Proposal to establish an Area of Concentration in Data Analytics (ARCO DA)
University of Pittsburgh School of Pharmacy

Faculty Oversight Group
Dr. Sandra L. Kane-Gill, PharmD, MS, FCCM, FCCP
Dr. Inmaculada Hernandez, PharmD, PhD
Dr. Levent Kirisci, PhD

List of School of Pharmacy Department(s) and/or Program(s) impacted by the addition of the ARCO
Pharmacy and Therapeutics
Pharmaceutical Sciences

Date Submitted
October 23rd, 2017

Maximum Number of Students Admitted to the ARCO-DA Annually
6

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.\textsuperscript{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. 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. However, in order to take full advantage of these benefits, clinicians will likely require some understanding of predictive analytics. For this reason, it is important to include the basics of big data and predictive analytics in the PharmD training. Our ARCO-DA 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.

**Purpose**

The purpose of the Area of Concentration in Data Analytics (ARCO-DA) in the School of Pharmacy is to allow students to learn and implement data analysis techniques while completing their PharmD degree. The ARCO-DA 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.

**Proposal**

A program would be established to provide students with the tools necessary to determine pharmacy-related needs where data can be useful for interpretation and application. Data can be further analyzed and compared by referring to current scientific literature to assess the validity of their data.

The scope of the initial approved courses in the ARCO-DA would provide students with an introduction to statistical analysis, data reporting and management, and evidence-based clinical decision making sources. Incorporation of these topics in the current curriculum will prepare pharmacy students to better read the data that can answer questions of providing optimal care that serves the needs of the patients. For example, it would be beneficial for a pharmacy student to examine a dataset and interpret that patients with hypertension respond better to drug A over drug B. Pharmacy students can develop their own projects to evaluate their intervention by utilizing clean data to analyze and assemble predictive models with different tools for forecasting that may or may not show desired results.
Experience and Skills Gained

- **Data visualization**: Recognize the details and observations from the data to determine how to proceed with creating predictive models that is best represented from the data.
- **Data management**: Understand database design concepts, sources of data, and utilization of database software.
- **Decision Analysis and Optimization**: Develop a mathematical map of the entire decision structure and optimizing strategies to identify the most effective action to a variety of applications.
- **Statistical Concepts**: Application of statistical methods to analyze data utilized for solving problems and decision-making processes.
- **Statistical Modeling tools**: Understand and use statistical software programs such as Statistical Analysis System (SAS) for predictive modeling and data mining.

Academic Requirements

Students who wish to enroll in the ARCO-DA must complete a total of 16 credit hours of coursework and rotations (i.e., 6 credits of approved elective courses and 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-DA 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.

In compliance with the requirements of the ARCO-DA, 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-DA. 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.

Pitt Pharmacy Outcomes Addressed by the Area of Concentration

1. **Learner**: The student will develop, integrate, and apply the breadth and depth of foundational knowledge and skills needed to advance population health and patient-centered care. Use critical thinking skills to retrieve and evaluate the scientific literature in order to make appropriate decisions, identify, solve, and prevent therapeutic problems in order to advance population health and patient-centered care.

7. **Problem Solver**: The student will identify problems; explore and prioritize potential strategies; design, implement and evaluate a viable solution.

10. **Collaborator**: The student will demonstrate a commitment a professional involvement, community service, and leadership by developing and achieving shared goals. The student will collaborate as an integral part of an interprofessional team, inclusive of patients, caregivers, colleagues, health professionals, and members of the community to make patient-centered pharmacotherapy decisions, and care plans; prevent, identify, and resolve drug-related problems; and promote patient-centered and population-based health. The student will actively participate and engage as a health care team member by demonstrating mutual respect, understanding, and values to meet patient care needs.
Project
Under the supervision of a faculty advisor, each student will be required to complete a project related to the use of data analytics. This is an opportunity for students to apply their statistical knowledge with their pharmaceutical analysis skills in practice. Students will coordinate and consult with their faculty advisor for project ideas and a timeline of completion. Acceptable projects will include those that require a hands-on manipulation and analysis of a large database.

Application Process
Application to the ARCO-DA 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.

University of Pittsburgh Departments Involved
ARCO-DA students will take classes from the School of Pharmacy, the School of Health Information Management, the School of Information Sciences, and the Clinical and Translational Science Institute. In selected classes from these schools, the ARCO-DA would require up to 6 seats to be reserved (see proposal for selected classes). By introducing pharmacy students into other schools the ARCO-DA will encourage interprofessional collaboration across multiple schools at the University that may not normally intersect or communicate. This will allow for a unique opportunity to build collaborations and research projects across schools.

Budget
Budget impact from the introduction of the ARCO-DA will be minimal. The classes included in the ARCO-DA are regularly offered, and only a maximum of 6 seats in selected classes will need to be held for ARCO-DA students. The oversight committee will consist of faculty members that already have a dedicated commitment and research program with the School of Pharmacy; thus, they will not require any extra compensation. It is appreciated that faculty will need to balance the ARCO-DA related activities with their other projects but the goal would be to have the students enrolled in the ARCO-DA provide assistance with their ongoing research activities. There will not be any extra materials that will need to be provided for the coursework by the School of Pharmacy outside of paper prints/handouts.

Evaluation
Evaluation plan for the ARCO includes completion of the necessary credit hours and two approved APPE rotations, as well as the completion of the project that will be presented to the oversight committee at the end of the program.

The oversight committee and the Curriculum Committee will evaluate the ARCO-DA every two years. The evaluation will include a review of the following measures:

- Number of applicants per class
- Number of participants per class
- Annual survey of student satisfaction with the ARCO-DA
- Student performance in ARCO-DA requirements
- Number of posters presented by students
- Number of presentations or conferences attended by students
- Number of posters publications by students
- Student post graduation plans
<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Description</th>
<th>Term Offered</th>
<th>Units</th>
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<tbody>
<tr>
<td>PHARM 5851</td>
<td>Special Topics</td>
<td>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.</td>
<td>Fall/Spring</td>
<td>1-3</td>
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<tr>
<td>PHARM 3045</td>
<td>Advanced Statistical Methods</td>
<td>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.</td>
<td>Spring</td>
<td>3</td>
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<tr>
<td>PHARM 5830</td>
<td>Discovering Scientific Inquiry</td>
<td>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.</td>
<td>Spring</td>
<td>3</td>
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<tr>
<td>BIOST 2041</td>
<td>Introduction to Statistical Methods 1</td>
<td>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.</td>
<td>Fall</td>
<td>3</td>
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<tr>
<td>BIOST 2042</td>
<td>Introduction to Statistical Methods 2</td>
<td>More techniques are given for the application of statistics to actual data with emphasis on distribution-free and multivariate methods. Interpretation of results and concepts will be stressed.</td>
<td>Spring</td>
<td>3</td>
</tr>
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References


