RESEARCH ARTICLES

Pharmacy Students’ Perceived Knowledge, Beliefs, and Responsibilities About Health Care Outcomes: A Five-Year Study

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Background. The purpose of this paper is to compare pharmacy students’ perceived knowledge, beliefs, and responsibilities about health care outcomes at the beginning and end of the third professional year and to assess whether there were gender or age differences on these constructs.

Methods. A survey instrument was developed and administered to third year pharmacy students for 5 consecutive academic years (from August 1996 to May 2001). The instrument’s reliability and validity were examined; paired sample t tests and multivariate analysis of variance measures were used in the data analysis.

Results. Across all 5 years, scores indicated that students’ perceived knowledge, beliefs, and responsibilities about health care outcomes were more favorable at the end of the year as compared to the beginning of the year. Furthermore, there were no significant differences in responses based on gender or age.

Conclusion. Incorporating information about health care outcomes into existing pharmacy courses seemed to be an effective means of improving students’ perceptions of their future role in health care outcomes. Enhanced communication among faculty members and integration of outcomes topics across all pharmacy courses are needed to consistently convey to students the importance of this issue.

Keywords: pharmacy students, health care, outcomes

INTRODUCTION

The importance of assessing health care outcomes has exploded in the last decade. The rising pressures in this unique time in American health care history have affected virtually every aspect of patients’ lives. As the twentieth century came to a close, various health care systems around the world realized the necessity of critically evaluating what type of health care was being delivered, how it was being provided, and what difference it made in patients’ experiences. The emphasis on the need for assessing the structure, process, and, particularly, outcomes of patient care prompted this study.

Pharmacists, in conjunction with other health care professionals, need to be aware of the essential nature of outcomes assessment in our health care system and the crucial part they play in this arena. Therefore, pharmacy educators must provide a means through which students can explore and evaluate their beliefs and knowledge about health care outcomes. A survey was developed in order to assess pharmacy students’ thoughts about this vital issue. The purpose of this paper is to describe the survey instrument used in and the results of assessing changes in third professional year (P3) pharmacy students’ perceived knowledge, beliefs, and responsibilities about health care outcomes. Students in their P3 year were chosen for this study since, at this point in their education, they had completed all basic science courses and were learning to put all of the pieces of the pharmacy practice puzzle together, including the overarching theme of patient outcomes.

While outcomes assessment has certainly received much attention in recent years, the concept was introduced about 4 decades ago. Donabedian addressed the terms structure, process, and outcome in the mid-1960s. He defined structure as the resources, personnel, policies, and procedures through which care is provided; process as the manner in which these struc-
A variety of methods are used in caring for patients; and outcomes as changes in health status or an assessment of what is actually accomplished for patients. In 1988, Relman critically reflected on the importance of outcomes assessment in his description of the era of assessment and accountability, stating that “we can no longer afford to provide health care without knowing more about its successes and failures.”

How do pharmacists’ actions and the manner in which these activities occur affect patients’ lives? To this end, Kožma, Reeder, and Schultz created a theoretical framework in 1993 to comprehensively assess health care outcomes. This economic, clinical, and humanistic outcomes (ECHO) model and its associated modes of measurement are as follows:

- Economic outcomes: eg, direct, indirect, and intangible costs compared with the consequences of various treatments;
- Clinical outcomes: eg, changes in parameters or conditions that occur as a result of a disease or treatment; and,
- Humanistic outcomes: eg, consequences of disease or treatment on a patient’s functional ability or quality of life.

While these 3 elements are truly interrelated in their scope, medical care has traditionally focused on the clinical aspects of patient outcomes and only recently has had enhanced concern for the economic and humanistic segments of this model. This shift, particularly toward the fiscal components of health care, has undoubtedly occurred due to the enormous financial pressures of the current health care market arena. There are presently several journals that specifically aim to address these 3 crucial elements of outcomes assessment, including the American Journal of Managed Care, Journal of Clinical Outcomes Management, Pharmacoeconomics, and Value in Health: The Journal of the International Society for Pharmacoeconomics and Outcomes Research. These and other publications are replete with articles that pertain to economic, clinical, and humanistic health care outcomes research.

