A Comparison of Pharmacoeconomics Topics in Journals and Entry-Level Pharmacy Degree Curricula

Jean T. Carter and Justin A. Ebel
School of Pharmacy and Allied Health Sciences, The University of Montana, Missoula MT 59812-1075

The purpose of this study was to compare the pharmacoeconomic topics covered in schools of pharmacy with those appearing in professional journals and to determine whether a “gap” still exists. Articles, letters and editorials published in the 1998 volumes of seven selected journals were reviewed and an e-mail survey of schools of pharmacy was conducted. Ten percent (6/60) of the schools did not cover any of the topics. The percent of schools covering cost-effectiveness, cost-benefit, and cost-utility analyses increased from just over 30 percent in 1992 to almost 90 percent in 1998. Thirteen of the 18 topics were taught in over 70 percent (43/60) of the schools; eight of those 13 topics also appeared in over 70 percent (5/7) of the journals for a 62 percent (8/13) overlap. The increased coverage of pharmacoeconomic topics in entry-level doctor of pharmacy programs has substantially reduced the gap between what is taught and what is needed to read and interpret the pharmacoeconomic literature.

INTRODUCTION

Schools of pharmacy strive to produce graduates who are prepared for current and future practice. As health care knowledge and practice change, schools adjust their curricula to reflect current trends and better prepare their students. During the past decade, schools have been busy adjusting their curricula to incorporate new knowledge and issues into student preparation.

Pharmacoeconomics is just one area in which schools have been incorporating topics into their curricula over the past ten years in an effort to prepare graduates for their professional role.

As pharmacoeconomic research grew, educators began to suggest including pharmacoeconomic topics in undergraduate pharmacy programs because reading and interpreting pharmacoeconomic research would require specific training that was not traditionally included in the professional curriculum. The ability to serve as managers and decision-makers would include the ability to interpret and use pharmacoeconomic information. Draugalis and Jones-Grizzle suggested incorporating pharmacoeconomic topics and concepts into existing courses in the curriculum. Kolassa took the recommendation a step further and suggested creating a separate course because of the importance of the subject. These recommendations focused on preparing pharmacists to interpret pharmacoeconomic information rather than actually perform the evaluations. Pharmacists interested in pursuing careers in pharmacoeconomic analysis were guided towards postgraduate training programs.

Apparently educators heeded this advice and began incorporating pharmacoeconomics training into their curricula. In 1996-97, undergraduate pharmacoeconomics training in U.S. schools of pharmacy was offered in 81 percent (64/79) of the schools of pharmacy. What is not known is whether the topics that are being taught in the schools are the same as those that appear in the professional literature.

To discover whether gaps existed between literature topics and educational preparation, studies by Moore et al., Hokansen et al., and Juergens et al. used parallel surveys of curricula and reviews of journals. In the late 1970s, the coverage of statistics topics in PharmD/MS curricula did not appear to meet the statistical education needs of students when compared to a representative sample of professional journals. Hokansen and colleagues reviewed the situation again in mid-1980s, and found that the quality of the statistics training would not prepare graduates to interpret the more sophisticated statistics found in journals. One pharmacoeconomic method, cost-benefit analysis (CBA), was included in the study.

The study by Juergens et al. (1992) found a “substantial gap” between the coverage of selected pharmacoeconomic topics in journals and classrooms. Again, educators were advised to increase curricular emphasis on statistical (quantitative) and pharmacoeconomic topics because students need those skills to make competent decisions.

Now, over 80 percent of the schools include pharmacoeconomic topics in their entry-level curricula. The question is whether this has decreased the “gap” between what is taught and what is needed to read the literature critically. Therefore, the purpose of this study was to compare the concepts and topics covered in schools of pharmacy with those appearing in professional journals to determine whether the gap still exists.

METHODS

Review of Selected Healthcare Journals

Seven pharmacy and medical journals were selected and reviewed to identify the number and frequency with which pharmacoeconomic topics appeared during 1998. The selected journals were American Journal of Health-System Pharmacy (AJHP), Annals of Pharmacotherapy, Journal of the American

Notes

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Pharmaceutical Association, U.S. Pharmacist, Pharmacotherapy, Journal of Managed Care Pharmacy (JMCP), and Journal of the American Medical Association (JAMA). The journals were selected to represent community, institutional, and managed care practices. Hokansen et al. and Juergens et al. used the first five of these selected journals in earlier studies(6,7).

