book E Part I Book F Part I Book A Part I Book B Part I Book C Step 1 Book D Step 1 Book A Step 1 Book B Step 1 Book C

Day 2 **TEST BOOKLET DISTRIBUTION**

Reviewer 1/5	Part II Book A Part II Book B Part II Book C Part II Book D Part II Book E Part II Book F Step 2 Book A Step 2 Book B Step 2 Book C Step 2 Book D
Reviewer 2	Part II Book B Part II Book C Part II Book D Part II Book E Part II Book F Part II Book A Step 2 Book B Step 2 Book C Step 2 Book D Step 2 Book A
Reviewer 3	Part II Book C Part II Book D Part II Book E Part II Book F Part II Book A Part II Book B Step 2 Book C Step 2 Book D Step 2 Book A Step 2 Book B
Reviewer 4	Part II Book D Part II Book E Part II Book F Part II Book A Part II Book B Part II Book C Step 2 Book D Step 2 Book A Step 2 Book B Step 2 Book C

Appendix 9

List of Medical Schools in
Group A: (Required Nutrition Curriculum)
and Group B: (Without Nutrition Elective or Curriculum)

P=Passing the exam is required for graduation
G=Passing the exam is required for graduation
R=Recording a score on the exam is required for graduation
O=Taking the exam is optional for graduation

MEDICAL SCHOOLS IN GROUP A-REQUIRED NUTRITION CURRICULUM

MEDICAL SCHOOL	REQUIRED NUTRITION					COURSE FORMAT	TAKING PARI/ STEP 1					TAKING PART II/ STEP 2					% of students	
	94-5	93-4	92-3	91-2	90-1		94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	STEP 1	STEP 2
U. of Alabama School of Medicine at Birmingham	X	X	X	X	X	Year 1 46 hours	P	P	P	P	P	G	G	G	G	G	99%	95%
U. of California College of Medicine at Irvine	X	X	X	X	X	Year 1 20 hours	P	P	P	P	P	G	G	G	G	G	83%	85%
Emory University School of Medicine	X	X	X	X	X	Year 2 16 hours	P	P	P	P	P	R	R	R	R	R	95%	4% excluded
Morehouse School of Medicine	X	X	X	X	X	Year 2 16 hours	P	P	P	P	P	G	G	G	G	G	89%	64%
U. of Health Sciences Chicago Medical School	X	X	X	X	X	Year 2 15 hours	P	P	P	G	G	G	G	G	G	G	100%	74%
U. of Chicago, Pritzker School of Medicine	X	X	X	X	NO	Year 2 46 hours	O	O	O	O	O	O	O	O	O	O	84%	94%
U. of Illinois-Chicago College of Medicine	X	X	X	X	X	Year 1 28 hours	P	P	P	P	P	G	G	G	G	G	97%	84%
U. of Massachusetts Medical School	X	X	X	X	X	Year 2 15 hours	R	R	R	R	R	R	R	R	R	R	84%	33% excluded
Tufts University School of Medicine	X	X	X	X	X	Year 2 10 hours	R	R	R	R	R	R	R	R	R	R	93%	23% excluded

MEDICAL SCHOOLS IN GROUP A-REQUIRED NUTRITION CURRICULUM

MEDICAL SCHOOL	REQUIRED NUTRITION					COURSE	TAKING PART I/ STEP 1					TAKING PART II/ STEP 2					% of students	
	94-5	93-4	92-3	91-2	90-1	FORMAT	94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	STEP 1	STEP 2
St. Louis University	X	X	X	X	X	Year 1	P	P	P	P	P	G	G	G	G	G	94%	89%
School of Medicine						24 hours												
UMDNJ: Newark	X	X	X	X	NO	Year 2	P	P	P	P	P	R	R	R	R	R	89%	35%
	Clinical Preventive Medicine					40 hours												excluded
Mount Sinai School of	X	X	X	X	X	Year 2	P	P	P	P	P	G	G	G	G	G	86%	95%
Medicine of the City of NY						13 hours												
State U. of New York	X	X	X	X	X	Year 2	G	G	G	G	G	G	G	G	G	G	84%	32%
Health Science at Brooklyn						17 hours												excluded
State U. of New York	X	X	X	X	X	Year 2	R	R	R	R	R	R	R	R	R	R	89%	12%
Health Science at Syracuse						10 hours												excluded
Jefferson Medical College	X	X	X	X	NO	Year 2	P	P	P	P	P	G	G	G	G	G	88%	90%
	Health of the Public					66 hours												
Brown Univesity	X	X	X	X	X	Year 2	O	O	O	O	P	G	G	G	G	G	73%	61%
Program in Medicine						20 hours												
Meharry Medical College	X	X	X	X	X	Year 1	P	P	P	P	P	G	G	G	G	G	80%	73%
School of Medicine, Nashville						20 hours												
U. of Tennessee, Memphis	X	X	X	X	X	Year 2	P	P	P	P	P	G	G	G	G	G	100%	91%
College of Medicine						33 hours												
TOTAL SCHOOLS WITH REQUIRED NUTRITION CURRICULUM =18 for STEP 1, 12 FOR STEP 2 - GROUP A																		