Pharmacy educators have also recognized the need to incorporate more economic and humanistic outcomes assessment in the curriculum. In 1991, Draugalis and Jones-Grizzle stated that including pharmacoeconomics in pharmacy curricula is a “critical issue,” adding that this topic could be incorporated into existing courses rather than creating a separate class. This article was closely followed by work from Juergens, Szeinbach, and Smith, as they examined the level of pharmacy school training in statistics and analytical methods necessary to appropriately evaluate pharmacoeconomic studies. The results indicated that only 32.8% of doctor of pharmacy (PharmD) programs and 19.3% of bachelor of science (BS) programs required training in cost-benefit, cost-effectiveness, and cost-utility analyses. There was also a wide range in the percentages of pharmacy schools in which other types of statistical tests and methods were required. Conferences sponsored by both the American Society of Hospital Pharmacists in September 1994 and the American Pharmaceutical Association in November 1994 further delineated the need for more emphasis on outcomes research. These organizations’ efforts complemented the American College of Clinical Pharmacy’s Self-Study Modules on the application of pharmacoeconomic principles and outcomes evaluation in patient care. These modules, originally produced in 1996, were modified into a college version in 1998 in order to provide a more student-centered approach to outcomes education.

Pharmacy schools were then challenged to integrate these concepts into professional course work. To assess whether any improvements had been made in this regard, Rascati, Conner, and Draugalis conducted a survey of pharmacoeconomic education in United States’ pharmacy schools during the 1996-97 academic year and found that 80% of the schools offered this training at the BS and/or PharmD level. Scott and Pedersen provided an example of this curriculum when they described an elective course in outcomes research that they initiated in 1995 and developed over the subsequent 3 years. They also assessed students’ perceived usefulness of specific economic and humanistic outcome measures and how these were viewed by governmental agencies and pharmaceutical companies. Student feedback about the course revealed that they generally valued the material presented. They also believed that pharmacists need to know how to evaluate and interpret journal articles about outcomes research. Scott and Pedersen concluded that schools and colleges of pharmacy should “provide more outcomes research course work in order to train future pharmacists to consider economic, clinical, and humanistic outcomes when recommending treatment modalities.”

In an effort to build on Scott and Pedersen’s foundation, the authors sought to examine the more personal aspects of health care outcomes and the ways in which students thought outcomes would influence their own professional lives. The purpose of this paper is to describe a survey instrument that was developed in...
order to assess pharmacy students’ thoughts about this vital issue and the results of assessing changes in pharmacy students’ perceived knowledge, beliefs, and responsibilities about health care outcomes. Data from the P3 students were collected over 5 consecutive years. Two hypotheses were purported in this study: (1) P3 students will have more favorable attitudes regarding perceived knowledge, beliefs, and responsibilities about health care outcomes at the end of the academic year than they do at the beginning, and (2) neither P3 students’ gender nor age will be significantly related to their responses.

**METHODS**

**Survey Development**

In the summer of 1996, the authors developed a 20-item survey entitled “Attitudes about Health Care Outcomes” to address the theoretical constructs of students’ perceived knowledge, beliefs, and responsibilities about outcomes in patient care. Demographic information including gender and age was obtained. Students were also asked to indicate the areas of pharmacy practice in which they had experience. However, since the vast majority of these students had experience in a few different areas, it was not possible to assess the relationships between one specific area of practice and the students’ responses; therefore, no further analysis was done on this particular information.

Survey responses were measured on a 5-point Likert scale indicating the extent to which the students agreed or disagreed with the given statements (5=strongly agree, 1=strongly disagree). The same instrument was administered at the beginning of the P3 year (ie, the presurvey) and again at the end of the P3 year (ie, the postsurvey). All 5 years of the postsurvey data from students (n=426) were used in determining the reliability and validity of the instrument.

**Survey Reliability and Validity**

Reliability of the survey instrument in terms of internal consistency was assessed by Cronbach’s alpha coefficient and item-total correlations (ITCs). The Cronbach’s alpha coefficient on the postsurvey data for all 5 years combined was 0.94, with individual years 1 through 5 ranging from 0.90 to 0.96. ITCs were also computed on the postsurvey data to examine the internal consistency of the items, and these ranged from 0.5154 (item 11) to .7991 (item 13). These results indicate that the instrument exhibited fairly strong internal consistency. Item 11 (potential for negative impact) had the lowest ITC, perhaps since it was in stark contrast to the overall theme of the survey items.

