Commentary

Advancing Pharmacogenomics-Based Care Through Interprofessional Education

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ABSTRACT

As genomic medicine becomes increasingly complex, pharmacists need to work collaboratively with other healthcare professionals to provide genomics-based care. The core pharmacist competencies in genomics were recently updated and mapped to the entrustable professional activities (EPAs). The new competency that is mapped to the “Interprofessional Team Member” EPA domain emphasizes the role of pharmacists as the pharmacogenomics experts in an interprofessional healthcare team. Interprofessional education (IPE) activities involving student pharmacists and students from other healthcare disciplines are crucial to prepare student pharmacists for a team-based approach to patient-centered care. This commentary discusses the pharmacogenomics-focused IPE activities implemented by 3 programs, the challenges faced, and the lessons learned. It also discusses strategies to develop pharmacogenomics-focused IPE activities based on existing resources. Developing pharmacogenomics-focused IPE activities will help prepare pharmacy graduates with the knowledge, skills, and attitudes to lead collaborative, interprofessional teams in the provision of pharmacogenomics-based care, consistent with the standards described in the genomics competencies for pharmacists.

1. Introduction

As genomic testing becomes more widespread, health care professionals will encounter patients presenting their genetic test reports for interpretation and integration into their care. Pharmacists across practice settings are increasingly consulted on how to interpret and apply pharmacogenomic results to medication prescribing, given their extensive education and training in pharmacokinetics and pharmacodynamics. Pharmacogenomics is a required element of United States (U.S.) pharmacy programs, with many schools offering stand-alone pharmacogenomics courses. In contrast, U.S. medical school curricula spend minimal time (≤10 h, if any) on pharmacogenomics instruction. It is no surprise, then, that many of the nation’s clinical pharmacogenomics programs are led by pharmacists. However, the ever-evolving complexities of genomic medicine and its implementation into clinical practice require pharmacists to have the knowledge and skills to effectively collaborate with other health care professionals to provide patient-centered, genomics-based care.

Interprofessional education (IPE) is an important pedagogical approach that prepares future pharmacists for collaborative, team-based, patient-centered care. According to the World Health Organization, IPE occurs “when students from 2 or more professions learn about, from, and with each other to enable effective collaboration and improve health outcomes.” The 2016 Accreditation Council of Pharmacy Education Standards has a dedicated standard (Standard 11) for IPE, and threads interprofessional collaboration across several other standards. The American Association of Colleges of Pharmacy (AACP) IPE Task Force provides IPE definitions, including examples of activities that are not considered IPE (1) students from different healthcare programs receiving the same learning instruction without reflective interaction;
A Comparison of Pharmacogenomics-focused Interprofessional Education Activities.