MEDICAL SCHOOLS IN GROUP B-WITHOUT NUTRITION ELECTIVE OR NUTRITION CURRICULUM

MEDICAL SCHOOL	NO NUTRITION ELECTIVE					TAKING PART I/STEP 1					TAKING PART II/STEP 2					% of Students	
	94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	STEP 1	STEP 2
U. of South Alabama College of Medicine, Mobile	X	X	X	X	X	P	P	P	P	P	R	R	R	R	R	88%	68
University of Connecticut School of Medicine	X	X	X	X	X	R	R	R	R	R	R	R	R	R	R	88%	74%
Georgetown University School of Medicine	X	X	X	X	X	R	R	R	R	R	O	O	O	R	R	96%	4% excluded
Mercer University School of Medicine, Georgia	X	X	X	X	X	P	P	P	P	P	G	G	G	G	G	82%	62%
Louisiana State U. (Shreveport) School of Medicine	X	X	X	X	X	G	G	G	O	O	O	O	O	O	O	95%	29% excluded
U. of Nebraska, Omaha College of Medicine	X	X	X	elect	elect	O	O	O	O	O	O	O	O	O	O	100%	40% excluded
New York Univesity School of Medicine, NYC	X	X	X	X	X	O	O	O	O	O	O	O	O	O	O	88%	15% excluded
U. of Cincinnati College of Medicine	X	X	X	X	X	P	P	P	P	P	G	G	G	G	R	83%	81%
U. of Oklahoma, Oklahoma College of Medicine	X	X	X	X	X	R	R	R	R	R	R	R	R	R	R	100%	48% excluded

MEDICAL SCHOOLS IN GROUP B-WITHOUT NUTRITION ELECTIVE OR NUTRITION CURRICULUM

MEDICAL SCHOOL	NO NUTRITION ELECTIVE					TAKING PART I/STEP 1					TAKING PART II/STEP 2					% of Students	
	94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	94-5	93-4	92-3	91-2	90-1	STEP 1	STEP 2
Hahnemann University School of Medicine	X	X	X	X	X	P	P	P	P	P	G	G	G	G	G	89%	91%
Medical University of South Carolina College	X	X	X	X	elect	P	P	P	P	P	O	O	O	O	O	87%	27% excluded
U. of South Dakota School of Medicine, Vermillion	X	X	X	X	X	P	P	P	P	P	G	G	G	G	G	98%	94%
U. of Texas Medical School at Houston	X	X	X	X	X	O	O	O	O	R	O	O	O	O	O	85%	6% excluded
Ponce School of Medicine Puerto Rico	X	elect	X	X	X	R	R	R	G	G	R	R	R	O	O	73%	17% excluded

TOTAL SCHOOLS WITH OUT NUTRITION ELECTIVES OR NUTRITION CURRICULUM = 14 FOR STEP 1 AND 6 FOR STEP 2 EXAMS.

Appendix 10

Topics Not Addressed and Those Covered in Excess

SUMMARY

TOPICS NOT ADDRESSED AND TOPICS COVERED IN EXCESS

PART I 1986

TOPICS COVERED IN EXCESS
- Nutritional biochemistry with little clinical relevance

STEP 1 1993

TOPICS NOT ADDRESSED

- Nutrition support
- Malnutrition in the elderly
- Refeeding syndrome
- Nutrition during pregnancy
- Nutrition requirements of breast feeding
- Pediatrics growth chart interpretations
- Nutrition and its role in prevention of disease
- Body composition

TOPICS COVERED IN EXCESS: None

PART II 1986

TOPICS NOT ADDRESSED
- Nutrition support/ Enteral feeding
- Childhood nutrition
- Refeeding syndrome
- Pathophysiology, Nutritional manifestation of various diseases
- Dietary Recommendations for diseases

TOPICS COVERED IN EXCESS: None

STEP 2 1993

TOPICS NOT ADDRESSED
- Nutrition support/ Enteral feeding
- Pathophysiology, Nutritional manifestation of various diseases

TOPICS COVERED IN EXCESS
- Eating disorders
- Thiamin deficiency
- Nutritional anemia
- Hyperlipidemia

CHAPTER 8

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