A data collection checklist with 25 specific pharmacoeconomic topics was developed for the journal review. The tables of contents of the selected journals published between January 1 and December 31, 1998 were examined for articles, letters, or editorials that related to pharmacoeconomic topics and outcomes research. Once an article was identified from the table of contents, it was reviewed. When a pharmacoeconomic term was found, it was documented on the data collection sheet. A data collection checklist was completed for each article identified, and the information was added to the journal database. If a topic appeared more than once in an article, it was counted only once. This review counted the frequency with which topics appeared, not the number of articles that contained the one or more topics.

Survey of Pharmacy Curricula

Schools of pharmacy that offered pharmacoeconomics courses were identified by searching for course information on the Internet, reviewing pharmacy articles about such programs, and by contacting representatives from the schools. Once schools with pharmacoeconomics courses or classes within courses were identified, the course instructors were contacted and asked to respond to a brief e-mail 11-item questionnaire. The questionnaire included a modified, 18-item version of the 25-item journal checklist. Respondents were given the option to send a copy of the course syllabus or answer questions about reading assignments, lecture topics, and textbook information.

The survey sought information about the extent to which U.S. schools of pharmacy were teaching topics in pharmacoeconomics and outcomes research to entry-level PharmD students. The questionnaire was e-mailed directly to course chairs at schools where the course instructor could not be readily identified. Two weeks following the first mailing, a second mailing of the survey was sent to those instructors who did not respond to the initial survey; a third mailing was sent about one month later.

Data Analysis

Analysis of the data was primarily descriptive with frequencies and percents calculated in Excel for Windows 97. The t test for independent proportions was hand calculated(8). Alpha was set a priori at 0.05 for the comparison.

RESULTS

Journal Review

A total of 1,865 research articles, editorials, and letters to editors were reviewed in the journal survey. Table 1 shows the number of items reviewed and the number of times pharmacoeconomic topics appeared in 1998. All seven journals contained at least one reference to cost-effectiveness analysis (CEA), cost-benefit analysis (CBA), and direct medical costs. During that same year, none of the journals discussed logistic regression, systems (i.e., equilibrium) approaches to pharmacoeconomic analyses, or intangible costs.

Original research articles accounted for 20 percent (375/1,865) of all materials reviewed. Five percent (17/375) of those research articles were pharmacoeconomics research. The JMCP and JAMA had the most pharmacoeconomics research articles, with each publishing five articles in 1998. These pharmacoeconomics research articles accounted for 26 percent (5/19) and three percent (5/199) of the total research articles in JMCP and JAMA, respectively.

Individual pharmacoeconomics topics appeared 197 times in the reviewed journals. Since more than one topic frequently appeared in the same site (i.e., letter, editorial, or article), the 197 does not directly correspond to the total number of places in which the topics were found. However, within a specific topic, the number does correspond to the number of letters, editorials, and articles that contain the term. For example, CEA, which was the most frequently found topic, appeared in 35 separate places. This was followed by CBA in eight, cost-minimization analysis (CMA) in seven, and cost-utility analysis (CUA) in five separate places. Cost analyses or descriptions were found in four places.

The frequency with which cost terms appeared also varied by type. Direct medical and direct non-medical costs were found in 32 places, followed by opportunity costs (10 places) and indirect costs (8 places). Simple sensitivity analyses (both one-way and multi-way) appeared in 16 places, while Monte Carlo and complex analyses appeared in five and six sites, respectively.

The most common study designs were deterministic (i.e., uncertainty is described by probabilities rather than variances), with decision analysis and decision trees found in eight and three places. Markov Processes were used in seven of those models. Statistical methods, such as multiple regression, appeared in four different places.

Clinical outcomes were the most commonly used outcome measure in economic analyses (nine) followed by economic and humanistic outcomes which were used in seven and five
Table II. Number (percent) of pharmacoeconomics (PE) courses, “other” courses, and total schools that cover specific pharmacoeconomic topics

