INSTRUCTIONAL DESIGN AND ASSESSMENT

Elective Course in Nutrition Taught by a Pharmacy Student

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Submitted January 7, 2007; accepted March 25, 2007; published August 15, 2007.

Objectives. Create, implement, and evaluate an elective nutrition course to increase students' awareness and knowledge of nutrition in pharmacy practice.

Design. A doctor of pharmacy student, who was also a registered dietitian, designed and taught a 2-credit-hour elective nutrition course with the assistance and oversight of 2 faculty members.

Assessment. Students who completed the final course evaluation (45% of the total) felt that the course would be useful to them in their pharmacy practice and highly recommended that other PharmD students take the course. Mean scores on the first and second knowledge-based examinations were 83% and 84%, respectively.

Conclusions. This project reflects an innovative approach to developing and delivering a course in an important area of the pharmacy curriculum and provided a pharmacy student the opportunity to explore an academic career in pharmacy.

Keywords: nutrition, curriculum, student teaching, peer teaching

INTRODUCTION

Pharmacists are in a unique position to educate the public on nutrition. While most community pharmacists are accessible by the public and could provide nutrition education, the literature on pharmacy nutrition mostly describes the role of the pharmacist as part of a nutrition support team in acute care institutions. Nutrition support pharmacists are an essential component of the health care team and have been specializing in this area for more than 30 years.¹ While board certification in nutrition support and nutrition support residencies are available to pharmacists wanting to specialize, it is important for all practicing pharmacists to have a basic understanding of nutrition. The Accreditation Standards of the Accreditation Council for Pharmacy Education include in the Professional Competencies and Outcome Expectations for Doctor of Pharmacy Programs that students should "understand relevant diet, nutrition, and non-drug therapies."² Additionally, Standard 11, Areas and Content of Curricular Core, specifies that nutrition should be included in pharmacy practice curricula. It is unknown what percentages of pharmacy schools in the United States currently include nutrition as a content area in the curricular core and to what extent. A 1995 survey of nutrition education of schools and colleges

of pharmacy indicated that 72% of responding schools included a basic biochemistry course with some nutrition instruction, but only 19% required a nutrition course as part of the core curriculum. Forty-six percent of pharmacy schools responding offered an elective nutrition course.³

It is pertinent for pharmacists to be competent in nutrition and nutrition support. Over 24 million Americans have heart disease, nearly 10% have diabetes, and two-thirds are overweight or obese.⁴ These and many other diet-related chronic disease states provide opportunities to educate patients on nutrition and medications simultaneously. In the institutional setting, many pharmacists are responsible for management of parenteral nutrition, even if they are not formally part of a nutrition support team. Inpatient and outpatient pharmacies stock enteral nutrition solutions and pharmacists may manage enteral nutrition therapy. Since administration of most medications for patients with enteral nutrition is through a feeding tube, pharmacists should be aware of and make recommendations to avoid interactions between patients' medications and their enteral solutions. Finally, in community pharmacies, many patients ask pharmacists about various recommendations for weight loss, diabetes, and cardiovascular health, as well as nonprescription nutritional products. Weight loss and good nutrition lead to decreased blood pressure, better glucose control, decreased low-density lipoprotein (LDL) levels, and ultimately, lower medication doses.⁵⁻⁸

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To determine whether there was sufficient need and desire for an elective course in basic nutrition for pharmacists, the University of Washington School of Pharmacy (UWSOP) PharmD curricula were reviewed for nutrition content and students' opinions were assessed. Students currently receive 5 hours of didactic instruction on nutrition-related topics during their third-professional year: weight management (1 hour), obesity (2 hours), nutrient deficiencies with bariatric surgery (1 hour), and drugs for weight loss (1 hour) in addition to medicinal biochemistry (6 credits over 2 quarters). The UWSOP offers 1 advanced nutrition course elective to third- and fourth-professional year students: *Fluid, Electrolytes, and Parenteral Nutrition*. There are several nutrition electives available to pharmacy students taught by the University of Washington Nutritional Sciences Department; however, anecdotal data from pharmacy students did not show that these courses were easily applied to pharmacy practice since they focused more on nutrition and public health. Also, there were no stand alone courses on basic nutrition in pharmacy practice. To better assess students' opinion on this topic, a survey asking first- and second-professional year pharmacy students "Would you be interested in taking a nutrition course geared towards clinical information that a pharmacist needs to know in the clinical and outpatient settings?" was administered via e-mail. Students logged on to a University of Washington web site to respond. Of the 41 respondents (response rate of approximately 23%), 29 said that they would definitely be interested in taking a nutrition course, 11 said they would probably be interested, and 1 was not interested. Based on this information and the curriculum review, it was determined that there was sufficient need and interest to offer the proposed course.