Face and construct validity of the survey instrument were also evaluated. Exploratory factor analysis was performed on the 20 postsurvey items to reduce the data to a few factors, and 3 balanced factor loadings emerged on the varimax rotated component matrix. Analysis of the first factor loading revealed that items 1 through 5 loaded heavily on the perceived knowledge construct (factor loadings = 0.64-0.83) and that items 6 through 13 reflected the perceived beliefs construct (factor loadings = 0.52-0.83). Items 15-20 (except 14 and 16) loaded on what was considered to be a perceived responsibility construct (factor loadings = 0.62-0.74). Even though the content of item 18 seemed to clearly reflect perceived knowledge, interestingly, this item loaded substantially on the responsibility construct (factor loading = 0.64). In order to be consistent with the authors’ primary factor loading definition of at least 0.50, item 18 remained in the perceived responsibility construct.

The 3 factors of perceived knowledge, beliefs, and responsibilities, which were evident on the scree plot and were the only factors with an eigenvalue greater than one, explained a combined 65% of the variance in this instrument addressing health care outcomes. Although items 14 (factor loadings = 0.27-0.497) and 16 (factor loadings = 0.31-0.48) did not have a minimal load of 0.50 on any one of these 3 factors, it was decided that they would not be dropped from the analysis due to their informative content. These 2 items are conceptually a combination of 2 or 3 of the previously identified factors and will comprise the mixed construct.

**Participants and Procedures**

During the first week of class in August and prior to any mention of health care outcomes, the presurvey instrument was administered to a convenience sample of P3 students in the entry-level PharmD program. Immediately following the students’ completion of the presurvey instrument, the first author provided a brief overview of structure, process, outcomes, and the ECHO model as these aspects pertained to her father’s illness and death from chronic heart failure. During the course of the ensuing academic year, the faculty members who taught the P3 students tried to incorporate as much about the ECHO model as possible as it related to their course-specific content. Required courses in this third professional year included therapeutics, fiscal management, human resources management, drug literature evaluation, nonprescription drug therapy, pharmacy practice, physical assessment, and ethics in Christianity and health care. The postsurvey instrument was given during the last week of the academic year in
Table 1. Respondent Demographics

<table>
<thead>
<tr>
<th></th>
<th>Year 1 N=102</th>
<th>Year 2 N=101</th>
<th>Year 3 N=92</th>
<th>Year 4 N=103</th>
<th>Year 5 N=92</th>
<th>TOTAL N=490</th>
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<tr>
<td>Respondents in each class</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>by percentage of class size</td>
<td>85 (83.3)</td>
<td>69 (68.3)</td>
<td>77 (83.7)</td>
<td>88 (85.4)</td>
<td>74 (80.4)</td>
<td>393 (80.2)</td>
</tr>
<tr>
<td>by percentage of total sample size</td>
<td>85 (21.6)</td>
<td>69 (17.6)</td>
<td>77 (19.6)</td>
<td>88 (22.4)</td>
<td>74 (18.8)</td>
<td>393 (100)</td>
</tr>
<tr>
<td>Gender*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23 (27.1)</td>
<td>19 (27.5)</td>
<td>15 (19.5)</td>
<td>17 (19.3)</td>
<td>21 (28.4)</td>
<td>95 (24.2)</td>
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<td>62 (72.9)</td>
<td>50 (72.5)</td>
<td>62 (80.5)</td>
<td>71 (80.7)</td>
<td>53 (71.6)</td>
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</tr>
<tr>
<td>Age(y)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 or younger</td>
<td>70 (82.3)</td>
<td>49 (71.0)</td>
<td>63 (81.8)</td>
<td>65 (73.9)</td>
<td>56 (75.7)</td>
<td>303 (77.1)</td>
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<tr>
<td>26 or older</td>
<td>13 (15.3)</td>
<td>20 (29.0)</td>
<td>14 (18.2)</td>
<td>23 (26.1)</td>
<td>18 (24.3)</td>
<td>88 (22.4)</td>
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<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>2 (0.5)</td>
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<td>Prior work experience*†</td>
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<td>医院</td>
<td>独立药房</td>
<td>医院</td>
<td>医院</td>
<td>总计</td>
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<tr>
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<td>61 (71.8)</td>
<td>54 (78.3)</td>
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<td>75 (85.2)</td>
<td>68 (91.9)</td>
<td>324 (82.4)</td>
</tr>
<tr>
<td>Hospital pharmacy</td>
<td>47 (55.3)</td>
<td>52 (75.4)</td>
<td>48 (62.3)</td>
<td>49 (55.7)</td>
<td>40 (54.1)</td>
<td>236 (60.1)</td>
</tr>
<tr>
<td>Independent pharmacy</td>
<td>43 (50.6)</td>
<td>35 (50.7)</td>
<td>35 (45.4)</td>
<td>33 (37.5)</td>
<td>32 (43.2)</td>
<td>178 (45.3)</td>
</tr>
<tr>
<td>Home health care</td>
<td>6 (7.1)</td>
<td>8 (11.6)</td>
<td>10 (13.0)</td>
<td>14 (15.9)</td>
<td>7 (9.5)</td>
<td>45 (11.5)</td>
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<tr>
<td>Long-term care</td>
<td>4 (4.7)</td>
<td>6 (8.7)</td>
<td>5 (6.5)</td>
<td>5 (5.7)</td>
<td>7 (9.5)</td>
<td>27 (6.9)</td>
</tr>
<tr>
<td>Other</td>
<td>3 (3.5)</td>
<td>3 (4.3)</td>
<td>3 (3.9)</td>
<td>2 (2.3)</td>
<td>2 (2.7)</td>
<td>13 (3.3)</td>
</tr>
</tbody>
</table>