Table 1

<table>
<thead>
<tr>
<th>In-person pharmacist-to-physician IPE</th>
<th>Telehealth-based pharmacist-to-physician IPE</th>
<th>In-person pharmacist-to-physician assistant IPE</th>
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</thead>
<tbody>
<tr>
<td>Students Involved</td>
<td>Students Involved</td>
<td>Students Involved</td>
</tr>
<tr>
<td>One to 2 P3 students paired with 1 M1 student</td>
<td>Two P3 students paired with 6 M1 students</td>
<td>Three to 4 P2 students paired with 1–2 PA2 students</td>
</tr>
<tr>
<td>Three pharmacists and 1 medical school faculty</td>
<td>Two pharmacists, 1 pharmacologist, 1 medical ethicist, and 2 physicians</td>
<td>Two pharmacy instructors</td>
</tr>
<tr>
<td>Activity: 5 patient cases per group</td>
<td>Activity: 1-hour large group conferencing (12 groups) to review a patient case, 30-minute individual group conferencing, and 30-minute discussion within each discipline to discuss their assigned patient case</td>
<td>Activity: Entire group watches a presentation followed by a patient case discussion within the group</td>
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<tr>
<td>Duration: 3 h</td>
<td>Duration: 2 h</td>
<td>Duration: 1 h</td>
</tr>
<tr>
<td>Teaching method: In-person</td>
<td>Teaching method: Online group meeting using PolyCom conferencing and team discussions via Google Hangouts</td>
<td>Teaching method: In-person</td>
</tr>
<tr>
<td>Assessment method</td>
<td>Student survey pre/postactivity adapted from the Scale of Attitudes Toward Physician-Pharmacist Collaboration (SATP-C) to assess students’ attitudes and perceptions surrounding physician-pharmacist collaboration, IPE, and PGx knowledge base</td>
<td>Student survey pre/postactivity to assess students’ knowledge and application of PGx and working in interdisciplinary teams</td>
</tr>
<tr>
<td>IPE activity facilitated peer teaching. Both pharmacy and medical students reported greater confidence in applying PGx postactivity. Although it did not alter their recognition of each other’s role in a statistically significant manner, students had an increased awareness of each other’s disciplines that would facilitate future reliance on each other as healthcare providers</td>
<td>IPE activity promoted interprofessional team dynamics, team education, and PGx knowledge. M1 students’ PGx confidence increased even though the only PGx instruction they received was from P3 students</td>
<td>IPE activity enhanced students’ PGx knowledge and confidence in working in interdisciplinary teams to apply PGx. Students engaged in peer teaching and learned to communicate conflicting viewpoints collegially</td>
</tr>
<tr>
<td>Challenges encountered</td>
<td>Technology issues encountered, such as students being temporarily locked out of the session</td>
<td>Finding other healthcare programs to partner with and create the IPE experience</td>
</tr>
<tr>
<td>Future suggestions</td>
<td>Scale up by offering this telehealth-based IPE activity more often during the academic year and/or involve more learners</td>
<td>Pre-record the presentation for students to watch prior to the IPE session. This creates extra time for in-class discussion. Move IPE online to overcome the geographical barrier of students not co-located on the same campus</td>
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Abbreviations: IPE, interprofessional education; M1, first-year medical student; PA2, second-year physician assistant student; PGx, pharmacogenomics; P2, second-year pharmacy student; P3, third-year pharmacy student.

Example 1. In-person Pharmacist-to-Physician IPE.

An example of an in-person pharmacist-to-physician IPE activity involving third-year student pharmacists and first-year medical students was implemented by the Manchester University Pharmacy Program in collaboration with Indiana University Medical School. This 3-hour IPE event was optional for student pharmacists but a requirement for medical students. Each team had 1–2 third-year student pharmacists paired with 1 first-year medical student, with student pharmacists having received pharmacogenomics education while the medical students had no prior pharmacogenomics education. The IPE was facilitated by 3 pharmaceutical sciences faculty members (both PharmD and PhD) and 1 medical school faculty member (PhD). It had 3 components: the first involved a discussion of simulated patient cases with no genotype results provided. This allowed third-year student pharmacists to teach first-year medical students about drug-gene interactions and how to use pharmacogenomics guidelines to determine the genes of interest for the patient’s case. The next component required medical students to write prescriptions and student pharmacists to verify the prescriptions. The final component required the group to interpret genotype results that were provided for their specific patient cases. The team then modified their clinical recommendations based on the genotype results, and the medical students wrote new prescriptions which were then verified by the student pharmacists.
pharmacists. Students were surveyed pre and postactivity using a 9-item questionnaire that assessed their confidence in pharmacogenomics knowledge and perceptions of their interprofessional roles in relation to pharmacogenomics application.

The study found medical students and student pharmacists had enhanced confidence in applying pharmacogenomics postactivity. This activity allowed students to engage in peer teaching on pharmacogenomics and helped them understand the roles and responsibilities of pharmacists and physicians in integrating pharmacogenomics into patient care as a team. Although geographical distance hindered the expansion of this IPE activity to other campuses, authors suggested conducting this activity remotely with the option to host certain activities asynchronously.

