

Emerging Innovations and Professional Skills Needed Within Pharmacy Curricula

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Journal of Medical Education and Curricular Development
Volume 7: 1–5
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DOI: 10.1177/2382120520943597



ABSTRACT: To ensure students are prepared for the rapidly evolving world of health care, curricula must be aligned with emerging innovations, as well as professional skills likely to influence students' abilities to be successful. At the 2019 annual meeting of PharmAlliance institutions, we asked experts to identify innovations and professional skills necessary for the future of pharmacy practice. Experts identified a wide range of topics, including personalized and precision medicine, digital health, interprofessional collaboration, clinical decision making, and overcoming complexity and ambiguity. While these findings are useful for informing curriculum content, we must also commit to ensuring our pharmacy curricula are emerging, forward thinking, and effective at preparing students for the challenges in health care.

KEYWORDS: delphi, pharmacy, interprofessional education, precision medicine, telemedicine

RECEIVED: April 27, 2020. **ACCEPTED:** June 12, 2020.

TYPE: Commentary

FUNDING: The author(s) received no financial support for the research, authorship, and/or publication of this article.

DECLARATION OF CONFLICTING INTERESTS: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Introduction

Health care professions are experiencing unprecedented change, motivated by a wide range of factors including advancing technologies, reconceptualization of health and health care delivery models, and changes in infrastructure and billing practices.¹ As a result, health care professionals must adapt and reconsider how their roles and responsibilities fit within these new approaches to care.^{2–4} In addition to their traditional roles as medication dispensers, pharmacists have assumed more direct patient care roles and are increasingly working more collaboratively with doctors, nurses, and other health professionals.^{2,3}

Due to increasing responsibilities placed on pharmacists, schools of pharmacy must ensure their curricula align with the evolving profession. The last major curricular change in pharmacy was around the turn of the century, when programs in North America converted to the entry-level Doctor of Pharmacy (PharmD), programs in Europe normalized the Master of Pharmacy (MPharm) degree, and Australian programs converted to 4-year courses, some incorporating an Honors qualification. More recently, US programs like the University of North Carolina Eshelman School of Pharmacy and the Auburn University Harrison School of Pharmacy have transformed their PharmD curricula to emphasize active learning, foster scientific inquiry, advance innovation, introduce patient care earlier in the curriculum, and focus on success in complex and team-based situations.^{5,6} Across various Asian countries, there have also been trends toward launching more clinically oriented curricula.⁷ For example, Monash University in Australia developed a Vertical Integrated Master's program with a focus on enhancing experiential

education, increasing interprofessional collaborations, and improving patient outcomes.⁸

At the course and program level, schools have used various strategies for curriculum change. These include expanded offerings for diversifying career pathways, new solutions to help students remain competitive for employment, and increased partnerships within health care systems.^{9,10} In addition, schools have focused on integrating pharmacists as contributing members of interprofessional teams, preparing students for advancements in digital technology, and creating resourceful consumers of evidence-based knowledge amid increasing amounts and types of data.^{3,10} Similarly, there are various accrediting bodies, professional organizations, and consumer advocacy groups that have made recommendations regarding curricular change.¹¹

As pharmacy schools work to ensure their curricula remain fit for purpose, educators must identify emerging areas of practice and new methods of training. What will students need to know and be able to do to be successful practitioners after they graduate from our programs? What content should be added, removed, or changed to ensure student success? As health care, pharmacy, and educational practices evolve, we must commit to pursuing forward-thinking curricula.

Opportunity

At the 2019 annual meeting of PharmAlliance institutions, we asked 17 attendees from the Faculty of Pharmacy and Pharmaceutical Sciences at Monash University, Australia (n=8), the School of Pharmacy at the University of College London, UK (n=6), and the UNC Eshelman School of



Pharmacy at the University of North Carolina, USA ($n=3$), to identify innovations likely to affect pharmacy education in the next 10 years. Using a list of planned attendees, the research team identified those individuals with teaching and leadership responsibilities within curricula involving the training of pharmacist practitioners (eg, MPharm, PharmD). Two weeks prior to the meeting, these pharmacy educators were informed of the Delphi and recruited by email to participate in-person at the international meeting. Six participants (35%) were professors, 4 (24%) were associate professors, 5 (29%) were assistant professors, 2 (12%) were educational designers or technicians, and 2 (12%) held additional administrative roles such as Dean or Associate Dean. (Note: International variations in professional titles were converged to those commonly used within US pharmacy schools.)

Using a Delphi method,¹² we asked participants to answer two questions. The first was, “What current and emerging innovations in pharmacy practice will influence what our students need to know to be successful in the next decade?” and the second was, “What professional skills will students need to develop to be at the forefront of pharmacy practice as innovations emerge?” The original list of items to select from was generated by participants 2 weeks before the meeting and supplemented by a literature review. Participants could add new items to the list during the first round. Frequencies and percentages were used to rank-order the items selected.