* Percentages based on sample size for that year.
† Numbers may total greater than 100% of respondents because some students had worked in more than one practice setting.

May. The pre- and postsurvey instruments were administered in 5 consecutive academic years: 1996-97 (year 1), 1997-98 (year 2), 1998-99 (year 3), 1999-2000 (year 4), and 2000-01 (year 5).

Data Analysis

The Statistical Package for the Social Sciences (SPSS®, Version 10.0.5, Chicago, IL, 2001) was used and a significance level of 0.05 was set for the data analyses. No reverse coding was required because no items were negatively stated. In this study, there were few missing data, and these were replaced with the series mean in order to allow for the availability of the total scores. SPSS® does not provide a total score if any data point is missing; therefore, the series mean was substituted for the missing information. Deleting a person’s responses from the analysis due to one absent data point would not be prudent, as the other key responses provided by that person would also be omitted.

To test the first hypothesis, the pre- and postsurvey means for each item and year were analyzed via the paired sample t test to determine if there were changes over time. Initially, the authors considered using a 2-tailed analysis for this hypothesis stating that there would be no differences between the means of the presurvey and postsurvey results would seem appropriate since there was no previous research along these lines. However, the authors hoped and, indeed, expected that students’ perceived knowledge, beliefs, and responsibilities would be more favorable at the end of the year compared to the beginning of the P3 year. Therefore, the 1-tailed analysis was used for detecting statistically significant differences in the presurvey and postsurvey results.

To test the second hypothesis, the two-factor multivariate analysis of variance (MANOVA) measure was used to determine the effects of gender and age on students’ attitudes toward health care outcomes. Pre- and postsurvey mean total scores served as dependent variables, while gender and age were the independent variables.

RESULTS

Response Rates and Demographics

The total number of usable responses and the corresponding response rate over the 5-year period was 80.2% (393/490) with response rates within each individual year of the study ranging from 68.3% to 85.4%. Table 1 depicts the number of usable responses and the demographic frequency data for each year’s sample of students. Due to a fairly wide range of student ages, the age demographic was divided into 2 categories: those 25 years or younger or those 26 years or older. Over
three-fourths of the students in the sample were female (75.8%) and were 25 years of age or younger (77.1%), which was reflective of our total student body during the same time frame. The total population over the 5 study years was 74% female with an average age of 22.3 years. Students used their mother’s maiden name as a unique identifier to track confidential responses through the pre- and postsurvey process. However, because of miscommunication during some administrations of the survey, the students in years 1 and 4 did not write their unique identifier on the survey. As a result, only aggregate pre- and postsurvey data are presented for these 2 years, while the matched pair pre- and postsurvey data are presented for years 2, 3, and 5.

**Hypothesis #1**

The first hypothesis was that the P3 students would have more favorable attitudes regarding perceived knowledge, beliefs, and responsibilities about outcomes of care at the end of the academic year than at the beginning. Table 2 denotes the mean pre- and postsurvey scores and $t$ test results for each year of the study, with higher scores representing a more favorable attitude about health care outcomes. Postsurvey scores were statistically significantly higher than were presurvey scores for each year of the entire study period. Mean score improvement ranged from +4.48 (year 4) to +14.14 (year 2), with an average improvement of 9.30 points on the postsurvey. Although their postsurvey scores were not significantly different from those for other categories of students, younger females in the sample showed the most improvement (mean increase of 10.75 points), while older females showed the least improvement (mean increase of 7.09 points).