<table>
<thead>
<tr>
<th>Topics:</th>
<th>PE course (n = 26)</th>
<th>Other courses (n = 28)</th>
<th>Total schools (n = 60)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-effectiveness analysis b</td>
<td>26 (100)</td>
<td>28 (100)</td>
<td>54 (90)</td>
</tr>
<tr>
<td>Humanistic outcomes</td>
<td>26 (100)</td>
<td>28 (100)</td>
<td>54 (90)</td>
</tr>
<tr>
<td>Economic outcomes</td>
<td>26 (100)</td>
<td>28 (100)</td>
<td>54 (90)</td>
</tr>
<tr>
<td>Cost-benefit analysis b</td>
<td>26 (100)</td>
<td>27 (96)</td>
<td>53 (88)</td>
</tr>
<tr>
<td>Cost-minimization analysis b</td>
<td>26 (100)</td>
<td>27 (96)</td>
<td>53 (88)</td>
</tr>
<tr>
<td>Costs c</td>
<td>26 (100)</td>
<td>26 (93)</td>
<td>52 (87)</td>
</tr>
<tr>
<td>Cost analysis</td>
<td>25 (96)</td>
<td>26 (93)</td>
<td>51 (85)</td>
</tr>
<tr>
<td>Clinical outcomes b</td>
<td>25 (96)</td>
<td>27 (96)</td>
<td>52 (87)</td>
</tr>
<tr>
<td>Cost-utility analysis d</td>
<td>25 (96)</td>
<td>26 (93)</td>
<td>51 (85)</td>
</tr>
<tr>
<td>Sensitivity analysis b</td>
<td>24 (92)</td>
<td>24 (86)</td>
<td>48 (80)</td>
</tr>
<tr>
<td>Quality-adjusted life years</td>
<td>23 (88)</td>
<td>23 (82)</td>
<td>46 (77)</td>
</tr>
<tr>
<td>Cost of illness analysis c</td>
<td>24 (92)</td>
<td>20 (71)</td>
<td>44 (73)</td>
</tr>
<tr>
<td>Decision Analysis b</td>
<td>23 (88)</td>
<td>21 (75)</td>
<td>44 (73)</td>
</tr>
<tr>
<td>Multiple regression</td>
<td>13 (50)</td>
<td>13 (46)</td>
<td>26 (43)</td>
</tr>
<tr>
<td>Logistic Regression</td>
<td>10 (38)</td>
<td>8 (29)</td>
<td>18 (30)</td>
</tr>
<tr>
<td>Markov process</td>
<td>11 (42)</td>
<td>6 (21)</td>
<td>17 (28)</td>
</tr>
<tr>
<td>Systems (equilibrium) analysis</td>
<td>7 (27)</td>
<td>4 (14)</td>
<td>11 (18)</td>
</tr>
<tr>
<td>Optimization</td>
<td>8 (31)</td>
<td>3 (11)</td>
<td>11 (18)</td>
</tr>
</tbody>
</table>

*aSix of the 60 respondents indicated that their school did not offer a stand-alone pharmacoeconomics course; they did not complete this part of the survey.

*bTopic also appeared in at least five of the seven journals reviewed for 1998.

cCosts counted were direct, indirect, opportunity, and incremental; other costs were not reported or counted.

Table III. Number (%) of schools using specific textbooks

<table>
<thead>
<tr>
<th>Title (First author or organization)</th>
<th>Number (%) of schools a (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principles of Pharmacoeconomics (Bootman)</td>
<td>20 (50)</td>
</tr>
<tr>
<td>Pharmacoeconomic and Outcomes: Applications for Patient Care (ACCP)</td>
<td>8 (20)</td>
</tr>
<tr>
<td>Methods for the Economic Evaluation of Health Care Programmes (Drummond)</td>
<td>7 (18)</td>
</tr>
<tr>
<td>Practical Pharmacoeconomics (Buskin)</td>
<td>5 (13)</td>
</tr>
<tr>
<td>Cost-Effectiveness in Health and Medicine (Gold)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Prevention Effectiveness (Haddix)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Meta-Analysis, Decision Analysis, and Cost-Effectiveness Analysis (Pettiti)</td>
<td>2 (5)</td>
</tr>
<tr>
<td>ISPOR Lexicon (Pashos)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Clinical Decision Analysis (Weinstein)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Textbook used, but title not specified</td>
<td>2 (5)</td>
</tr>
<tr>
<td>Used one or more selected chapters from other texts</td>
<td>5 (13)*</td>
</tr>
</tbody>
</table>

aPercent do not sum to 100 percent because several schools used more than one textbook.

*bChapter and text information included in Appendix A if provided by respondent.

Curevum Survey

After sending two follow-up reminders, the overall response rate was 74 percent (60/81). Pharmacoeconomic topics were taught to entry-level pharmacy degree students at 90 percent (54/60) of the schools. Less than half of the schools (43 percent or 26/60) offered a stand-alone pharmacoeconomics course. Many schools, 78 percent (47/60) covered pharmacoeconomic topics in one or more other courses. Nineteen schools covered pharmacoeconomics topics in both a stand-alone course and as part of other courses.

Of the 47 schools which covered pharmacoeconomic topics in courses not solely devoted to this subject, about one-third (16/47) of them covered them in two or more different courses. In those schools, pharmacoeconomics topics were most frequently inserted into management courses (18/47) and drug literature evaluation / research methods courses (17/47) followed by health systems courses (12/47), pharmacy practice courses (8/47), and general pharmacy administration courses (6/47). The topics were also covered in one each of the following courses: clerkship, therapeutics course, public health course, and an epidemiology course. Six of the 47 respondents did not specify in which course(s) they covered the topics.

