

How space design and technology can support the Pharmacy Practice Model Initiative through interprofessional collaboration

Lindsay Hahn, PharmD, BCPS¹; Martha Buckner, PhD, RN²; Georgetann B. Burns, M. Arch.³; and Debbie Gregory, BSN, RN⁴

¹Belmont University College of Pharmacy; ²Belmont University School of Nursing; ³Health Facilities Planning Partners, LLC; and ⁴Smith Seckman Reid, Inc.

Authors disclose no conflicts of interest, and the results/data/figures in this manuscript have not been published elsewhere, nor are they under consideration by another publisher.

Keywords: interprofessional collaboration, clinical outcomes, technology integration, collaborative care, meds at the bedside, pharmacy practice model initiative, PPMI, readmission avoidance, clinical pharmacy, drug therapy

Abstract

Purpose: The Pharmacy Practice Model Initiative (PPMI) calls pharmacists to more direct patient care and increased responsibility for medication-related outcomes, as a means of achieving greater safety, improving outcomes and reducing costs. This article acknowledges the value of interprofessional collaboration to the PPMI and identifies the implications of the Initiative for space design and technology, both of which stand to help the Initiative gather additional support. **Summary:** The profession of pharmacy has for some time now become increasingly vocal about its desire to take on greater responsibility for patient outcomes. With drug costs representing the largest portion of a hospital's pharmacy budget and reimbursements becoming more contingent on readmission avoidance, the pharmacy's influence on a hospital's bottom line is significant. More importantly, study after study is showing that with greater pharmacist intervention, patient outcomes improve. This article addresses the ways in which developments in the fields of technology and facility design can assist in the deployment of the PPMI. **Conclusion:** As the PPMI achieves a critical level of support from inside and outside the pharmacy, and more empirical research emerges regarding the improved outcomes and cost savings of increasing the roles of both clinical pharmacists and pharmacy technicians, the industry sectors of healthcare technology and healthcare design stand ready to assist in the execution of this new model. By encouraging pharmacists, doctors and nurses to work together – and all caregivers to work with facility designers, biomedical engineers and IT specialists, there is the increased likelihood of these fields turning to each other to problem-solve together, all for the ultimate benefit to patients and their families.

Introduction

As the profession of pharmacy takes a critical look at itself during this opportune time of change in healthcare, the industry is speaking loudly and clearly that it's ready to redefine its role in healthcare and assume greater responsibility for patient outcomes. With drug costs representing the largest portion of a hospital's pharmacy budget and reimbursements becoming more contingent on readmission avoidance, the pharmacy's influence on a hospital's bottom line is significant. More importantly, study after study is showing that with greater pharmacist intervention, patient outcomes improve.¹

Launched in 2008 by the American Society of Health-System Pharmacists (ASHP) and the ASHP Research and Education Foundation, the Pharmacy Practice Model Initiative (PPMI)

calls pharmacists to more direct patient care and increased responsibility for medication-related outcomes, as a means of advancing the health and well-being of patients.² The PPMI is a concerted message to the healthcare industry that pharmacists desire greater responsibility for medication-related outcomes, that they are fully capable of the task, and that the industry needs greater pharmacy involvement to achieve greater safety, improve outcomes and reduce costs. The PPMI is gaining steam, and as it does so, it's important to identify the implications of the Initiative for space design and technology, both of which stand to help the Initiative gather additional support. The implications for design and technology reach far and wide, and interprofessional collaboration will be the key to success for the entire equation.

PPMI effect on patient outcome

Since the PPMI was launched in 2008, many studies have shown that increased pharmacist involvement can improve patient outcome. The Institute of Medicine estimates that there are at least 1.5 million adverse drug events (ADEs) each year.³ Because medication errors represent one of the most

Corresponding Author: Lindsay Hahn, Belmont University College of Pharmacy, 1900 Belmont Boulevard, Nashville, Tennessee 37212 (lindsay.hahn@belmont.edu)
Phone: 615-460-8119

common patient safety errors⁴, it stands to reason that pharmacists have a critical role to play in improving safety through an improved drug therapy process.