Table 3 summarizes the mean pre- and postsurvey scores and $t$ test results for each survey item divided into the major constructs of perceived knowledge, beliefs, and responsibilities, as well as the mixed category. Each construct measured by the survey is discussed in further detail below.

**Perceived Knowledge.** Survey items 1-5 measured perceived knowledge concerning health care outcomes. Favorable, statistically significant results were found for 96% (24/25) of items measuring this construct across all 5 years of data; item 1 on year 4 also yielded a favorable result, but was the only item not statistically significant ($P = 0.07$). Mean increase across the entire sample on the postsurvey for knowledge-related items was 5.34 points (16.01 to 21.35 points), with female students as a whole increasing their scores the most (5.49 points) and male students as a whole increasing their scores the least (4.83 points).

**Perceived Beliefs.** Survey items 6-13 measured perceived beliefs concerning health care outcomes. Of these items, 35% (14/40) across all 5 years of data yielded favorable, statistically significant results. Mean increase across the total sample on the postsurvey for belief-related items was only 0.56 points (35.80 to 36.36 points). Postsurvey scores may not have improved more because they were scored fairly high initially. This indicates that students already believed at the start of the P3 year that the pharmacist could have an impact on patient care outcomes. The scores of younger students as a whole increased the most (0.82 points), while the scores of older students as a whole actually decreased (0.20 points). For unmatched respondents in years 1 and 4, all of the belief construct responses except for item 11 on year 1 (belief that they could have a negative impact on the outcomes of their patients) either decreased or stayed the same from the presurvey to the postsurvey.

**Perceived Responsibilities.** Survey items 15 and 17 through 20 measured perceived responsibility related to health care outcomes. Of these items, 60% (15 of 25) were scored as favorably, statistically significant
### Table 3. Presurvey and Postsurvey Responses for Each Item by Year of Study.*

**Perceived Knowledge**

1. I know what is meant by the term “outcome” with regard to patient care.
   - Year 1: 3.98 / 4.48 (<0.001)
   - Year 2: 4.09 / 4.78 (<0.001)
   - Year 3: 3.86 / 4.48 (<0.001)
   - Year 4: 4.10 / 4.27 (0.074)
   - Year 5: 4.04 / 4.66 (<0.001)

2. I can explain various outcomes of health care.
   - Year 1: 3.31 / 4.21 (<0.001)
   - Year 2: 3.14 / 4.46 (<0.001)
   - Year 3: 3.17 / 4.14 (<0.001)
   - Year 4: 3.40 / 3.90 (<0.001)
   - Year 5: 3.46 / 3.93 (<0.001)

3. I can explain the concept of economic outcomes.
   - Year 1: 2.84 / 4.21 (<0.001)
   - Year 2: 2.77 / 4.51 (<0.001)
   - Year 3: 2.69 / 4.09 (<0.001)
   - Year 4: 2.89 / 3.90 (<0.001)
   - Year 5: 2.82 / 4.11 (<0.001)

4. I can explain the concept of clinical outcomes.
   - Year 1: 3.38 / 4.27 (<0.001)
   - Year 2: 3.22 / 4.64 (<0.001)
   - Year 3: 3.25 / 4.25 (<0.001)
   - Year 4: 3.36 / 4.01 (<0.001)
   - Year 5: 3.27 / 4.41 (<0.001)

5. I can explain the concept of humanistic outcomes.
   - Year 1: 2.81 / 4.06 (<0.001)
   - Year 2: 2.33 / 4.42 (<0.001)
   - Year 3: 2.32 / 4.04 (<0.001)
   - Year 4: 2.97 / 3.85 (<0.001)
   - Year 5: 2.67 / 4.04 (<0.001)

**Perceived Beliefs**

6. I believe that assessment of outcomes is important in health care at the present time.
   - Year 1: 4.56 / 4.56 (0.500)
   - Year 2: 4.45 / 4.77 (<0.001)
   - Year 3: 4.38 / 4.61 (0.008)
   - Year 4: 4.30 / 4.20 (0.213)
   - Year 5: 4.35 / 4.51 (0.041)

7. I believe that assessment of outcomes will be important after I become a pharmacist.
   - Year 1: 4.64 / 4.51 (0.090)
   - Year 2: 4.55 / 4.77 (0.009)
   - Year 3: 4.39 / 4.60 (0.019)
   - Year 4: 4.32 / 4.16 (0.093)
   - Year 5: 4.36 / 4.55 (0.015)

