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Effects of Pilot Nutrition Curriculum on Medical Student Knowledge and Ability at the University of Minnesota Medical School Duluth Campus

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Abstract

Purpose: Undergraduate medical education is facing an increasing need to bridge the longstanding gap between basic nutrition knowledge and its application to patient care. In an effort to improve upon knowledge and confidence in this area, the University of Minnesota Medical School Duluth Campus implemented a pilot curriculum to increase content and exposure in the areas of food, food systems, nutrition, and clinical application.

Methods: Two classes of outgoing second-year medical students at the University of Minnesota Duluth Campus were surveyed about personal health, knowledge of nutritional topics, and confidence in implementing these topics in patient care. The control group consisted of outgoing second-year medical students (MS2s) during the 2019-2020 academic year (n=28) prior to pilot nutrition curriculum inception. The cohort group (n=29) consisted of outgoing MS2s from the 2020-2021 academic year who received the new pilot curriculum.

Findings: Survey findings did not yield statistically significant differences in control versus cohort responses in students' personal health and knowledge of nutritional concepts. However, over 90% of the cohort group, versus 54% of control, agreed that they were able to discuss and recommend healthy dietary modifications to a patient with a chronic disease. The cohort group also reported higher confidence in talking with patients about dietary patterns (69% vs 39%), whole-food, plant-rich diets (90% vs 50%), as well as working inter-professionally with other members of the healthcare team around issues of food and nutrition (97% vs 71%).

Conclusion: Results demonstrate that the pilot curriculum increased medical student confidence in evaluating the multidimensionality of food, food systems, and nutrition content as well as the application of this content to patient care. This pilot curriculum may have relevance to other medical schools who are also wishing to bridge this longstanding gap in medical education.

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Background

U.S. medical students receive an average of 19.6 hours of nutrition instruction during 4 years of medical school.[1] Physicians are finding themselves inadequately prepared to provide patient-centered nutrition recommendations, leaving many calling for curriculum change at the medical school level.[2 - 5] To determine where the lack of confidence originates, we must look at undergraduate medical education.

Licensing exams emphasize biochemical knowledge and the importance of identifying the clinical manifestations of common nutritional deficiencies. Little emphasis has been placed on how societal

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conditions play a role in poor diet and nutrition, the translation of basic nutritional biochemistry to the food people eat, or the clinical application of this material through patient-centered care. Upon completion of medical school, students should be equipped with strategies to provide basic, evidence-based dietary interventions in patient care. However, medical schools rarely offer an accompanying curriculum that bridges this basic science knowledge to patient care.[6]

Poor diet, obesity, tobacco use, and hypertension are leading causes of morbidity and mortality in the U.S., while diet and high BMI greatly contribute to disease burden.[7] Many studies support the role of dietary interventions in both preventing and managing chronic disease.[1, 7 - 16] Guidelines from major advisory organizations call for optimizing diet as foundational to chronic disease management.[14, 17-19] There is also increasing recognition of the role of food access, food insecurity and the larger food system in both individual and community health.[20] Because of this, medical students need essential training on how to identify the intersectionality between food systems and nutrition in the context of these chronic conditions and address needed dietary interventions.

In effort to improve upon knowledge and confidence in these areas, the University of Minnesota Medical School Duluth Campus implemented a pilot curriculum to increase medical student exposure to the intersectionality of food, food systems, nutrition, and its application to patient care. This pilot curriculum entailed 5.5 hours of novel curriculum beyond previously taught nutrition topics. The new curriculum included interactive lectures, a hands-on cooking lab, and a nutrition-focused patient case assignment and discussion.

Duluth's regional campus has a systems-based 2-year foundational curriculum. The pilot curriculum incorporated these additional 5.5 hours into the Gastrointestinal Medicine Course in the spring semester of year two. Given the University of Minnesota's COVID19 guidelines during AY 2020-21, the pilot curriculum was created to run virtually. Students participated in the following: 1) a 1-hour large-group live virtual introductory session with small-group breakout-room discussions, 2) a 1-hour large-group live virtual discussion of nutrition myths and dietary patterns' impact on health and disease, 3) a small-group 1.5-hour virtual hands-on cooking lab with students participating from their own home kitchen, 4) a case assignment that students completed asynchronously and submitted in pairs, and 5) a 2-hour large group live virtual discussion of the assignment cases, where chosen students presented each case with large group discussion following. The patient case scenarios that were used for this assignment/discussion covered the following conditions: diabetes, obesity, hypertension, and depression. Objectives for each of these sessions are listed in Table 1.

