



Research Article

Student pharmacists' knowledge of biostatistical and literature evaluation concepts[☆]

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Abstract

Background: Pharmacists must have working knowledge of biostatistical and literature evaluation concepts in order to accurately interpret data from the primary literature and deliver effective patient care. Therefore, it is important for colleges and schools of pharmacy to provide graduates with a strong foundation in biostatistics knowledge.

Objective: To assess student pharmacists' knowledge with regard to biostatistics and literature evaluation concepts during each year of a professional degree program.

Methods: A previously validated Biostatistical Knowledge Test Survey Instrument (BKTSI) was administered to all students in the graduating class of 2013 on an annual basis as they progressed through P1–P4 years of the curriculum.

Results: Response rates were 79% (131/166), 88% (146/165), 73% (115/158), and 70% (109/156), during the P1, P2, P3, and P4 years, respectively. The mean BKTSI scores were $44.5\% \pm 10.6$, $49.5\% \pm 12.4$, $45.0\% \pm 12.9$, and $47.1\% \pm 14.2$ during the P1, P2, P3, and P4 years, respectively. BKTSI scores were numerically higher in the P2 year compared to the P1 and P3 years.

Conclusion: Although an improvement in mean BKTSI score was seen early in the curriculum, a trend toward improvement was not observed over the entire four-year period. These results underscore the importance of continued emphasis and application of biostatistical and literature evaluation concepts throughout pharmacy training.

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Introduction

Pharmacists need to have a working knowledge of biostatistical concepts in order to accurately interpret data from the primary literature and practice evidence-based medicine. The 2016 Accreditation Council for Pharmacy Education (ACPE) Standards and Key Elements for the Professional Program in Pharmacy Leading to the Doctor of Pharmacy Degree (“Standards 2016”) recognize biostatistics as a required element of the biomedical sciences within the didactic curriculum.¹ Additional required elements include evaluation of research methods, evaluation of the validity

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and reliability of the conclusions of published research studies, and application of published medical literature to provide evidence-based therapeutic recommendations.¹ Biostatistical concepts are critical for students as they incorporate each of these elements to develop an approach to patient-centered care.

A number of published reports have highlighted deficiencies in health care professionals' knowledge of biostatistical concepts presented in the medical literature.^{2–7} Windish et al.³ administered a multiple-choice biostatistical knowledge test to 277 internal medicine residents. Questions were developed based on the most common statistical methods used in contemporary research published in six of the top general medical journals (e.g., *New England Journal of Medicine*, *Journal of the American Medical Association*, and *Lancet*) in 2005. The average medical resident biostatistical knowledge score was 41%. Bookstaver⁸ administered a similar, but slightly modified, biostatistical knowledge test to 214 pharmacy residents who were completing accredited, post-graduate year one (PGY1) residency programs. The average pharmacy resident biostatistical knowledge score was slightly higher than that of medical residents at 47%. Other surveys have been administered to other health care professionals, with similar results.^{5,6} The intent of this narrative is to highlight that significant opportunities exist for improvement in the biostatistical instruction of future health care professionals. In addition to the scores noted above, Windish et al.³ reported that senior residents performed worse than junior residents, suggesting a loss of biostatistical knowledge over time and a need for reinforcement.

More recently, program directors from accredited PGY1 pharmacy residency programs were surveyed regarding their satisfaction with the biostatistical knowledge of their residents.⁹ Although residency program directors were generally satisfied with their residents' abilities to interpret biostatistical concepts, only 51% were confident in their "residents' ability to discuss statistical methods utilized in evidence-based medicine with colleagues."⁹ Additionally, residency program directors expressed the importance of colleges and schools of pharmacy to provide graduates with a strong foundation in biostatistics knowledge.

Given the importance of biostatistics instruction and the lack of published data evaluating the competency of pharmacy students, the objective of this study was to assess student pharmacists' knowledge with regard to biostatistics and literature evaluation concepts across each of the four years of a professional degree program for the graduating class of 2013. A description of the biostatistics curriculum when the study was conducted has been published in a previous article.¹⁰

Methods

We administered an online survey instrument based on the Biostatistical Knowledge Test Survey Instrument (BKTSI).³ This instrument was developed by the

researchers at Yale University School of Medicine, based on the most common statistical methods used in contemporary research published in six of the top general medical journals (e.g., *New England Journal of Medicine*, *Journal of the American Medical Association*, and *Lancet*) in 2005. It was pilot tested by medicine faculty with advanced training in biostatistics who reviewed the content for validity and suggested revisions. The BKTSI has been previously used in medical residents, orthodontic graduate students, and pharmacy residents.^{3,5,8} The survey instrument was administered to all Purdue University Doctor of Pharmacy students in the graduating class of 2013 on an annual basis as they progressed through the professional program. The survey consisted of the following three parts: (1) demographics; (2) self-perceived confidence in statistical abilities; and (3) the BKTSI. In the first section, demographic information was collected including sex, age, degrees prior to pharmacy school, and previous education in biostatistics, epidemiology, and evidenced-based practice. The confidence portion consisted of eight items rated on a 5-point Likert-type scale relative to the student's own perception or confidence in their statistical knowledge. The last section, the BKTSI, consisted of 20 questions and was previously administered and validated in several studies to medical residents, pharmacy residents, and other health care professionals. The topics covered by the instrument have been previously described.³ The BKTSI questions are either multiple choice with one correct answer or short answer fill in the blank.

We conducted the survey from December 2009 to April 2013 of students in the Class of 2013. Students received an electronic invitation to their university e-mail address to complete the survey on four separate occasions:

- 1) December 2009—following completion of the biostatistics course in the P1 year
- 2) December 2010—following completion of the drug information and literature evaluation course in the P2 year
- 3) April 2012—following completion of the Integrated therapeutics laboratory sequence in the P3 year
- 4) April 2013—at the conclusion of the Advanced Pharmacy Practice Experience (APPE) in the P4 year of the curriculum

On each occasion, the survey link remained open for a time period of approximately three weeks, with one reminder e-mail. As an incentive for participation, students were awarded extra credit points during the P1, P2, and P3 years. During the P4 year, students who participated received a \$5 coffee gift card. All responses were anonymous. Qualtrics[®] Research Suite (Provo, UT) was used to provide the survey in an electronic format. The project was granted exempt status by the Indiana University–Purdue University Indianapolis (IUPUI) Institutional Review Board.

The primary outcome measure was the sum percent score of the BKTSI. The BKTSI was scored by determining

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