In the final round of the Delphi, participants rank-ordered (1) personalized and precision medicine, (2) digital health, (3) greater incorporation of pharmacists in team-based care, (4) pharmacists as prescribers, and (5) pharmacists’ access to targeted quality data for their patients as the innovations that will influence what our students need to know in the future (Table 1). When asked why they selected specific items, participants provided 17 comments that indicated current and emerging innovations will “require pharmacists to take on different roles” and the “knowledge needed to prescribe will be different than what is currently being taught” in pharmacy education. Participants expressed that many innovations are currently influencing pharmacy practice by “changing the way pharmacists work.” Furthermore, some participants indicated that the top five innovations “are all interrelated and dependent . . . and must be addressed simultaneously.”

For professional skills, our participants rank-ordered (1) collaborating in an interprofessional environment, (2) clinical decision making, (3) overcoming complexity and ambiguity, (4) creative problem solving and design thinking, and (5) how to provide precision or personalized medicine (Table 1). Comments concerning the professional skills students should develop reflected the changing role of pharmacists. Participants opined that “creative thinking is important because we need to recognize that our profession is changing,” and that “creative problem solving, is important for pharmacists [to be able] to cope with changes creatively and effectively.” Furthermore, “collaboration and creative problem solving are skills that

pharmacists are currently not strong in but will be needed for future roles; we need to develop pharmacists who have the courage to take the profession forward into uncharted waters.” In addition to creative problem-solving skills and courage, participants acknowledged that “pharmacists clinical decision making is vital to the primary skill set” and that “students need to have robust clinical decision-making skills in order to be able to provide personalized medicine” to patients. Participants also recognized that “collaborating inter-professionally is extremely important” and “team-based clinical work contributes to greater patient outcomes.”

Discussion

Pharmacy schools must anticipate and respond to the rapidly evolving world of health care. The Delphi process described in this commentary provides some insight into topics and processes that may be useful for ensuring pharmacy curricula appropriately equip students for the near future. The similarities between identified topics and skills are important to note as the United States, United Kingdom, and Australia have differently funded health care and education systems resulting in different pharmacy degrees (BPharm, MPharm, PharmD).^{5,8}

Educators must be attuned to the innovations infiltrating health care practice and committed to incorporating these innovations into our curricula. As our participants acknowledged, many of the innovations and skills described above already exist within current practice in limited scope. However, students interested in innovative and emerging trends in health care are often left to look beyond the curriculum using independent self-directed learning opportunities.^{13,14} This leaves some question as to how proactive we should be about integrating these topics into our curricula so students can be self-directed learners postgraduation.

Specifically, our experts indicated that schools must prepare students to practice in an era of personalized and precision medicine. Although literature and continuing education in pharmacogenomics date back more than 20 years,^{15,16} offerings of personalized and precision medicine in pharmacy degree programs remain limited.^{14,17} Opportunities exist to further incorporate this topic into practice-based therapeutic courses and pharmacy practice experiences, and several researchers have reported increased student learning associated with genomic testing in their curriculum.^{12,17}

A growing body of literature also supports our participants’ prioritization of team-based care and collaboration as essential skills for pharmacy.^{3,10} In 2015, for example, the International Pharmaceutical Federation (FIP) stressed the importance of IPE and collaborative practice, acknowledging that “IPE was more purposeful than having students from more than one health profession sitting in the same classroom.”^{18(p6)} To prepare students for team-based care, some schools have incorporated a team-based curriculum such as the longitudinal Continuous Development of Teamwork Skills (CDTS) model at University of Florida.¹⁹ Additional examples are described

Table 1. Ranked results for current/emerging innovations and professional skills (N= 17).

ITEM RANK	CURRENT AND EMERGING INNOVATIONS	N (%)	PROFESSIONAL SKILLS	N (%)
1.	Personalized and precision medicine	16 (9.41)	Collaborating in an interprofessional environment	15 (8.82)
2.	Digital health	14 (8.24)	Clinical decision making	12 (7.06)
3.	Greater incorporation of pharmacists in team-based care	14 (8.24)	Overcoming complexity and ambiguity	12 (7.06)
4.	Pharmacists as prescribers	13 (7.65)	Creative problem solving and design thinking	11 (6.47)
5.	Pharmacists' access to targeted quality data for their patients	13 (7.65)	How to provide precision or personalized medicine	10 (5.88)
6.	Automation of drug dispensing activities	11 (6.47)	Communication skills in general	10 (5.88)
7.	Expanding roles for pharmacists in clinics	11 (6.47)	Self-directed learning	10 (5.88)
8.	Expanding clinical roles for pharmacists	11 (6.47)	Diagnostic reasoning and physical assessment skills	8 (4.71)
9.	Telemedicine	11 (6.47)	Communicating with patients from different cultures	8 (4.71)
10.	Pharmacists access to population health metrics	10 (5.88)	Overcoming challenges and failure	8 (4.71)
11.	Augmented or virtual reality in patient care	10 (5.88)	Growth mindset	8 (4.71)
12.	Greater use of health care institution quality improvement methods	9 (5.29)	How to interpret, intervene, and/or produce quality metric data	8 (4.71)
13.	New medicines requiring specialized storage, delivery, and/or dispensing	8 (4.71)	Creating institutional-wide change/quality improvement	6 (3.53)
14.	Wearable sensing devices	5 (2.94)	Empathizing with patients	6 (3.53)
15.	Expanding roles for pharmacists in pharmaceutical industry	4 (2.35)	Communicating through video teleconferencing	5 (2.94)
16.	Implantable sensing devices	4 (2.35)	How to create and justify new pharmacist positions	5 (2.94)
17.	Nanotechnology	4 (2.35)	Triaging/prioritizing patients	5 (2.94)
18.	Pharmacist home visits	2 (1.18)	Global mindset	4 (2.35)
19.			Health systems science	4 (2.35)
20.			Personal and professional identity formation	4 (2.35)
21.			Dealing with institutional-wide change	2 (1.18)
22.			Entrepreneurship skills	2 (1.18)
23.			Intrapreneurship	2 (1.18)
24.			Caring for patients with disabilities	1 (0.59)
25.			Coding and/or programming skills	1 (0.59)
26.			Conducting home visits	1 (0.59)
27.			Speaking multiple languages	1 (0.59)
28.			Understanding and application of nanotechnology	1 (0.59)