Table 1. Objectives of Pilot Curriculum

a) Introduction to Food, Food Systems, and Nutrition
   i) Define or explain a food system
   ii) Explain food systems and their connection with human and environmental health
   iii) Examine how food access and food security are critical social determinants of health
   iv) Examine the role of food production methods on human and environmental health
   v) Describe the relationship between dietary patterns and environmental impact
   vi) Understand how to explore patient-specific dietary context
   vii) Identify the nutritional and cultural importance of traditional foods and dietary patterns
b) Nutrition Myths and Dietary Patterns' Impact on Health and Disease
   i) Examine common nutrition myths and the evidence-based science that refutes them
   ii) Recognize how to discern quality nutritional information that is accurate and evidence-based
   iii) Critique common dietary patterns and their balance and sources of macronutrients
   iv) Apply these concepts to the assessment of food plates and dietary patterns
c) Hands-On Cooking Lab
   i) Identify and learn needed food skills for self-care and translate into patient care contexts
   ii) Develop diet recommendations appropriate to the patient's nutritional status, justify them, and communicate them in a way that the patient understands
   iii) Examine the relationship of macronutrient quality to the health-disease continuum
   iv) Be able to effectively counsel patients on cooking nourishing, healthy, culturally-aligned meals with limited resources
d) Case Assignment/Discussion
   i) Identify student assignments that are most inclusive and robust in capturing learning objectives from the prior food/food systems/nutrition sessions germane to each patient scenario
   ii) Summarize key responses to each case that best capture the recommendations, justification, and communication necessary for that patient scenario
   iii) Discuss key clinical knowledge and literature that supports best practice in the management of each patient scenario
   iv) Recognize how to discern quality nutritional information that is accurate, non-reductionistic, and evidence-based
   v) Critique common dietary patterns and their balance and sources of macronutrients
   vi) Apply these concepts to the assessment of food plates and dietary patterns

Materials and Methods

The pilot curriculum was evaluated by use of a Qualtrics survey and was sent to students at the completion of their second year of medical school. This survey was developed by expert physician and chef with MPH and vetted for face validity. IRB review was sought, ID: 00008967, and the study was granted

exemption as it was not considered human subject research.

Students were asked to rate questions via a 5-point Likert-type scale, inquiring about their personal health, knowledge of nutritional concepts, and confidence in the ability to implement nutritional concepts in patient care (see Table 2 for survey questions). The control group consisted of outgoing second-year medical students (MS2s) during the 2019-2020 academic year prior to pilot nutrition curriculum inception. The cohort group consisted of outgoing MS2s from the 2020-2021 academic year who received the new pilot curriculum within the Gastrointestinal Medicine course.

The year prior to pilot implementation, nutrition workshops had occurred in planning for this curricular change. A small number of students participated in these workshops and were asked to identify themselves within the survey. Students from either the control or cohort groups who participated in any of the workshops were excluded from this analysis.

There was a total of 66 surveys. One was excluded as a test survey, leaving 65 surveys (36 for 2019-2020 outgoing MS2s [control group] and 29 for 2020-2021 outgoing MS2s [cohort group]). There were three students in the control group that did not indicate whether or not they attended the nutrition workshops, therefore they were excluded from the analysis. There were five students in the control group who indicated they attended nutrition workshops, so they were also excluded from the control group. The final sample sizes were 28 for the control group and 29 for the cohort group; total N=57.

To compare the responses between control and cohort groups, nonparametric Wilcoxon rank-sum tests were used given the ordinal (non-normal) distribution of the data and small sample sizes. P-values <0.05 were considered statistically significant and practical significance (i.e., meaningful results) was considered in the interpretation of the results. P-values were not adjusted for multiple-testing due to the small sample size and exploratory nature of this study.