Table II shows the frequency of coverage of specific topics by schools with pharmacoeconomics courses and those without such a course. Coverage of individual topics ranged from 27 to 100 percent (7/26 to 26/26) for schools with pharmacoeconomics courses and from 11 to 100 percent (3/28 to 28/28) for those without a stand-alone pharmacoeconomics course. Thirteen of the 18 topics were taught in over 70 percent (26/26) of the school. Figure 1 shows how coverage of CBA, CEA, and CUA in school curricula has increased since earlier studies by Hokanson et al. (1985) and Juergens et al. (1992).

Textbooks used in pharmacoeconomics courses and other courses that cover pharmacoeconomics topics varied from school to school. Table III contains the frequency (percent) of schools using various texts. Appendix A contains a bibliography of the textbooks. Of the 40 schools that reported using a textbook, 100 percent (40/40) of them also used pharmacoeconomic research articles.

Pharmacoeconomics articles were used by 81 percent (49/60) of the schools. Of the schools with stand-alone phar-
macroeconomics courses, 100 percent (26/26) used pharmacoeconomics research articles as part of their course materials and assessed their students’ ability to evaluate completed pharmacoeconomic evaluations (e.g., research article, technical report). In schools that did not offer a stand-alone pharmacoeconomics course, research articles were used by 68 percent (23/34). Of those schools using research articles, 78 percent (18/23) of them also assessed their students’ ability to critically evaluate completed analyses.

Comparison of Journal and Curricula Data

Overall, most (16/18) topics found in the school curricula also appeared in the journals. Two topics, logistic regression and systems analysis, were not found in any of the journals. The overlap between topics that appeared in over 70 percent (43/60) of the schools and those that also appeared in over 70 percent (5/7) of the journals was 62 percent (8/13 topics). Table II shows the eight overlapped topics.

Most topics appeared in a higher percentage of the schools than the journals. However, six topics occurred in a higher percentage of journals. Three of those topics, CEA, CBA, and costs, appeared in all of the journals (7/7) compared to 90 percent (54/60), 88 percent (53/60), and 87 percent (52/60) of the schools, respectively. Sensitivity analysis occurred in 86 percent (6/7) of the journals compared to 80 percent (48/60) of the schools. Two other topics, multiple regression and Markov Process, each appeared in 57 percent (4/7) of the journals compared to 43 percent (26/60) and 28 percent (17/60) of the schools, respectively.

Since the percentage of journals in which Markov Process appeared was approximately double the percentage of schools that taught it, the difference was tested. The results of the t test for independent proportions was not significant ($P=0.0582$, one-tailed); however, the power of the comparison was estimated at 0.472 (per power calculator at: http://www.dssresearch.com/SampleSize/betapct2.htm).

DISCUSSION

Schools of pharmacy have been incorporating pharmacoeconomic topics and concepts into their curricula in an effort to better prepare their graduates for a cost-conscious healthcare practice environment. The results of this study show a high degree of agreement between topics covered in school curricula and professional journals. This may be due, in part, to the use of pharmacoeconomics research articles in the courses.

Unlike earlier studies, no disparities between curricular and journal topics were found(6,7). Most topics appearing in journals were offered in similar or greater percentages of the curricula. Even the difference in the appearance of the Markov Process in journals and curricula was not found to be statistically significant. However, a lack of power may account for this, so conclusions should be drawn with caution. While Markov Process is arguably an advanced topic for an undergraduate course, its relatively frequent appearance in journals suggests that undergraduate courses should at least include a discussion of the concept.

Certain topics, such as systems (equilibrium) approaches to pharmacoeconomic analyses and optimization methods, were found in very few of the undergraduate curricula and not in any of the selected journals. This finding was not a surprise; these topics were included in the study because they represented potentially different approaches to economic evaluation or application of results to budgetary decisions. At this time, these are most likely topics for a graduate-level course. However, as these topics begin to appear in mainstream research literature, they will likely become incorporated into the undergraduate curricula. It may be appropriate to discuss the underlying concepts rather than the actual techniques in an undergraduate course.

The steady increase in the teaching of topics such as CEA may be due to several factors, such as the transition to entry-level PharmD degree programs, increased awareness of healthcare costs and outcomes, and increased faculty interest in conducting pharmacoeconomic research. It is also likely that there are now more faculty who receive graduate training in pharmacoeconomic methods. Unlike graduate-level pharmacoeconomic training, it is not clear how much influence industry has exerted to promote the inclusion of these topics in the undergraduate degree programs.