by the National Center for Interprofessional Practice and Education, including hotspotting, IPE simulation, and mental health training.

Furthermore, students need clinical decision-making skills that are sophisticated enough to meet current practice needs and flexible enough to be effective in future practice models.

The COVID-19 pandemic, for example, has prompted pharmacy schools and practices to reconsider how essential skills are taught and applied. Rapid changes have necessitated the use of innovation to sustain curricula and practice, ultimately affecting engagement with patients (eg, telemedicine), management of exposure and risk (eg, personal protective equipment), and collaboration within health care teams (eg, virtual huddles, virtual rotations). These experiences further reflect the need for us to stay ahead of the game. We face even more pressure to ensure students are equipped with decision-making skills and tolerance of ambiguity requisite for success in uncertain times. How clinical decision making is presented, taught, and incorporated into pharmacy curricula can influence how students develop and use those skills in the professional setting,¹¹ making it critical for us to identify best practices for developing these skills in our trainees now and in the future.

As it specifically relates to practice changes, schools should also consider the future of pharmacists as providers. Recently passed legislation in the US states of Ohio and Oregon acknowledged the evolving role of pharmacists as providers and recognized the importance of pharmacists as key personnel in the health care delivery system, with pharmacists in Oregon having the ability to prescribe formulary drugs without a physician's approval.^{20,21} In the United Kingdom, pharmacists have been prescribing medications since 2003, and there is evidence to suggest that pharmacists can prescribe medications just as effectively as doctors.²² This provider designation requires multiple professional skills such as clinical decision making, overcoming complexity and ambiguity, and creative problem solving and design thinking. To best prepare pharmacy students to succeed in a health care environment with pharmacists as providers, schools should consider incorporating related topics such as systems thinking or exercises emphasizing the changing roles and responsibilities of health care providers.^{4,13}

Although this study provides insights into the skills and innovations needed for pharmacy students to remain at the forefront of their profession, it is not without limitations. First, the sample size was small and selective, as only individuals who attended the international meeting participated. Second, participants were only from schools of pharmacy. Third, these schools were within Westernized, English-speaking countries and individuals from other countries may have differing perspectives. Therefore, caution should be used when interpreting results, as findings may be biased toward these characteristics and not generalizable to all of pharmacy education, other health professions, or globally.

Despite these limitations, our Delphi participants provided insight into emerging innovations and professional skills likely to affect pharmacy students as they enter contemporary practice in the United States, United Kingdom, or Australia. This method should be replicated in other health professions, as the innovations and skills identified in pharmacy may differ from those needed in medicine or pharmaceutical sciences.²³ Along

the same lines, other stakeholders such as employers and recent graduates could provide related yet unique insights. Furthermore, other approaches, such as interviews and surveys, may also be useful for this purpose. Educators should consider our results in light of their own schools, regions, and countries while also investing in their own approaches to ensuring that health care curricula remain contemporary amid rapidly evolving health care practices. This will allow us to continue identifying contemporary learning strategies and content that prepares and differentiates students within an increasingly competitive job market.

Acknowledgements

The research team would like to thank Kayley Lyons (PharmD, PhD) at Monash University, Australia, for helping facilitate this study; Vann Ly from Monash University, Australia, for coordinating logistics; and PharmAlliance, for allowing us to conduct this activity during their annual meeting. Thanks to the participants and their willingness to lend their expertise and engage in this activity with us.

Author Contributions

AAO led the design, implementation, analysis, and writing of this work; LMM contributed to the design and implementation and provided critical review and edits to the manuscript; KAM and TPB provided critical review and edits to the manuscript; JEM oversaw the design, implementation, analysis, and writing of this work and provided critical review and edits. All authors provided approval for the final version of the manuscript.


Ethical Approval

This study was reviewed by the Office of Human Research Ethics at the University of North Carolina and was determined to be exempt from further review according to the regulatory categories described under 45 CFR46.101(b).

Informed Consent

Participants were informed of the purpose and process of the study during email recruitment. The purpose and process was reiterated at the start of the in-person meeting. Consent was provided by the participants prior to the start of the Delphi.

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