Table 2: Survey Questions

a) Students were asked to rate the following questions about their personal health on a scale of 1 (poor) to 5 (excellent):
   i) Nutritional quality of students' diet
   ii) Ability to prepare nutritious meals/snacks
   iii) Student overall wellbeing
   iv) Student overall health

b) Students were asked to rate their level of knowledge and ability on a scale of 1 (strongly disagree) to 5 (strongly agree):
   i) I know what it means to eat a nutritionally balanced meal
   ii) I can define/explain the macronutrients
   iii) I know where to find the macronutrients in food
   iv) I know how to use fresh, whole ingredients to prepare meals

c) Students were asked to rate their current level of confidence in their knowledge and ability on a scale of 1 (strongly disagree) to 5 (strongly agree):
   i) I can explain to a patient how food is a part of lifestyle and the impact their diet has on their health
   ii) I can link certain dietary practices to specific chronic diseases and discuss this with a patient
   iii) I am able to discuss and recommend healthy dietary modifications to a patient with a chronic disease
   iv) I have sufficient knowledge to discuss and answer questions from patients about various dietary patterns (vegetarian, vegan, paleo, Mediterranean, gluten-free, low-sodium, ketogenic, various food intolerances)
   v) I can explain a whole-food, plant-rich diet in basic terms to patients
   vi) I am able to guide a patient through basic food preparation techniques
   vii) I feel comfortable working inter-professionally with other members of the healthcare team around issues of food and nutrition

Results

Student Personal Health

Survey findings did not yield statistically significant differences in control versus cohort responses in personal health and nutrition. Generally, most students reported relatively high ratings for personal health and nutrition. Over half of the students chose ratings of a 4 or 5 on a scale from 1-poor to 5-excellent for each of the questions about personal health and nutrition. Although there were no statistically significant differences in student self-reported personal health and nutrition between the control group and the cohort group, the control group generally appeared to have higher self-ratings. For example, 11% of the control group rated the nutritional quality of their diet as excellent, as compared to only 3% of the cohort group. Similarly, 18% of the control group rated their overall health as excellent, as compared to 0% of the cohort group.

Knowledge of nutritional concepts

Survey findings did not yield statistically significant differences in control versus cohort responses in knowledge of nutritional concepts. Students from both groups reported high agreement for the knowledge questions. More than 90% of the students in both groups agreed they know what it means to eat a nutritionally balanced meal. Although agreement did not vary statistically significantly by group, in the

cohort group, 93.1% of students agreed they can define/explain the macronutrients, as compared to only 78.5% in the control group. Similar proportions of students agreed with the other knowledge statements.

Confidence in implementing nutritional concepts in patient care

In examining confidence to implement nutritional concepts in patient care, the cohort group reported higher confidence in several areas, as seen in Table 3. Over 90% of the cohort group agreed or strongly agreed that they were able to discuss and recommend healthy dietary modifications to a patient with a chronic disease, as compared to 54% of the control group. The cohort group also reported higher confidence in talking with patients about dietary patterns (69% vs 39%) and whole-food, plant-rich diets (90% vs 50%), as well as working inter-professionally with other members of the healthcare team around issues of food and nutrition (97% vs 71%). The differences between groups for the other three questions were not statistically significant.

Table 3. Students' self-reported confidence of applying nutritional concepts to patient care

