Cooperative Learning in the Disease Management Decision-Making Process: Use of Group Projects in an Outcomes Assessment Course

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ABSTRACT. Pharmacy graduates need knowledge and skills beyond pharmaceutics, pharmacology, and pharmacotherapeutics to participate in the management of medication therapies for populations of patients in diverse settings in the managed health care environment. The Outcomes Assessment in Pharmacy course was designed to introduce students to the methods and tools used within managed care to document, evaluate, and improve upon the medication use process in achieving defined therapeutic outcomes. Students completed group projects where they were provided a real-life decision-making situation involving several therapeutic interventions (including both drug and nondrug therapies) for a specific condition or disease. Students were required to use decision analysis techniques and analyses in arriving at their conclusions. This use of group projects in the described course appeared to have assisted students in accomplishing the assigned course objectives.

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From 1993-1998, Mr. MacKinnon was the Coordinator of the Outcomes Assessment in Pharmacy course and Assistant Dean for Post-Graduate Education at the Chicago College of Pharmacy, Midwestern University, Downers Grove, IL. This course is no longer offered at the Chicago College of Pharmacy. However, a similar course, Outcomes Assessment and Health Economics, will be taught in the all-Pharm.D. curriculum at the College of Pharmacy-Glendale beginning in 2000.

KEYWORDS. Outcomes assessment, disease management, cooperative learning, decision analysis, group project

INTRODUCTION

Since the mid-1980's, interest in the economic value and total costs associated with medication therapies has increased in the United States due to escalating health care costs, competitive technology and products, influence of managed health care organizations (MCOs) and integrated health care delivery systems, growing expectations of third-party reimbursement plans, increased reimbursement of prescriptions by third parties, increased availability of medical and prescription data, and quality of life issues. Future pharmacy graduates need knowledge, skills, and experience in decision-making principles to participate in the management of medication therapies for populations of patients in the managed health care environment. Future pharmacists must be able not only to manage individual patients in one setting but also to oversee the care delivered to a specified population of patients in diverse settings.

In the business world, the techniques of decision analysis have been used for some time (1). In simplistic terms, decision analysis allows for systematic analysis of various options and their associated outcomes, given certain variables leading to the generation of results that can be quantified. This quantification may result in economic information or criterion ratings. Traditionally, efficacy and safety have been the primary indicators for assessing medication therapy. As increased pressure to quantify and justify the value of pharmaceutical products and services continues, future pharmacists must understand the various pharmacoeconomic principles and methods used to describe the outcomes (both health related and economic) associated with the provision of health care services and products.

COURSE OVERVIEW

Outcomes Assessment in Pharmacy was a required three-quarter credit course taught to baccalaureate and doctor of pharmacy students in their third professional year at the Chicago College of Pharmacy,

Midwestern University. This pharmacy program was established in 1991. The course was designed to introduce students to the methods and tools often used by managed care to document, evaluate, and improve upon the medication use process in achieving defined therapeutic outcomes. The course built upon previous course work covered in the basic and clinical sciences. Approximately 100 students per year were enrolled in the course.

The course addressed the following areas, as they related to the U.S. health care environment: formulary management, drug use evaluation, adverse drug events and medication misadventuring, pharmaceutical care, disease management, critical pathways, pharmacoeconomics, methods of reimbursement, and health care reform. Guest lecturers and panel discussions included individuals from the pharmaceutical industry, pharmacy benefit management companies, health insurers, health care institutions, software manufacturers, and health care providers. Guest lecturers brought a real-life feel to the course.

One of the course goals required students to use problem-solving skills in disease management. Assignments incorporating decision trees and decision tables were used to facilitate the learning process. Course requirements included completion of a pre- and post-course assessment, one written assignment on a health care topic taken from a primary literature source and describing its impact on the pharmacy profession, two in-class assignments, two examinations, and an elective course project.

DESCRIPTION OF THE COURSE PROJECT

Course projects were completed by groups of students, providing students with real-life decision-making situations where they were to choose from among several therapeutic interventions (including both drug and nondrug therapies) for treatment of a specific condition or disease. The course coordinator preselected project topics, although some student groups may have suggested a topic for consideration. For example, a group may have been assigned benign prostatic hyperplasia and its various treatment options, including alpha-blockers, androgen hormone inhibitors, natural products, and surgical intervention.

Students were required to use the techniques of decision analysis and pharmacoeconomics when assessing various therapeutic options.

All projects required a discussion of the epidemiological, financial, and clinical data pertinent to the analysis. The conclusion was to be based upon drug monographs, medication costs, review of the disease, decision tree and table, cost-effectiveness ratios, and sensitivity analyses. The executive summary was to provide a critical review of the disease state or condition and the medications (or therapies) used in its treatment.