**Example 2. Telehealth-Based Pharmacist-to-Physician IPE.**

Although the first IPE example required coordination of schedules between co-located schools to schedule in-person IPE activities, this may be difficult for multiple institutions that face geographical constraints. An IPE collaboration between the College of Pharmacy at Ferris State University and the medical program at Western Michigan University overcame this challenge by developing a multi-institution telehealth team-based IPE activity for first-year medical students and third-year student pharmacists. This 2-hour IPE activity used PolyCom conferencing for the whole group to initially introduce the patient case and their assigned roles as pharmacists and physicians. The students then went into their profession-specific groups to work up the case separately, with medical students focused on the pathophysiology and diagnosis of the disease, while student pharmacists focused on analyzing the pharmacogenomic results and drug adjustment for the case. The students then reconvened in teams of 6 medical students with 2 student pharmacists to teach each other about the diagnosis, comprehensive treatment plan, and treatment recommendations based on the patient’s pharmacogenomic results using Google Hangouts. The whole group was finally debriefed using PolyCom conferencing to review the pharmacogenomics cases and discuss the students’ IPE experiences. Students were surveyed pre- and postactivity using an 18-item questionnaire adapted from the Scale of Attitudes Toward Physician-Pharmacist Collaboration that measured changes in attitudes and perceptions surrounding physician-pharmacist collaboration, IPE, and pharmacogenomics knowledge base. The study found positive changes in student pharmacists’ attitudes and perceptions across 4 domains of responsibility and accountability, shared authority, IPE, and pharmacogenomics confidence. The medical students also reported greater confidence in interpreting pharmacogenomics data even though they only received direct pharmacogenomics instruction from student pharmacists, suggesting that student pharmacists were effective in teaching pharmacogenomics to medical students. Overall, this activity allowed medical students and student pharmacists to learn about their roles and responsibilities in collaborative practice and to gain experience with interprofessional communication and team-based practice. Despite the technology issues encountered, this activity could be scaled up to accommodate more learners.

**Example 3. In-person Pharmacist-to-Physician Assistant IPE.**

An in-person pharmacogenomics-focused IPE involving student pharmacists and physician assistants was implemented at the Manchester University College of Pharmacy, Natural and Health Sciences Pharmacy Program. This 1-hour IPE activity coincided with the didactic integrated cardiovascular module in the pharmacy curriculum. It required the whole group to initially learn about genetic testing and interpretation of pharmacogenomic results, after which 3–4 second-year student pharmacists were paired with 1–2 second-year physician assistant students to discuss their patient case and provide antiplatelet therapy recommendations based on a patient’s pharmacogenomic results. Students were surveyed pre and postactivity using a 12-item questionnaire that assessed their knowledge and application of pharmacogenomics, and working in an interdisciplinary team.

Both student cohorts reported greater confidence in interpreting and clinically applying pharmacogenomics postactivity. This activity allowed students to engage in peer teaching and communicate conflicting viewpoints collegially. The authors suggested students could watch a prerecorded presentation prior to the activity to allow for a more efficient use of in-class time.

### 1.1. Strategies to Advance Pharmacogenomics Integration in IPE Activities

Some of the challenges in developing, implementing, or sustaining a pharmacogenomics-focused IPE program include, limited number of faculty/instructors trained in pharmacogenomics, need for administrative buy-in to develop the pharmacogenomics curricula, and the lack of availability of genetic laboratory data in electronic health platforms to simulate pharmacogenomics cases. These challenges can coexist with other IPE-related hurdles, including finding partnerships with other health care programs, geographic distances between programs, logistics in aligning schedules across programs, and technology issues encountered.

Here, we propose strategies to address some of these issues.