8. It is important to learn about the outcomes of drug therapy.
   - Year 1: 4.76 / 4.59 (0.023)
   - Year 2: 4.65 / 4.84 (0.031)
   - Year 3: 4.60 / 4.71 (0.090)
   - Year 4: 4.63 / 4.32 (0.002)
   - Year 5: 4.62 / 4.73 (0.051)

9. Being aware of various outcomes of drug therapy will make a difference in the way that I practice pharmacy.
   - Year 1: 4.66 / 4.48 (0.025)
   - Year 2: 4.61 / 4.71 (0.165)
   - Year 3: 4.47 / 4.58 (0.118)
   - Year 4: 4.51 / 4.23 (0.003)
   - Year 5: 4.39 / 4.66 (<0.001)

10. As a pharmacist, I can have a positive impact on the outcomes of my patients.
    - Year 1: 4.67 / 4.55 (0.110)
    - Year 2: 4.78 / 4.87 (0.138)
    - Year 3: 4.68 / 4.70 (0.374)
    - Year 4: 4.64 / 4.36 (0.004)
    - Year 5: 4.58 / 4.73 (0.023)

11. As a pharmacist, I can have a negative impact on the outcomes of my patients.
    - Year 1: 4.19 / 4.23 (0.422)
    - Year 2: 4.28 / 4.43 (0.126)
    - Year 3: 3.99 / 4.46 (0.002)
    - Year 4: 4.06 / 4.05 (0.474)
    - Year 5: 4.08 / 4.39 (0.007)

12. I will need to have a positive impact on the outcomes of my patients in order for me to be fulfilled in my profession.
    - Year 1: 4.72 / 4.59 (0.073)
    - Year 2: 4.51 / 4.64 (0.130)
    - Year 3: 4.43 / 4.59 (0.076)
    - Year 4: 4.36 / 4.24 (0.112)
    - Year 5: 4.19 / 4.41 (0.029)

13. It is my responsibility to learn about outcomes of drug therapy.
    - Year 1: 4.72 / 4.52 (0.011)
    - Year 2: 4.62 / 4.80 (0.032)
    - Year 3: 4.48 / 4.62 (0.076)
    - Year 4: 4.55 / 4.26 (0.006)
    - Year 5: 4.34 / 4.59 (0.001)
Table 3 cont. Mean Presurvey and Mean Postsurvey Responses for Each Item by Year of Study

**Perceived Responsibilities**

15. It is the pharmacist’s responsibility to help patients identify their desired outcomes of drug therapy.

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Mean Presurvey</th>
<th>Mean Postsurvey</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>4.13 (0.109)</td>
<td>3.86 (0.011)</td>
<td>3.95 (0.021)</td>
</tr>
<tr>
<td>2004</td>
<td>4.07 (0.312)</td>
<td>4.01 (0.369)</td>
<td>3.96 (0.042)</td>
</tr>
<tr>
<td>2005</td>
<td>2.89 (&lt;0.001)</td>
<td>2.41 (&lt;0.001)</td>
<td>2.52 (&lt;0.001)</td>
</tr>
<tr>
<td>2006</td>
<td>4.00 (0.056)</td>
<td>3.64 (&lt;0.001)</td>
<td>3.69 (0.001)</td>
</tr>
<tr>
<td>2007</td>
<td>4.41 (0.201)</td>
<td>4.22 (0.005)</td>
<td>4.12 (0.042)</td>
</tr>
<tr>
<td>2008</td>
<td>3.19 (&lt;0.001)</td>
<td>2.83 (&lt;0.001)</td>
<td>2.83 (&lt;0.001)</td>
</tr>
<tr>
<td>2009</td>
<td>3.69 (&lt;0.001)</td>
<td>3.52 (&lt;0.001)</td>
<td>3.53 (&lt;0.001)</td>
</tr>
</tbody>
</table>

17. Being aware of various outcomes of drug therapy will make a difference in the way that I study/studied my courses this year.

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Mean Presurvey</th>
<th>Mean Postsurvey</th>
<th>Significance</th>
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<tr>
<td>2003</td>
<td>4.07 (0.312)</td>
<td>4.01 (0.369)</td>
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<td>2004</td>
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<td>2.41 (&lt;0.001)</td>
<td>2.52 (&lt;0.001)</td>
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<tr>
<td>2005</td>
<td>4.00 (0.056)</td>
<td>3.64 (&lt;0.001)</td>
<td>3.69 (0.001)</td>
</tr>
<tr>
<td>2006</td>
<td>4.41 (0.201)</td>
<td>4.22 (0.005)</td>
<td>4.12 (0.042)</td>
</tr>
<tr>
<td>2007</td>
<td>3.19 (&lt;0.001)</td>
<td>2.83 (&lt;0.001)</td>
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</tr>
<tr>
<td>2008</td>
<td>3.69 (&lt;0.001)</td>
<td>3.52 (&lt;0.001)</td>
<td>3.53 (&lt;0.001)</td>
</tr>
<tr>
<td>2009</td>
<td>3.52 (0.40)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18. I can explain techniques to assess outcomes of health care.