The course project requirements were slightly modified over the four-year period in which the course was taught. In 1994 and 1995, students completed projects in preassigned groups, whereas in 1996 and 1997, students were allowed to self-select their groups. The change in the process of group selection resulted from student input. Approximately 18-20 projects were graded annually, and groups were given about 6 weeks to complete the projects. From 1994-1996, each project, on average, consisted of 20 typewritten pages and required 4-5 hours to evaluate. All projects were reviewed and graded solely by the course coordinator. Specific projects assigned for 1997 can be seen in the Appendix.

In 1997 a poster session was instituted. In this year, complete projects consisted of a four-to five-page typewritten executive summary of the project (in lieu of the 20-page report) and the final poster display. During this year, 18 posters were presented in conjunction with the annual career fair in late October. Students were encouraged to use the software Powerpoint™ to produce their posters, as it was available in the university library. The poster session allowed students the opportunity to display their work and to interact with colleagues and potential employers in a scholastic manner. Specific requirements for the posters are provided in Table 1.

DECISION ANALYSIS TECHNIQUES EMPLOYED

Decision Tables

Decision tables require the identification of several alternatives for a stated problem/situation. Each alternative in the decision table is then evaluated against various criteria that have been identified as being important to various stakeholders. The foundation of this approach is the multiattribute utility (MAU) model (2). Each criterion

TABLE 1. Required Components in the Poster Displays.

1.	Title of the project with authors' names
2.	Abstract describing the project and its conclusions
3.	Panels describing: a. Study objectives b. Background of the disease/condition c. Methodology (including assumptions used) d. Results
4.	A decision tree with assigned probabilities depicting a treatment "strategy" and the costs associated with the various paths/options. Assumptions used in the construction of the decision tree and expected value calculations were included as well.
5.	A decision table depicting the criterion, values, assigned weights, and criterion rating and sum of criteria ratings
6.	Calculated cost-effectiveness ratios and expected values (costs) and a sensitivity analysis (pharmacoeconomics)
7.	Limitations of the analysis
8.	Conclusions

receives an assigned weight that is consistent with all similar criteria of the different alternatives. The total sum of the assigned weights among the criteria must equal 1.0. The assigned weights essentially prioritize the various criteria to be evaluated in a numerical manner. A criterion that has a greater utility would have a larger numerical value.

Additionally, each individual criterion specific to each alternative is given a value rating. This value rating is specific to the alternative and cannot exceed 100 for each criterion being assessed. An alternative that was exceptional may have several scores of 100 for individual criteria. A final criterion rating is then determined for each criterion by multiplying the assigned weight by the value rating. Each criterion is then added together to determine the overall criteria rating.

For example, a comparison is made between products X and Z for a given disease or condition. Product X is dosed once daily but costs significantly more than product Z, which is dosed three times daily. Both agents are equally efficacious, but product Z has some limiting side effects that can become problematic in patients receiving it. The four criteria evaluated for these products are: Criterion 1 (safety),

Criterion 2 (efficacy), Criterion 3 (dosing convenience), and Criterion 4 (product acquisition cost). Table 2 provides an example decision table based on the previously listed conditions. Overall product X scores higher with a criterion rating of 76 than Product Z with a criterion rating of 66. Given the assigned values and weights, X is the preferred agent.

Decision Trees

Decision trees provide a graphic representation of each course of therapy from beginning to end, depicting the multiple events and sequelae that can result from one or more courses of action. Decision trees represented graphically usually contain choice and chance nodes. Choice nodes typically depict a point at which a decision needs to be made for the user to progress forward in trying to achieve a desired outcome. Chance nodes have a likely probability of taking place and may or may not be favorable (e.g., adverse medication events). Each event in the decision tree can be assigned a probability of occurrence. The sum of the probability values associated with each branch of the tree must equal 1.0 or 100%.

The primary literature usually serves as a source for the probabilities, but they can also be derived from consensus panels. Databases offer more promising sources for the future, allowing the use of accu-

TABLE 2. Example Decision Table.

	VALUE		ASSIGNED WEIGHT		CRITERION RATING	
Drugs	**X**	**Z**	**X**	**Z**	**X**	**Z**
Criterion 1 (safety)	80	60	.40	.40	32	24
Criterion 2 (efficacy)	80	80	.30	.30	24	24
Criterion 3 (dosing convenience)	80	40	.20	.20	16	8
Criterion 4 (product acquisition cost)	40	100	.10	.10	4	10
Totals	**n/a**	**n/a**	**1.00**	**1.00**	**76**	**66**

mulated clinical data or records and outcomes from actual practice to determine predictable scenarios for similar clinical situations. Once probabilities are assigned to all likely discrete events, the sum probabilities of outcomes must be calculated.