To address a perceived need for additional nutrition curricula at the UWSOP, a PharmD student who had previously worked as a registered dietitian before entering pharmacy school designed a nutrition course elective for pharmacy students with the assistance of 2 faculty members: one with expertise in curriculum design and the other, a certified diabetes educator with nutritional expertise. This experience gave the student instructor an opportunity to explore the world of academic teaching. The purpose of this paper is to provide an overview of the course planning, design, implementation, and evaluation. The authors hope to encourage other schools of pharmacy to provide teaching opportunities for student pharmacists when possible.

DESIGN

After the aforementioned needs assessment was completed, course goals and objectives and a course descrip-

tion and schedule were created. It was determined that a 1-quarter, 2-credit, lecture-based, credit/no credit design would be practical for this course. Since the student had practiced as a registered dietitian for 4 years in the areas of internal medicine, critical care, pediatrics, and neonatal intensive care and worked as a preceptor for dietetic intern students prior to entering pharmacy school, it was determined that she had sufficient expertise to serve as the primary instructor for the course but would be supported and mentored by the faculty members.

In order to establish the course as a viable elective, the Department of Pharmacy faculty at the University of Washington was presented with the *Nutrition in Pharmacy Practice* elective course proposal. The faculty unanimously supported its development and implementation. The next step was to present the course to the School's curriculum committee for approval. Initially, the committee deferred approval of the course proposal since University policy stated that currently enrolled undergraduate and professional students could not participate in teaching or grading other students. Upon inquiry, the Vice Provost and Attorney General for the University carefully considered and approved the proposal, based on the contingency that the 2 faculty members serve as course masters for the course and be responsible for grading. The UWSOP Curriculum Committee then approved the proposal in the winter quarter of 2004, to be offered the following fall quarter as a pilot elective course.

Lectures, practice worksheets, examinations, and examination review sheets were prepared by the primary instructor over the spring and summer quarters and were designed with references to the current literature. Potential textbooks for the course were reviewed but none were found to cover the entire content of the course. In the end, one was selected as a recommended text for the course. The primary instructor also designed a course web site that included the course syllabus, weekly lecture notes, worksheets, and examination review material, all in PDF format, and students were responsible for printing course materials prior to each class session. The web site was password protected to safeguard copyright of the materials and all materials were reviewed for accuracy and appropriateness by the course masters.

The primary instructor registered for independent study credit with the number of credits commensurate to the effort expended in designing and implementing the course. She also asked one of her classmates with a bachelor's degree in nutrition to serve as a teaching assistant and lecturer. This student also registered for independent study credit. Her responsibilities included delivering 1 lecture and assisting with course administration details.

The following course description and goals were created: "This seminar is designed to give pharmacy students a thorough understanding of clinical nutrition. Students will learn how to calculate nutritional needs for all ages and disease states, provide basic diet counseling specific to disease state, and explain fad diets to patients. Students will also calculate enteral and parenteral nutrition needs, and be able to choose an appropriate nutrition formula for a patient." Course content and design were based on course outcomes for a basic nutrition course for future pharmacists titled *Seminar Series in Nutrition in Pharmacy Practice* (Table 1).

Based on available resources, maximum enrollment for the new nutrition elective was set at 30 students. Registration was limited to second- and third-professional year pharmacy students because the only course prerequisite was biochemistry, which is included in the first-professional year PharmD curriculum at the UWSOP. When registration for the class was complete, 30 students were enrolled and 45 additional students were placed on a waiting list. Two faculty members, the primary student instructor, and the student teaching assistant developed and implemented the course. The 2 faculty members assisted and supported the primary student instructor by reviewing all lectures, worksheets, and examinations, as well as attending all lectures. Each week, the faculty members met with the primary instructor and teaching assistant to discuss that week's lessons plans and any other course issues.

The primary instructor's intent for the course was to develop a class that could possibly evolve into a required course in the core curriculum and which would provide

Table 1. Course Outcomes for *Nutrition in Pharmacy Practice Seminar Series*

After completion of the Nutrition in Pharmacy Practice Seminar Series, the student is expected to be able to:
• List basics functions of carbohydrates, protein, and lipids
• State how carbohydrates, proteins, and fat are digested and absorbed
• Calculate nutritional requirements for healthy patients, including calories, protein, carbohydrate, and fat
• List disease states requiring adjusted nutritional needs and calculate appropriate adjustments
• Discuss when nutrition support is appropriate for use
• Differentiate between tube feeding and total parenteral nutrition and appropriate situations when is each used
• Calculate fluid, calories, and protein needs for enteral feeding and choose an appropriate formula
• Calculate fluid, calories, protein, and lipid needs for total parenteral nutrition
• Write a total parenteral nutrition order for macronutrients

minimum competency in nutrition so that in the event that students could not take other nutrition electives, they would meet the minimum requirements set by ACPE accreditation standards.