This improved process centers around greater attention on a patient's drug therapy by a professional trained solely in that practice. Adverse drug events are shown to decrease significantly when the patient has access to a clinical pharmacist, who can actively engage in managing the patient's medicine.¹ By encouraging pharmacists to practice at the top of their field, patients benefit from better use of the pharmacist's knowledge and experience. Increased clinical involvement between pharmacist and patient can result in better patient response to medications, fewer side effects, and avoidance of ADEs. Greater pharmacist knowledge of a patient's condition and history will help the pharmacist alter medications and dosage to result in fewer negative interactions.

Additionally, greater pharmacist involvement can result in greater patient education, which equips the patient and/or the patient's family to be more successful with their medications after discharge.

PPMI effect on cost reduction

The same study that estimated an annual 1.5 million ADEs each year³ also estimated \$8,750 in system cost per ADE. Based on these estimates, our nation may be spending upwards of \$13 billion in ADEs every year. Those costs are simply the costs of extended hospital stays, which are shared by patients, healthcare providers, insurers and employers – and don't even reflect costs such as lost earnings or pain and suffering compensation. With a clinical pharmacist as an advocate, the occurrence of ADEs – and their associated costs – are reduced.⁵

Aside from cost savings related to better patient care, about 80 percent of a hospital's pharmacy budget is in its drug costs.⁶ When pharmacists are engaged in a more direct relationship with drug therapies, they are able to provide more cost-effective treatment recommendations. Combined with greater pharmacist participation in formulary management, hospitals can realize savings in the form of reduced inventory and waste and fewer write-offs.

While the PPMI promotes a greater investment in pharmacy technicians and technology to release pharmacists for greater clinical roles, the Initiative predicts that overall, hospitals will save money due to improved safety, better outcomes, and a more watchful eye on the pharmaceutical inventory.

Interprofessional collaboration and the Triple Aim as an industry backdrop

The World Health Organization defines interprofessional collaborative practice as the coming together of multiple health workers from different professional backgrounds to provide comprehensive services by working with patients, their families, caregivers and communities to deliver the highest quality of care across settings.⁷ The concept of interprofessional collaborative practice has roots that date back at least 40 years⁸, but a more recent resurgence of industry interest has garnered greater support than ever before.

At the same time that the healthcare industry is reawakening to interprofessional collaboration, the Institute for Healthcare Improvement's Triple Aim Initiative calls for 1) improving the patient experience of care (including quality and satisfaction) 2) improving the health of populations and 3) reducing the per capita cost of health care.⁹ The Triple Aim has been widely embraced by the healthcare industry and reflected in recent healthcare reform legislation.

The purported benefits of interprofessional collaboration and the emergence of the Triple Aim are a fitting backdrop for the PPMI, which promotes the pharmacist as a more active member of the clinical care team and shares the goals and vision of the Triple Aim.

Technology: A willing and able assistant of the PPMI

The benefits of increased clinical pharmacy practice are believed to more than pay for themselves, and technology offers cost offsetting opportunities that increase the feasibility of an expanded pharmacy role. Indeed, it will be imperative for technology to assist in the execution of the PPMI, especially initially, while the benefits of the Initiative are in the proving stage.

Some models of expanded clinical pharmacy include the pharmacist rounding with physicians and nurses; others suggest that technology can bridge the communication gap between patient room and pharmacy. Through telehealth, interactive patient education systems integrated with the pharmacy can enable virtual personal interaction for medication education or consultation.

Electronic health records (EHRs) – even those that operate only within the confines of a provider system – are allowing for far greater sharing of patient information among the members of a collaborative patient team. With all team members – including pharmacy – contributing to a single medical record in real-time, patient safety improves and costs decrease.¹⁰

An increased level of technological automation is proving to increase the efficiency and effectiveness of the pharmacy. While automated dispensing cabinets have been standard in hospitals for many years, the greater use of EHRs, especially when they are integrated with computerized physician order entry (CPOE) and decision support systems are automating many functions, saving pharmacist time and reducing errors.