Some disease states, such as infectious processes, lend themselves to defined clinical end points, such as clinical resolution or microbiological cure. Yet some diseases, such as hypertension, typically use surrogate end points. In the treatment of hypertension, the desired outcome may be a reduction in the incidence of myocardial infarction; however, the surrogate end point assessed is normalized blood pressure in the patient. Utilization of decision trees usually requires several steps, as seen in Table 3.

An example best illustrates this process. As seen in Figure 1, if two drug regimens are compared and Regimen 1 has the following probabilities:

- Treatment success of 60% with no adverse effects 80% and adverse effects 20% resulting in dosing adjustments 50% and switching drugs 50%
- Treatment failure of 40% resulting in switching drugs 50% and adding an additional agent 50%

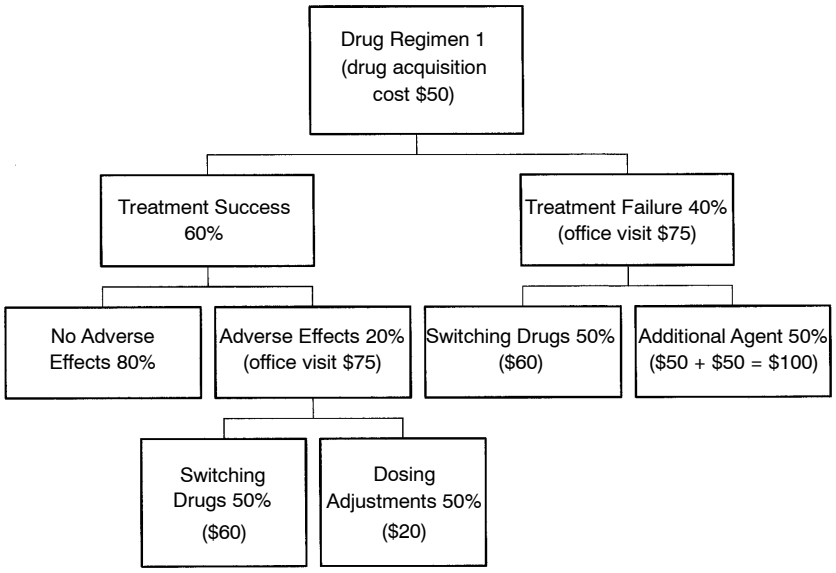
then the overall probability of an outcome can be determined.

In Regimen 1 the following probabilities can be determined for successful outcomes:

TABLE 3. Steps Involved in Decision Tree Analysis.

1.	State the problem
2.	Identify alternatives to attain desired outcomes
3.	Structure the decision problem as a logical sequence of events (include choice nodes)
4.	Characterize known and uncertain events, then establish probabilities of events occurring (include chance nodes)
5.	Place values on the resource consumed and calculate expected costs
6.	Make a selection based on the results
7.	Conduct a sensitivity analysis (alter various probabilities and/or assumptions to see if the calculated results change)

FIGURE 1. Decision Tree with Associated Outcomes and Costs.



- Without adverse effects occurs 48% of the time (0.6 0.8 = 0.48)
- With adverse effects that result in switching to another agent occurs 6% of the time (0.6 0.2 0.5 = 0.06)
- A successful outcome with adverse effects that results in adjusting the current agent occurs 6% of the time (0.6 0.2 0.5 = 0.06).

Probabilities associated with treatment failures can also be calculated, each being 20%, respectively:

- Failures resulting in switching therapy (0.40 0.50 = 0.20)
- Failures resulting in additional agents being added (0.40 0.50 = 0.20).

Expected values can then be calculated based on the costs associated with each event in the decision tree. If a successful outcome without adverse effects occurs 48% of the time in Regimen 1 and the sole costs at this point are related to drug acquisition cost of the agent in this regimen (i.e., $50), then the expected value associated with this outcome is $24 (0.6 0.8 $50 = $24). Likewise, the expected

value for a successful outcome with adverse effects that results in switching to another agent would be $11.10 based on the following costs: drug acquisition cost of $50, $75 for the second physician office visit due to the adverse event, and $60 for the new agent prescribed [0.6 0.2 0.5 ($50 + $75 + $60) = $11.10]. In the final scenario for successful outcomes of Regimen 1, the expected value for a successful outcome with adverse effects that result in adjusting the dose of the current agent would be $8.70 based on the following costs: drug acquisition cost of $50, $75 for the second physician office visit due to the adverse event, and $20 for costs associated with a dosing adjustment [0.6 0.2 0.5 ($50 + $75 + $20) = $8.70]. Treatment failure costs would be $37.00 [0.4 0.5 ($50 + $75 + $60) = $37.00] and $45.00 [0.4 0.5 ($50 + $75 + $100) = $45.00], respectively.