The main logistical problem with this course was finding a class time in the student schedule during the fall quarter so that both second- and third-professional year students could register for the course. A twice-weekly, 1-hour block was identified during the fall quarter.

The course was primarily taught in a lecture format using an overhead projector to increase discussion and interaction with the students. The lecture material was presented with many visual aides (eg, feeding pumps, feeding tubes, formulas) and students were allowed to ask questions throughout the lectures.

The nutrition elective was designed to cover basic nutrition principles important for an entry-level pharmacist as determined by the literature, and by the primary student instructor and faculty members. The first half of the course covered nutrition assessment and diet; the second half covered nutrition support and pediatrics. The course outline is shown in Table 2. Readings from the recommended textbook were not required but were provided to supplement the lecture material. Many students indicated on the final course evaluation that they did not use the textbook.

Practice worksheets and examination review sheets were given to students to enhance their learning. These review sheets were designed to help students prepare for

Table 2. Course Outline

Material Covered in Examination 1

- Lecture 1 – Introduction, calculating calorie needs
- Lecture 2 – Carbohydrates and fiber
- Lecture 3 – Protein and lipids
- Lecture 4 – Nutrition screening and assessment
- Lecture 5 – Modified diets for hypertension, congestive heart failure, and coronary heart disease
- Lecture 6 – Modified diets for renal and hepatic dysfunction
- Lecture 7 – Diabetes background and diet
- Lecture 8 – Weight management
- Lecture 9 – Popular diets, reading a food label

Material Covered in Examination 2

- Lecture 10 – Nutrition support introduction
 - Lecture 11 – Enteral nutrition background
 - Lecture 12 – Enteral nutrition calculations
 - Lecture 13 – Total parenteral nutrition
 - Lecture 14 – Total parenteral nutrition continued
 - Lecture 15 – Total parenteral nutrition calculations
 - Lecture 16 – Pediatric nutrition
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each examination by providing questions on each topic. The worksheets included calculations and allowed students to practice using and applying equations. Although these assignments were not graded, students were encouraged to complete them to adequately prepare for the examinations. Three of the worksheets were discussed and completed in class to allow students the opportunity to ask questions. A total of 5 worksheets and 2 review sheets were provided over the quarter. See Table 3 for a worksheet sample.

At the beginning of each lecture, the previous lecture was reviewed briefly and any confusing areas were clarified. At the end of most lectures, students were asked to complete "one-minute papers," in which they anonymously responded to questions regarding that day's lecture. Generally, students were asked to note areas that needed clarification as well as to comment on interesting or well-taught topics. The primary instructor used feedback provided in the one-minute papers to continually improve clarity of information as well as adjust lectures to meet the needs and desires of the students.

Students were given 2 noncumulative examinations to evaluate learning and there was no final examination. The examinations included a combination of essay, short answer, and multiple-choice questions and were worth 100 points each. Class credit was given for students obtaining a final grade of 75% or above.

The success of the course was determined using course evaluations from students, the one-minute papers, and student performance on examinations. Additionally, the student instructors were videotaped to help them accurately self-assess their teaching styles. Both student

instructors were given weekly feedback from the course-masters.

ASSESSMENT

The mean score on the first and second examinations were 83% and 84%, respectively. Students in the course completed brief evaluations at the end of the quarter. The evaluation (Appendix) asked about the quality of the course, worksheets, amount of material, and applicability to career. It also gave students the opportunity to provide suggestions for improvement in the course content, organization, and teaching by the instructors. The evaluation was designed by the primary student instructor and used to help identify future improvements to the course if it was to be offered again. Almost 45 percent (13/30) of the class completed the final course evaluation. See Appendix 1 for example responses to the evaluation.

In general, students found the course to be interesting and applicable to their future careers in pharmacy. While the students liked the teaching styles of the instructors, they felt that the amount of material was too much for 2 credits and suggested either reducing the content or expanding the class to 3 or 4 credits. Most students responded that the lecture material was very good but felt rushed during the class sessions due to time constraints and too much material. Students asked to have more time for questions and discussion. Additionally, students unanimously liked both the worksheets and the review sheets and felt that they helped to apply the material. Students stated that the examinations covered too much lecture material. All students felt that the course should be offered again in the future to pharmacy students.