Please rate your current level of confidence in the following statements about knowledge and ability:	Study Group: Control (n=28) n	%	Curriculum (n=29) n	%	p-value
I. I can explain to a patient how food is a part of lifestyle and the impact their diet has on their health.					0.773
Strongly Disagree	0	0.0%	0	0.0%	
Disagree	2	7.1%	1	3.4%	
Neutral	2	7.1%	1	3.4%	
Agree	15	53.6%	18	62.1%	
Strongly agree	9	32.1%	9	31.0%	
II. I can link certain dietary practices to specific chronic diseases and discuss this with a patient.					0.094
Strongly Disagree	1	3.6%	0	0.0%	
Disagree	2	7.1%	0	0.0%	
Neutral	5	17.9%	2	6.9%	
Agree	15	53.6%	20	69.0%	
Strongly agree	5	17.9%	7	24.1%	
III. I am able to discuss and recommended healthy dietary modifications to a patient with a chronic disease.					0.042
Strongly Disagree	0	0.0%	0	0.0%	
Disagree	2	7.1%	1	3.4%	
Neutral	11	39.3%	1	3.4%	
Agree	9	32.1%	21	72.4%	
Strongly agree	6	21.4%	6	20.7%	
IV. I have sufficient knowledge to discuss and answer questions from patients about various dietary patterns (vegetarian, vegan, paleo, Mediterranean, gluten-free, low-sodium, ketogenic, various food intolerances)					0.028
Strongly Disagree	4	14.3%	1	3.4%	
Disagree	3	10.7%	3	10.3%	
Neutral	10	35.7%	5	17.2%	
Agree	8	28.6%	12	41.4%	
Strongly agree	3	10.7%	8	27.6%	
V. I can explain a whole food, plant-rich diet in basic terms to patients.					0.004
Strongly Disagree	0	0.0%	1	3.4%	
Disagree	6	21.4%	0	0.0%	
Neutral	8	28.6%	2	6.9%	
Agree	11	39.3%	18	62.1%	
Strongly agree	3	10.7%	8	27.6%	
VI. I am able to guide a patient through basic food preparation techniques.					0.283
Strongly Disagree	0	0.0%	0	0.0%	
Disagree	2	7.1%	4	13.8%	
Neutral	4	14.3%	1	3.4%	
Agree	18	64.3%	15	51.7%	
Strongly agree	4	14.3%	9	31.0%	
VII. I feel comfortable working inter-professionally with other members of the healthcare team around issues of food and nutrition.					0.041
Strongly Disagree	0	0.0%	0	0.0%	
Disagree	1	3.6%	0	0.0%	
Neutral	7	25.0%	1	3.4%	
Agree	12	42.9%	15	51.7%	
Strongly agree	8	28.6%	13	44.8%	

Notes. *p*-values are from nonparametric Wilcoxon rank sum tests.

Discussion

In effort to meet a clear need within medical education, the University of Minnesota Medical School Duluth Campus introduced a pilot curriculum to increase medical student education concerning the multidimensionality of food, food systems, and nutrition content, as well as the application of this content to patient care. Although this is a small pilot study, the results suggest an improvement in medical students' confidence to apply nutrition and food system concepts in patient care settings, with minimal additional curricular effort.

With a crescendoing call for expanded nutrition education for students, residents, and physicians,[1-6, 21] this study suggests that a pilot curriculum such as that implemented may begin to fill some of the recognized gaps within medical training. Our regional campus plans to continue to deliver and optimize this curriculum, as well as work on a newly developing bi-campus curriculum which will be incorporated into both the Duluth and Twin Cities campuses of the University of Minnesota. Lessons learned within our regional campus can serve as a template for our state's expanded bi-campus curriculum. Outcome data will continue to be followed with cohorts of students moving forward.

While not statistically significant, the fact that that cohort group rated themselves lower on personal health and nutrition is notable. The question that arises is whether the control group truly came in with a higher level of personal health and nutrition, or whether the differences seen could be representative of the cohort group's expanded understanding of health and nutrition as a result of the curricular changes, which ultimately changed expectations and left them feeling less personally healthy and knowledgeable as a result. This finding introduces an interesting area for future exploration.

Limitations of this study should be noted. Due to a small cohort, there was limited power to detect statistical differences between student groups. In addition, because these differences are self-reported, they may not represent measurement of knowledge or ability surrounding these topics. Demographics were not reported and therefore there may be differences between the two cohorts that could account for findings unrelated to the course. Also, given the discussed exclusions from the control group, there is an inability to determine whether inclusion of these students' responses would have altered the statistical outcome.

With limitations recognized, this pilot curriculum may have applications to other medical schools that are also wishing to bridge this critical gap in medical education. Curricular sessions such as those implemented at our regional campus may serve as an example template for innovations in medical education ultimately aiming to produce physicians with both nutritional competency and a larger understanding of food systems and structural determinants of health. Equipping our region's future physicians with skills to effectively apply food and nutrition practices to offer disease-modifying interventions in clinical care is the ultimate patient-centered goal.

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