Once all expected values are calculated for each possible path in the decision tree, an overall sum of costs associated with the decision tree can be attained. Thus the overall expected value for successful outcomes in Regimen 1 is $43.80 based on ($24.10 + $11.10 + $8.70), and overall treatment failure costs would be $82.00 ($37.00 + $45.00). Therefore, the average cost a patient could incur in this model is the sum of $43.80 and $82.00, equaling $125.80, not simply the drug acquisition cost of $50.00. This is because when therapy is initiated it is difficult to predict which patients will have successful outcomes as opposed to treatment failures. The same process described above would be repeated for Drug Regimen 2 and the lowest overall expected value between Drug Regimen 1 and Drug Regimen 2 would be selected as providing least overall cost of therapy, including successes and failures.

DISCUSSION

Future pharmacists must have the ability to review and evaluate the health and pharmacoeconomic literature critically. They must also be able to determine whether the economic evaluations used appropriate methodologies and had valid results and conclusions and whether such results are applicable to their practice environment. This course helped expose students to the fact that drug acquisition cost should not be the only factor considered when selecting medication therapies for either

individual patients or populations of patients. The full economic impact of an intervention must be determined and examined.

After students from the college began their experiential rotations, they often commented that Outcomes Assessment prepared them to better understand the complex health care delivery system that they were experiencing. Additionally, these students brought to their respective practice sites knowledge and skills related to decision analysis not typically seen in pharmacy students. At the 1997 poster display, prospective employers, students, faculty, and administrators found the posters to be thought provoking and enlightening. As a result, students were able to showcase their work not only to faculty and peers but also to future employers. Some employers commented on the high level of understanding of the "big picture" exhibited by the students.

In the future, a select number of pharmacists may be asked to apply similar tools employed in this course to evaluate and conduct studies in their own environments. It is hoped that through this course and assigned projects, students were able to understand and apply these important principles in the future. As Andrew Carnegie said, "As I grow older, I pay less attention to what men say. I just watch what they do."

Received: January 16, 1999
Reviewed: April 28, 1999
Revised: May 24, 1999
Accepted: September 29, 1999

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APPENDIX

Group Projects Assigned in Outcomes Assessment in Pharmacy in 1997

Disease or Condition	Interventional Therapies
Migraine	Imitrex (injection), Imitrex (oral), Imitrex (nasal spray), Maxalt (rizatriptan), Excedrin Extra Strength (OTC)
Vaginal Candidiasis	Clotrimazole (intravaginal) 3 day Rx, Diflucan (oral) 1 Rx, Terconazole 0.8% (Terazol 3) 3 day Rx, Butoconazole (Femstat 3) 3 day OTC, Tioconazole 6.5% (Vagistat-1) 1 OTC
Hypertension	Lisinopril, Enalapril, Diovan, Cozaar
Hypercholesterolemia	Zocor, Pravachol, Lescol, Lipitor, Baycol, Cholestin
Alzheimer's Disease	Cognex, Aricept, Ginkgo biloba (natural product)
LV Heart Failure w/no Volume Overload	Digoxin, Vasotec, Corge, Isosorbide dinitrate
Otitis Media (peds)	Bactrim, Ceclor, Augmentin, Biaxin, Amoxicillin
Hypertension	Posicor, Sular, Procardia XL, Norvasc
Benign Prostatic Hyperplasia	Proscar, Flomax, Cardura, Hytrin, TURP (surgery)
Chemotherapy Nausea and Vomiting-from High to Moderate Emetogenicity	Kytril, Zofran, Dexamethasone
Peptic Ulcer Disease (*H. pylori*)	Metronidazole/Amoxicillin/H2 Anatagonist, Helidac, Tritec/Clarithromycin, Omeprazole/Clarithromycin
Allergic Rhinitis	Chlorpheniramine, Claritin, Allegra, Zyrtec
Prevent Thromboembolism in Orthopedic Surgeries	Dalteparin (Fragmin), Enoxaprin (Lovenox), Ardeparin (Normiflo), Heparin
Depression	Amitriptyline, Paxil, Zoloft, Prozac
Smoking Cessation	Nicotrol NS (spray), Nicorette gum-OTC, Zyban, Nicotrol patch-OTC
HIV	Ritonavir (Norvir), Saquinavir (Invirase), Indinavir sulfate (Crixivan), Lamivudine (Epivir), Stavudine (Zerit)
Diabetes (NIDDM, Type II)	Glucophage, Precose, Rezulin, Glucotrol
Uncomplicated UTI	Maxaquin, TMP/SMZ, Macrodantin, Floxin