Table 3. Enteral Nutrition Calculations Sample Worksheet

63 y/o WM is on a ventilator in the ICU following a massive CVA. He is 5'8" and weighs 90 kg. He has been NPO since admission 6 days ago due to ventilation. He has a history of Type II Diabetes and CHD. Current labs indicate adequate renal and liver function, Glu 280, Alb 2.5 Accuchecks: 254, 280, 319, 275. Today's physical exam notes and discussion with the nurse indicate that the patient has a soft and non-tender abdomen with + bowel sounds in all four quadrants.

- A. Determine IBW, % IBW, and adjusted weight (if greater than 125% IBW)
- B. Calculate calories needs using a quick estimate
- C. Calculate fluid needs: 1 ml per kcal or 30-35 ml/kg or 1500 ml/m²
- D. Calculate protein needs using a quick estimate
- E. Address whether nutrition support is appropriate and what form of nutrition support is best and why
- F. Choose an enteral formula for the patient
- G. Calculate amount of formula needed to meet calorie needs
- H. Determine if the volume of formula will meet protein needs
- I. Calculate amount of formula needed to meet calorie needs
- J. Determine if the volume of formula will meet protein needs
- K. Determine TF administration and rate
- L. Determine additional fluid needs
- M. Give the final plan (include initiation rate and advancement of feedings)

Each of the student instructors was videotaped once during the early part of the quarter. Afterward, the tapes were reviewed with the student instructor and faculty members. The student instructors reflected on the lectures and made notations about strengths and weaknesses in the lecture.

The primary student instructor taught 17 of the 21 class sessions, the teaching assistant taught 2 sessions, and 2 sessions were used as examination periods. The primary student instructor spent approximately 15-20 hours preparing for each lecture. This takes into account time for research, reading, writing, editing, posting the material on the web site, and practicing the lecture. Additionally, the primary instructor spent time creating worksheets, review sheets, and examinations as well as grading examinations (students' names were blinded), and meeting with students and course masters. In all, the primary instructor spent approximately 400 hours preparing for and implementing the course. The primary instructor received 6 independent study course credits for her work. The teaching assistant gave 1 lecture and 1 review session. Additionally, she reviewed all lecture material for the primary instructor and graded 1 of the examinations (students' identities were blinded). In total she spent approximately 50 hours on this course and received 2 independent study course credits for her work. At least 1 of the 2 coordinating faculty members attended each lecture. Both reviewed all lectures, worksheets, review sheets, examinations, and kept the grade book. In total, the senior faculty members spent a total of 2-5 hours per week on the course.

The budget for the course was limited. The student instructors did not receive monetary compensation and the senior faculty members did not receive additional compensation for the course. The course budget included money for transparencies, copying, and handouts. The total direct cost of the course was \$310.

DISCUSSION

To date, there has been minimal research on providing nutrition education in pharmacy curricula. Jarvis et al reported the development and implementation of a service-learning nutrition pharmacy course.⁹ First-year pharmacy students taught inner-city elementary school children about healthy nutrition and exercise. Dickerson et al described the nutrition curricula of the doctor of pharmacy program at the University of Tennessee (UT), known for its education in nutrition support. Students at UT receive 6 hours of required nutrition support instruction in their second-professional year and 34 hours of nutrition support instruction during their third-professional year in pharmacotherapeutics. Additionally, students have the opportunity to take a nutrition elective

worth 2 credits during their second-professional year and a subspecialty nutrition support course in their third-professional year. Finally, students have the opportunity to complete a nutrition support clerkship rotation during their fourth-professional year. No articles were found that described standalone nutrition courses as part of pharmacy school core curricula.

The benefits of offering this course greatly outweighed the challenges. First, it is difficult to obtain course approval with students as instructors. Curriculum committees across the nation may differ in their policies regarding student teaching. To avoid problems with bias and conflict of interest, it is important to establish guidelines for what student instructors will and will not be allowed to do. Second, the amount of time needed to establish a new course can be overwhelming. While it would be of great benefit to include more instructors to share the workload, at least 1 person needs to be designated to organize the lectures, and each student instructor needs to have content expertise or the guidance of a senior faculty member. Finally, it is important to have enough class time to cover the fundamentals of nutrition. It was our experience that almost 2 hours per week for 11 weeks was not enough. Most students requested that class time be expanded, rather than reduce content.