<table>
<thead>
<tr>
<th>Year of Study</th>
<th>Mean Presurvey</th>
<th>Mean Postsurvey</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>4.00 (0.312)</td>
<td>4.01 (0.369)</td>
<td>3.96 (0.042)</td>
</tr>
<tr>
<td>2004</td>
<td>2.89 (&lt;0.001)</td>
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</tr>
<tr>
<td>2009</td>
<td>3.52 (0.40)</td>
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</tbody>
</table>

19. My knowledge of outcomes will be important for determining reimbursement.

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<th>Mean Postsurvey</th>
<th>Significance</th>
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<tbody>
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</tr>
<tr>
<td>2009</td>
<td>3.52 (0.40)</td>
<td></td>
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</tr>
</tbody>
</table>

20. It is the pharmacist’s responsibility to help patients achieve their desired outcomes of drug therapy.

<table>
<thead>
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<th>Significance</th>
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<tr>
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</tr>
<tr>
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<td>3.52 (0.40)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Mixed Construct**

14. I know the questions to ask in order to obtain patient outcome information. (Knowledge, Responsibility)

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<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>3.19 (0.999)</td>
<td>2.83 (0.333)</td>
<td>2.83 (0.21)</td>
</tr>
<tr>
<td>2004</td>
<td>2.83 (0.999)</td>
<td>2.83 (0.21)</td>
<td>3.10 (0.03)</td>
</tr>
<tr>
<td>2005</td>
<td>3.69 (0.999)</td>
<td>3.52 (0.51)</td>
<td>3.53 (0.18)</td>
</tr>
<tr>
<td>2006</td>
<td>3.52 (0.999)</td>
<td>3.52 (0.40)</td>
<td>3.52 (0.40)</td>
</tr>
</tbody>
</table>

16. Health care outcomes can be measured. (Knowledge, Beliefs, Responsibility)

<table>
<thead>
<tr>
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<tr>
<td>2006</td>
<td>3.52 (0.999)</td>
<td>3.52 (0.40)</td>
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</table>

*Five-point Likert scale: 5=strongly agree, 4=agree, 3=undecided, 2=disagree, 1=strongly disagree.
†Significance level at 0.05.
‡Because this hypothesis was 1-tailed and SPSS® reported the 2-tailed significance values, the P values on the output were divided by 2 to yield the P values listed as suggested by Cronk.27
on the postsurvey. Mean increase across the total sample on the postsurvey for responsibility-related items was 2.01 points (range of 18.42 to 20.43 points), with female students as a whole increasing their scores the most (2.17 points), and older students as a whole increasing their scores the least (1.83 points). Again, one reason that postsurvey scores may not have improved more is that they were also already fairly high at the beginning of the year, denoting that students at the start of their P3 year already thought the pharmacist has a responsibility for improving patient care outcomes.

**Mixed Construct.** Items 14 and 16 both had a mixed factor loading and exhibited features of more than 1 of the 3 constructs discussed above. Of these hybrid items, 100% (10/10) had favorable, statistically significant results across the 5 years of data on the postsurvey.

**Hypothesis #2**

The second hypothesis was that neither gender nor age would be significantly related to the pre- or postsurvey score. A 2-factor MANOVA was used with the pre- and postsurvey mean total scores serving as the 2 dependent variables; gender and age were the 2 independent variables. Due to some missing data regarding age and gender, only 377 of the 393 total usable survey responses were used to assess these 2 variables in the MANOVA.

There were no statistically significant differences found between males and females on either the pre- or the postsurvey mean total scores (Figure 1) \([\text{Lambda} (2, 372) = 0.28, P=0.75]\). There were also no statistically significant differences between the older and younger students on the pre- and postsurvey mean total scores (Figure 2) \([\text{Lambda} (2, 372) = 0.71, P=0.49]\). Not surprisingly, there were also no statistically significant differences between the gender or age categories and any of the perceived knowledge, beliefs, or responsibilities constructs. Although their changes from the pre- to the postsurvey scores were not significantly different from other categories of students, younger females showed the most improvement (mean increase of 10.74 points), while older females in the sample showed the least improvement (mean increase of 7.09 points). All combinations of age and gender had more favorable scores on the postsurvey than they did on the presurvey.