Larger hospital pharmacies are using robots to improve safety and efficiency, and free up pharmacists and technicians to focus more on clinical services. At the University of California San Francisco Medical Center, a centralized robotic pharmaceutical facility prepared about three million doses of medication in its first two years of operation (2010-2012) – without a single error. Additional benefits of robotics include a safer environment for pharmacy workers, who can depend on robots to handle the more toxic medicines, and reduced waste due to human touch contamination. Some hospitals, like University of Maryland Medical Center in Baltimore, are achieving faster delivery times through mobile robots that travel from the pharmacy to the unit.¹¹

Technology helps clinical pharmacists identify patients who would benefit from increased pharmacy involvement, so that pharmacists can focus more on those who truly need them. Decision support technology automatically flags patients who may be at risk of an ADE based on the combination of drugs that have been prescribed, any known allergies or reactions, medical history, current vital signs and other data. This technology saves an enormous amount of time and synthesizes data so much more quickly than a human can, and ADEs can be predicted much further in advance and more often avoided.

The emergence of bar code technology is having positive effects throughout the hospital, especially in the pharmacy, where barcoding is used during inventory, preparation, compounding, dispensing, and administration. Bar code technology has sharply reduced medication errors and improved inventory management, and for these reasons the PPMI is supportive of the widespread use of barcoding.¹²

Interprofessional collaboration is as present in technology as it is in direct patient care. Device and app developers who design for healthcare are wising up to the notion of consulting nurses and other end-users of their technologies during development.¹³ As technology evolves in the pharmacy, vendors likewise should be collaborating with pharmacists to ensure that their products meet an existing need. It sounds obvious, but a surprisingly high number of technology products end up in the “junk closet” because

actual need for such a product was not predetermined and end-users not consulted.

Technology as a communications facilitator and its limits

As previously mentioned, the rise of the clinical pharmacist is occurring during a reemergence of interprofessional collaboration. This is good for pharmacists, as professionals from many backgrounds are opening up to the idea of working across disciplines. One of the strongest defining characteristics of successful collaboration involving professionals with different backgrounds is the undeniable need for improved communication, made possible in part by evolving technology.

Patient care teams can tap a far greater volume of knowledge and achieve greater outcomes than can single caregivers operating alone. The knowledge explosion of the last 15-20 years has moved the industry toward a team model, which is imperative to containing this wealth of knowledge. However, the value of the collective knowledge is only as good as the team’s ability to share and synthesize that information for the good of the patient.

Medical errors are most likely to occur when a patient is “handed off” from one professional to another, and with an increasing number of professionals on an individual patient’s team, solid methods of communication are essential. Mentioned earlier, EHRs are creating valuable repositories of information accessible to any member of the patient team, at any time. This long-awaited tool is proving to offer exceptionally improved communication about a patient’s status, medication administration and response to therapies, to name just a few data points. The EHR neither forgets nor fails to hear important information – the same cannot be said of overtired or distracted clinicians during a shift change.

Personal hand-held devices and smart phones are being used more often between professionals on a team as a means of direct communication. The immediate communication available through personal devices at the moment of need can provide advantages over physically locating another clinician. Strategic communication and technology integration will greatly improve the continuum of care.

Technology is key to facilitating communication, but ironically, the speed at which it is developing threatens simultaneously to diminish its value in communication. Most facility improvement budgets cannot match the pace of technological change, and there is a hard limit on healthcare provider investment in such technology, even when it promises even greater benefits.

How space design can aid the PPMI

Facility designers are charged with creating healthcare environments that enable care and don't disable care. Greater direct pharmacist interaction with the patient in the patient's room, is going to increase traffic at the bedside. The design community and process will be expected to create spaces that are appropriate for every caregiver and can accommodate increased human traffic in the patient room. As nurses and other caregivers are being asked to share more space with pharmacists, effective patient room and unit design will be helpful in providing the working space each needs to accomplish his or her job.