Currently, there is a national pharmacist shortage that is predicted to increase as the baby-boomer population ages and begins taking more chronic medications. An increasing shortage of pharmacists will result in fewer pharmacy faculty members across the nation over the next decade.¹⁰ Giving student pharmacists the opportunity to teach other students sparks interest in students who might not have otherwise considered pursuing an academic career. In this case, the primary instructor plans to pursue an academic career in the future. Additionally, students who may have minimal teaching experience may work harder to improve their teaching methods to engage their fellow classmates.

The course faculty members, instructors, and students recognized the value of the elective pilot course. Although it could not be offered again due to the graduation of the primary instructor, the UWSOP is currently undergoing extensive curricular review and hopefully will include a required nutrition course in the future. Also, the University's nutrition department developed an interdisciplinary nutrition course which pharmacy students may take as an elective.

The UWSOP is currently undergoing curricular review. The instructors and faculty members who were involved with this course are recommending that the school include more nutrition curricula in required PharmD courses. A basic understanding of nutrition is vitally important for all current and future pharmacists.

SUMMARY

A 2-credit hour nutrition elective, taught by students and guided by faculty members, was successfully designed and implemented at the University of Washington School of Pharmacy. The elective filled an important gap in the curriculum, as confirmed in evaluations from students who completed the course. Additionally, the primary instructor and teaching assistant, while both students themselves, gained valuable experience in course development and teaching. It is hoped that this experience will encourage other schools of pharmacy to give student pharmacists the opportunity to teach when possible.

ACKNOWLEDGEMENTS

The authors wish to acknowledge Mary McKay, PharmD; Nanci Murphy, PharmD; Milo Gibaldi, PhD (posthumously); and Ling-tak Neander Chan, PharmD, for their support throughout the development and implementation of this course.

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Appendix 1. Nutrition in Pharmacy Practice Course Evaluation Questions and Answers

Nutrition in Pharmacy Practice Course Evaluation		
Directions: Please read each question and provide your comments, constructive criticism, and suggestions for change.		
Question	Most Common Responses	Example Comments
1. What feature(s) of the course contributed most to your learning (e.g. worksheets, reviewing prior material at beginning of each class, etc)?	Worksheets, 85% Lecture Notes, 46%	“Worksheets were very helpful to learn the calculation aspects.” “Handouts and worksheets were very useful.”
2. What feature(s) of the course detracted from your learning?	Too much information, 62%	“Limited class time, always seemed rushed.”
3. Was the class too easy or too hard? Why?	Just right, 62% Too hard, 31%	“I feel that this was one of the more challenging elective courses that I have taken, but it was worth all the time I spent studying for it.”
4. Did the worksheets and review sheets help you understand the material better?	Yes, 100%	“The worksheets helped me to see how much of the material I actually knew. In addition the review sheets helped me know what to focus on for the exam.”
5. Was the pace of the class too slow or too fast? Why?	Too fast, 77% Just right, 23%	“It was a little fast but the notes were so well done that it was easy to review the material outside of class.”
6. Was the amount of material covered in the class reasonable for the amount of credit? If not, why?	No, too much material, 69% Yes, it was reasonable, 31%	“I felt we covered an enormous load for a 2 credit class because I spent an average of 6 hours outside of class a week studying.”
7. Will the information covered in this course be useful to you in your pharmacy practice?	Yes, 100%	“Nutrition is something that interests a lot of people. I already get a lot of questions just in the retail setting regarding nutrition issues. In addition, I felt like I learned a lot to help me in the hospital setting too.” “At first, I didn’t think so since I work retail. But in the last three weeks I have received several medication orders for patients with gastric tubes and have used the material covered in class to aid in clinical decisions.”
8. Do you think the class should be offered to pharmacy students in the future? If so, why?	Yes, 100%	“All pharmacy students, whether hospital or retail, can benefit from this information.” “This information is integral to so many practice settings, and is something we do not receive enough of (definitely not to this level!) in the standard lectures.”
9. Were the course objectives met?	Yes, 100%	No responses
10. Did you like having the lecture material provided or would you prefer to take more notes?	Yes, 85%	“Like having it provided, but need a little more space to take notes in between sections.” “I liked having lecture material provided then all I had to do was make extra notes of additional info.”
11. Please describe what you liked most about the course.	The subject material, 77%	“Good, practical information that will have a direct impact on my ability to provide patients care in the future.”
12. Please describe what you liked least about the course.	Not enough time, 54%	“Time limit – I think this class should have 3 hours per week but not cover any more material except pediatrics. This would allow for more student questions.”