Area of Concentration in PharmacoAnalytics (ARCO-PA) in the Doctor of Pharmacy (PharmD) Program

Purpose

The purpose of the Area of Concentration in PharmacoAnalytics (ARCO-PA) in the School of Pharmacy is to allow students to learn and implement data analysis techniques while completing their PharmD degree. The ARCO-PA is designed to help students utilize data and technology to enhance pharmaceutical use, operations, and outcomes and drive better quality patient care while also providing pharmacists with the tools and knowledge necessary to analyze trends from large data sets and then interpret these trends in a way that allows them to improve their daily practice. Students will become acquainted with big data sources, managing data, data analytic techniques from experience with statistical and analytics software to apply towards decision-making processes in the pharmacy field, including drug development, drug pricing and acquisition, and patient care outcomes.

Description

Background

Pharmacists are health care advocates and an integral member of the health care team that provides patient care. Pharmacists specialize in pharmaceutical care, in which they maintain the responsibility of managing the safe and effective use of drug therapies intended to improve the well-being of patients and communities. Technology and data are becoming increasingly more important to optimize pharmaceutical use and outcomes. Pharmacists are key contributors to pharmacoepidemiology analyses. Pharmacists often contribute to institutional quality improvement initiatives. Also, it is becoming more common in practice for pharmacists to be part of the data analytics team due to their background knowledge of the medications as well as their understanding of statistical methods necessary to analyze large data sets. Pharmacists use statistical tools to learn more about disease states, pharmacological aspects of drugs, and to provide others with high quality evidence-based recommendations from collecting data. Pharmacy students learn about the mechanisms of drug action, indications, side effects, drug-drug interactions and apply their knowledge and skills to now obtain a Doctor of Pharmacy degree.

Current Need

Health-information technology will play a bigger role in the reduction of health care costs, improving the quality of care, and increase the operational efficiency of health care systems. Using health-information technology will include databases containing information that can be leveraged to create innovative models that will transform the health care industry. Studies have been done to show the benefit of combining knowledge driven and data driven insights to identify risk factors using health records. In a study performed by IBM, data and knowledge risk factors were compared using a statistical performance metric, and it was found that the addition of data driven features enhanced the predictability performance of the model. Even more interesting is that six out of the top ten data-driven features were related to medications.[2] A big data/data analytics course will teach pharmacy students how to identify and answer clinical and community needs which big data can solve. Opportunities exist to improve medication adherence, efficiency of generating prescriptions, reduce medication errors, and identify appropriate medication use for indications. The content area covered in the program will be applicable to other health professionals wanting to improve health care delivery utilizing technology. For example, pharmacists and physicians can reduce wasteful medication spending by incorporating patient genomic analytics as a part of the prescribing process. We want to search and discover the evolving data that can answer complex questions in different areas of pharmacy. Pharmacists can incorporate data into their current understanding to study the effective use of medicines and drug therapy interventions that improve the well-being of patients they care for.

The recent payment shift from volume to value has incentivized the implementation of interventions that optimize pharmaceutical use and outcomes.[1-5] The increased quality, granularity and accessibility to electronic patient data has created a unique opportunity to orient the implementation of these strategies towards patients who can benefit the most from them. For example, large data bases and advanced data analysis techniques can be used to direct pharmacists' time towards those patients whose clinical outcomes can improve the most as a consequence of their interventions. In addition, predictive analytics can be used in predicting pharmaceutical outcomes, which will enable pharmacists to have a better understanding of the risks for specific medication-related problems that each patient faces.[6] However, in order to take full advantage of these benefits, clinicians will likely require some understanding of predictive analytics.[6] For this reason, it is important to include the basics of big data and predictive analytics in the PharmD training. Our ARCO-PA will address this need, by exposing PharmD students to early experiences in the use of data to optimize pharmaceutical operations, pharmaceutical use, and outcomes. This curriculum will empower students to develop a deep understanding of the pharmaceutical sciences, recognize and address drug therapy needs of patients, and advocate for pharmacist-expanded involvement in health care systems as technology and data become more valuable and more readily available to improve health care.

Academic Requirements

Students who wish to enroll in the ARCO-PA must complete a total of 16 credit hours of coursework and rotations (i.e., 6 credits of approved elective courses and ten (10) credits from two APPE rotations aligned with the learning outcome for the ARCO and approved by the ARCO oversight committee and director of experiential learning). Students must also complete an approved scholarly project under a faculty advisor.

Coursework

Students must complete coursework that has been approved by the ARCO-PA oversight group to fulfill the requirements. Students may select from the courses below and are to be completed after the first professional year. Additional courses a student wishes to pursue will be evaluated by the oversight group for approval. Students wishing to receive credit may enroll in "Special Topics" or conduct the project as a part of their P4 rotation. Enrollment in Special Topics course does require the approval from the chair of the Curriculum Committee. The School of Pharmacy approved courses are listed in Table 1.

Experiential Rotations

In compliance with the requirements of the ARCO-PA, students must complete two APPE rotations that require the use of data. Students accepted into this ARCO will have meetings with faculty from the oversight group to discuss selection of APPE rotations. Students will choose from a list of APPE rotations that meet the requirements established by the ARCO-PA. Students may also choose to create proposal with the faculty oversight committee to add new APPE rotations that would be submitted to the director of experiential learning for quality assurance and approval.