**DISCUSSION**

Concerning the first hypothesis, there were favorable differences between the pre- and postsurvey mean total scores in each of the 5 study years. This indicates that students’ perceived knowledge, beliefs, and responsibilities about health care outcomes were more favorable at the end of the year than they were at the beginning of the year. Of these 3 constructs, the knowledge items had the highest percentage of favorable, results (96%), followed by those items assessing responsibility (60%) and beliefs (35%). Students had a mean improvement of 9.30 points on the postsurvey, with their perceived increase in knowledge accounting for over half of this increase (5.48 points). It is encouraging to see that students thought their knowledge of health care outcomes had increased over the course of the year.
Concerning the second hypothesis, neither age nor gender was found to be significantly related to pre- or postsurvey scores, either on all survey items as a whole or on the 3 main constructs of knowledge, beliefs, and responsibilities. In general, males scored higher than females on the presurvey, older students scored higher than younger students on the presurvey, and younger females showed the most improvement from the pre- to the postsurvey. However, none of these differences was statistically significant.

Overall, the greatest improvement in score from the pre- to the postsurvey was shown by students in year 2 (mean increase of 14.14 points), followed by students in year 5 (mean increase of 11.75 points), students in year 3 (mean increase of 10.97 points), students in year 1 (mean increase of 6.51 points), and students in year 4 (mean increase of 4.48 points). Reasons for the differences in improvement over the 5-year period are unclear. Possible explanations include variability in student attention to or retention of outcomes-related material, timing of the postsurvey in relation to course content on outcomes, and more consistent references by faculty to the ECHO model in some years.

**Limitations**

There were several limitations to this study. First, although the authors reviewed the survey items extensively, the instrument was not examined by others for content validity. Second, no information was collected regarding the specific course content related to outcomes that was covered in the P3 year of the curriculum. Third, no respondent follow-up was conducted in any year of the study. Therefore, not all students completed both a pre- and a postsurvey, resulting in a loss of some comparative data in the final sample. Fourth, because unique respondent identifiers were recorded in only 3 of the 5 years of the study, a paired sample t test could not be performed on 2 years of the data. For years 1 and 4, providing a line at the top of the survey on which the students could have written their unique identifier may have minimized the problem. Nevertheless, both the 2 years of unmatched respondent data and the 3 years of matched respondent data generated statistically significant results across all 5 years, as shown in Table 2.

Finally, the data represent a population of third year students at only one school of pharmacy; therefore, results are not necessarily generalizable to other schools or colleges of pharmacy. Additional study is warranted to determine how student attitudes and opinions related to health care outcomes at our school compare with those of students in other schools of pharmacy or in different years of the professional curriculum.

**CONCLUSIONS**

Monitoring for drug-related problems in order to prevent, identify, or resolve such issues is paramount to a pharmacist’s responsibility. Thus, pharmacy students must realize that they personally can affect patient outcomes every day of their practice. Incorporating information about economic, clinical, and humanistic outcomes into existing courses as suggested by Draugalis and Jones-Grizzle\(^2\)\(^3\) seemed to work well in the P3 curriculum at our school of pharmacy. However, more integration and communication among the faculty about including these 3 dimensions of the ECHO model across courses is warranted to consistently present the importance of outcomes assessment that permeates our present health care culture.
Implications for further research are plentiful. Future studies could build on the perceived knowledge assessed here by devising a mechanism to assess actual knowledge of students about health care outcomes and their ability to measure these in their professional practice sites. One could also compare the results from this study with the responses from pharmacy practitioners across several settings or across multiple disciplines such as nursing or medicine. A cross-sectional study could also assess students’ perceived knowledge, beliefs, and responsibilities of health care outcomes across each of the 4 years of the professional pharmacy curriculum.

Health care professionals are accountable for the outcomes that they produce. Thus, health care outcomes measurement is and will continue to be an essential component of a health professional’s education. Pharmacy educators are challenged to provide thought-provoking, comprehensive methods of incorporating information about economic, clinical, and humanistic patient care outcomes into the daily complexities of learning in a professional program. Exposing students to these topics is crucial to their understanding and valuing the purpose, responsibilities, and opportunities of health care outcomes.

REFERENCES