Potential Limitations

Potential limitations to this study include possible bias introduced by the choices made in selecting pharmacoeconomic topics for the two surveys. Similar bias may have been created by the selection of the seven journals. Topic and journal selections were selected with the intention of covering a broad, representative range of subjects and practitioners. The relatively small number of journals also decreased the power of the statistical comparisons.

Since the primary purpose of this study was to quantify the presence of topics in school curricula and journals, it did not attempt to evaluate the quality of the information provided in classrooms, journals, or textbooks. The depth with which topics were covered in the various sources was also not measured; topics that were simply introduced or defined were counted the same as those that were presented in detail.

CONCLUSIONS

The “gap” between what is taught and what is needed to read the literature appears to be much smaller than previously reported. Many schools of pharmacy have now incorporated pharmacoeconomic topics into their undergraduate curricula. The widespread use of pharmacoeconomic research articles in the courses may account for some of the decrease in the education-to-practice knowledge gap.

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tion and training programs in U.S. colleges of pharmacy,” Am. J.
“Statistical background needed to read professional pharmacy journals,” 
Bryant, S.G. and Luttman, D.I., “Do pharmacy schools need to increase 
the statistical education of their students?” ibid., 49, 46-49 (1985).
(7) Juergens, J.P., Szeinbach, S.L. and Smith, M.C., “Will future pharmacists 
understand pharmaco economics research?” ibid., 56, 135-140 (1992).
(8) Kachigan, S.K., “Interval estimate of the difference between two inde-
pendent proportions,” in Statistical Analysis: An Interdisciplinary 
Introduction to Univariate and Multivariate Methods, Radius Press, New 

APPENDIX A.

Full citations for textbooks and chapters listed in Table III.

Textbooks:
ACCP, Pharmacoeconomics and Outcomes: Applications for Patient 
Care: College Version, (edit., Bungay, K., Paladina, J., Sanchez, L.), 
American College of Clinical Pharmacy, Kansas City MO (1996).

Baskin, L.E., Practical Pharmacoeconomics: How to Design and 
Analyze Outcomes Research, Advanstar Communications, Cleveland 

Bootman, J.L., Townsend, R.J. and McGhan, W.F., Principles of 
Pharmacoeconomics, 2nd ed., Harvey Whitney Books, Cincinnati OH 
(1996).

Drummond, M.F., Stoddart, G.L. and Torrance, G.W., Methods for the 
Economic Evaluation of Health Care Programmes, 2nd ed., Oxford 

Gold, M.R., Siegel, J.E., Russell, L.B. and Weinstein, M.C., Cost-
Effectiveness in Health and Medicine. Oxford University Press, New 

Haddix, A.C., Teutsch, S.M., Shaffer, P.A. and Dunet, D.O., Prevention


ISPOR Lexicon, (edit., Pashos, C.L., Klein E.G. and Wanke, L.A.), 
International Society for Pharmacoeconomics and Outcomes 

Pettiti, D.B., Meta-Analysis, Decision Analysis, and Cost-
Effectiveness Analysis: Methods for Quantitative Synthesis in 

Weinstein, M.C., Fineberg, H.V., Elstein, A.S., Frazier, H.S., 
Neuhauser, D., Neutra, R.R. and McNeil B.J., Clinical Decision 
Analysis, W.B. Saunders, Philadelphia PA (1980).

Chapters from these Textbooks were used (chapter information 
given if it was provided by respondents):

Introduction to pharmacoeconomics,” in Applied Drug 
Information: Strategies for Information Management, (edit., M. 

Social and Behavioral Aspects of Pharmaceutical Care, (edit., Smith, 
M.C. and Wertheimer, A.I.), Pharmaceutical Products Press 
(Haworth), New York NY (1996).

Sanchez, L.A., “Chapter 1: Pharmaco economics: principles, 
methods, and applications to pharmacotherapy” and Coons, S.J., 
“Chapter 2: Health outcomes and quality of life,” in: 
Pharmacotherapy: A Pathophysiologic Approach, 3rd ed., (edit., 
DiPiro, J.T., Talbert, R.L, Yee, G.C., Matzke, G.R., Wells, B.G. and 

Valuing Health Care: Costs, Benefits, and Effectiveness of 
Pharmaceuticals and Other Medical Technologies, (edit., Sloan, 
paperback version titled, Valuing Health Care, was published in 
1996.]

Luce, B.R. and Elixhauser, A., Standards for Socioeconomic 
Evaluation of Health Care Products and Services, (edit., AJ. 