Although the development of pharmacogenomics-focused IPE activities relies on having faculty trained in pharmacogenomics as a resource to drive this initiative, pharmacy programs can invest in training existing faculty to close the pharmacogenomics knowledge gap. This can be achieved through continuing professional education programs, internet-based lectures, or certificate programs. For programs that cannot organize a dedicated pharmacogenomics-focused IPE activity, pharmacogenomics can be added to existing IPE activities in therapeutic areas where there are clinical pharmacogenomics guidelines and facilitated by faculty in that therapeutic area. An example is to add pharmacogenomic data to existing cardiology-focused IPE activities involving clopidogrel (CYP2C19), simvastatin (SLCO1B1), and/or warfarin (CYP2C9, VKORC1). For IPE activities involving electronic health platforms that do not have genetic data built-in, faculty can create pharmacogenomics cases simulating real-world examples. The AACP Pharmacogenomics SIG has developed a pharmacogenomics repository with cases of varying difficulty (introductory, intermediate, and advanced) that are available to pharmacy educators and AACP members via the AACP Connect platform. Faculty can also utilize free sample pharmacogenomics reports that some commercial pharmacogenomic testing companies share on their company website to build additional new pharmacogenomics cases or modify existing ones from the AACP pharmacogenomics case repository.

Although developing pharmacogenomics-focused IPE activities can be resource-intensive in terms of labor and time, some programs are utilizing pharmacogenomics practice sites to provide interprofessional collaboration experiences for their student pharmacists instead. This approach is implemented by the University of Pittsburgh at the University of Pittsburgh Medical Center Primary Care Precision Medicine Clinic, where student pharmacists have the opportunity to complete an Advanced Pharmacy Practice Experience (APPE) alongside genetic counseling students enrolled in the Master of Science in Genetic Counseling graduate program. Students from both programs contribute to a multidisciplinary health care team that provides clinical genetic and pharmacogenomic services in the primary care setting. Genetic testing for diseases and disease risk is led by the genetic counselor and physician, while pharmacogenomic testing is led by the pharmacist and physician. Student pharmacists and genetic counseling students learn about, from, and with each other at clinic team meetings 2 days prior to clinic, during in-person and telehealth patient visits, and during case presentations to the physician leader. Such pharmacogenomics practice sites, however, are not ubiquitous. A recent survey of 142 U.S. pharmacy programs found that less than 30% offer APPEs with a primary focus on pharmacogenomics. In the face of limited pharmacogenomics practice sites, pharmacogenomics-trained faculty could consider precepting student pharmacists from other institutions to bridge this gap. The AACP Pharmacogenomics SIG has created a shared database of pharmacogenomics APPE sites on the AACP Connect platform and indicated sites open to taking students from different schools.
1.2. Call to Action

Pharmacy educators have been early adopters of IPE with AACP among the original member organizations of the Interprofessional Education Collaborative that developed core competencies for interprofessional collaborative practice. The 2020–2021 AACP Argus Commission outlines a charge to identify strategies that promote effective collaboration with other health professional education associations to advance IPE and practice. In light of this, pharmacy programs are encouraged to explore innovative ways to implement pharmacogenomics-focused IPE activities to equip student pharmacists with the knowledge and skills to lead interprofessional health care teams in the provision of pharmacogenomics-based care. Such expertise will provide student pharmacists an employment advantage, as more institutions seek to implement pharmacogenomics. In concert with developing pharmacogenomics-focused IPE activities, suitable assessment tools need to be used to evaluate the effectiveness of IPE activities. Many programs have traditionally focused on learner experiences when evaluating IPE activities, such as student satisfaction with the activity, and changes in students’ self-confidence or self-perceived pharmacogenomics knowledge, which are subject to significant bias and are less important compared with learning and behavioral change. Future work should consider using validated and reliable tools, such as the Interprofessional Education Collaborative Core Competencies to evaluate pharmacogenomics-based IPE activities, report outcomes beyond learner satisfaction or perception data, and disseminate these results through scholarly publication.

2. Conclusion

As pharmacy programs adopt the updated genomic competencies for pharmacists in their pharmacy curricula, it is necessary to implement pharmacogenomics-focused IPE activities that will concurrently prepare our pharmacy graduates to be practice-ready pharmacists who work collaboratively in an interprofessional team to deliver genomics-guided care. With AACP leading the way in pharmacogenomics education, increasing IPE opportunities will importantly help build a critical mass of health care professionals with pharmacogenomics exposure, which can further drive uptake across practice settings, ultimately helping improve patient care.

Author Contributions

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Declaration of Competing Interest

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References