Project

As part of the ARCO-PA, students must complete a project under the supervision of a faculty member. Once accepted into the ARCO-PA, students will meet with the ARCO-PA coordinator to discuss suitable project ideas and identify faculty mentors. While the project is required, completing it "for credit" is not. Students may elect to work on the project for credit by enrolling in a Special Topics or Independent Study course. Students should consult the School of Pharmacy Academic Records Manager for enrollment information for Special Topics courses. Projects must have pharmacoanayltics implications and/or impact. Students must have their project proposed and approved by the ARCO-PA coordinator and project preceptor prior to the beginning of the P4 year. Project assessment will be based on a formal presentation to the oversight group and a written report. Student pharmacists are encouraged to present their work at local, national, and international conferences (e.g. PPA, ASHP).

Student Application Process

Application to the ARCO-PA includes submission of a letter of intent with a discussion of the anticipated value from enrollment in the ARCO, professional portfolio with either résumé or CV, permission for the oversight committee to review the applicant's academic transcript, and an interview with a member of the oversight committee upon request from the committee.

ARCO-PA Oversight Group

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References

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5. Roebuck MC, Liberman JN, Gemmill-Toyama M, Brennan TA. Medication Adherence Leads To Lower Health Care Use And Costs Despite Increased Drug Spending. *Health Aff.* 2011;30(1):91-99. 10.1377/hlthaff.2009.1087
6. Hernandez I, Zhang Y. Using Predictive Analytics and Big Data in Optimizing Pharmaceutical Outcomes. *Am J Health Syst Pharm.* 2017;In press

Table 1: Elective Courses Already Approved by the School of Pharmacy Curriculum Committee that Fulfill ARCO-PA Requirements

Course Number	Course Title	Description	Term Offered	Units
PHARM 5851-5858	Special Topics	Student has the opportunity to explore a pharmaceutical research or pharmaceutical care topic on an individual or small group basis with the oversight of a faculty member. Generally, the successful completion of a project is required.	Fall/Spring	1-3
PHARM 3045	Advanced Statistical Methods	Course is designed to teach graduate students advanced statistical methods of data analysis. Where appropriate and consistent with the student's' educational background, theoretical foundations for statistical methods will be discussed. Students will obtain skills necessary to analyze complex data sets and to identify and apply methods appropriate for solving statistical problems presented during class sessions, in homework assignments, and in exams. At the end of the course, students will have skills to construct and test complex statistical models and will be able to understand statistical methods used in research articles and critique the methods selected. Experience and Skills Gained: Statistical Concepts	Spring	3
PHARM 3073	Applied Multivariate Statistical Analysis in Pharmaceutical Sciences	This course is designed to teach graduate students multivariate statistical methods. Where appropriate and consistent with the students' educational background, theoretical foundations for multivariate statistical methods will be discussed. Students will obtain skills necessary to analyze complex data sets and to identify and apply multivariate statistical methods appropriate for analyzing complex data sets and statistical problems presented during class sessions, in homework assignments, and in an exam. At the end of this course, they will have skills to construct and test and analyze complex statistical models. Furthermore, they will be able to understand multivariate statistical methods used in research articles and critique the methods selected. The major topics covered in this course will be (1) matrix and vector algebra, (2) measures of central tendency, dispersion, and association, (3) graphical display of multivariate data, (4) multivariate normal distribution, (5) inference for means, (6) multivariate regression, (9) multivariate analysis of variance, (10) canonical correlation coefficient, (11) repeated measures analysis, (12) principal component analysis, (13) factor analysis, (14) cluster analysis, (15) discriminant analysis, classification and pattern recognition. Students will be required to apply statistical software packages, such as STATA, SPSS, SAS, R or other appropriate programs.	Spring	3
PHARM 5830	Discovering Scientific Inquiry	The primary purpose of the course is to adequately prepare learners to execute an outcomes research-based project during the P4 curriculum. As a required component of the pharmacotherapy scholars program, this course will enable P3 students in the spring semester to design a study, submit the required institutional review board documents, and strengthen their data analysis skills. Experience and Skills Gained: Decision Analysis and Optimization	Spring	3
PHARM 5834	Python for Data Management & Analytics	This course will provide an introduction to programming, data processing, and data analytics using Python for highly motivated students with little or no prior experience in programming. The course will focus on learning the Python programming language in the context of working with data, planning and organizing programs, commonly-used algorithms, data management, data cleaning, and basic data mining.	Spring	3
BIOST 2041	Statistical Methods	Discusses techniques for the application of statistical theory to actual data. Topics include probability theory, estimation of parameters, and tests of hypothesis for both the discrete and continuous case. Experience and Skills Gained: Statistical Concepts	Fall	3

BIOST 2049	Applied Regression Analysis	This is an introductory course in statistical modelling intended for Masters or PhD students in biostatistics or other disciplines who have already had basic training in statistical methods. The course focuses on all types of regression methods with the following learning objectives: To fit and interpret linear regression models with multiple continuous and/or categorical predictors. To fit and interpret generalized linear models (GLMs) with emphasis on logistic and Poisson regression. To justify and apply standard modelling procedures using data, including model interpretation and assessment of model adequacy. To analyze data sets taken from the fields of medicine and public health. To develop oral and written communication skills through the description of analytic strategies and the summarization and interpretation of results.	Spring	3