In design, interprofessional collaboration is expanding outside the patient care team – we might even call it an “extended patient care team,” which includes disciplines that are involved even before ground is broken on a new hospital. Architects, engineers and facility planners are brainstorming with nurses and other caregivers in the front-end design process, which is resulting in spaces that improve clinical workflow. Pharmacists are being invited to the design table as well, particularly if they already participate in rounding teams and require in-unit space to complete their tasks.

WellStar Paulding Hospital in Dallas, Ga., recently utilized a collaborative process to design a new intensive care unit within a 108-bed replacement hospital. The design team for the new patient care units was expansive, including facility designers as well as physicians, unit nurses, patients, infection prevention nurses, respiratory therapists, clinical pharmacists – all those who would ultimately use the space. Working with the Center for Health Design's Pebble Project, the design team had access not only to the wealth of information and experience from within their team, but also evidence-based research and best practices data from other Pebble Partners. Among the many collaborative practices of the WellStar project were full-scale mockup patient care rooms (both acute care and ICU), which allowed team members to experience the rooms repeatedly from their own perspectives. While the facility is still under construction at the writing of this article, there is great optimism that the design features of the completed patient care units will contribute greatly to patient care, and clinical staff members continue to use the mockup rooms to refine safe, patient-centered processes.¹⁴

In addition to focusing on the individual patient care rooms, the design team provided multiple locations for staff collaboration outside the room. Charting niches in the corridor offer opportunities for immediate documentation or electronic contact with other caregivers. Perches, located in proximity to every four patient rooms, allow walk-up work

areas for caregivers to interact with each other and with those not currently on the floor. Teaming stations, located to support 14 patient rooms, accommodate the whole range of providers who periodically come to the unit and are involved in patient care.

Some hospitals support greater collaborative care but simply don't have the budget to redesign and renovate their spaces. There are ways to enable greater interaction without moving walls or doors. Older hospitals may employ mobile devices like tablets to improve collaboration and team-based care without facility renovation. One design solution is the use of “collaboration hubs,” which can be as simple as small standing tables, around which professionals can easily and spontaneously interact. (Figure 1)

Another often discussed concept that touches pharmacy is “meds at the bedside,” which promotes medicines that are patient-specific and stored in the patient room, to reduce nurse transit and procurement time and reduce medicine-related errors. Accommodating secure drawers or cabinets for such medicines is best planned on the front end and designed for the ease of access of both pharmacy technician and nurse. Mockup rooms, like those used in the WellStar Paulding project, are a valuable tool for design and placement of these cabinets.

Preparing for PPMI in higher education

To assist higher education in its curricula development, the Accreditation Council for Pharmacy Education (ACPE) undertook a significant study with employers of new pharmacy graduates to determine their expectations of competencies. The ACPE formed three joint task forces with four organizations: the first with the American Society of Health-System Pharmacists (ASHP), a second with the Academy of Managed Care Pharmacy (AMCP), and the third with both the National Community Pharmacy Association (NCPA) and the National Association of Chain Drug Stores Foundation (NACDSF). Reports from these task forces were made available at the ACPE Invitational Conference *Advancing Quality in Pharmacy Education: Charting Accreditation's Future*. Increased preparation for collaboration was noted as an area that could be improved.¹⁵

With encouragement from efforts like the PPMI, pharmacy school administrators have revised curricula and otherwise changed the way they prepare graduates for their careers. New pharmacists emerge knowing that they have greater responsibility than in times past and are better prepared to accept that responsibility. The PPMI pushes pharmacists to practice at the top of their profession, and encourages certification through the Board of Pharmacy Specialties,

which certifies pharmacists in ambulatory care, critical care, nuclear, nutrition support, oncology, pediatrics, pharmacotherapy and psychiatric pharmacy. Where the PPMI encourages education specifically to expand is in the area of pharmacy residency programs, which offer both increased experience for the pharmacist and strengthened assurance to fellow caregivers regarding pharmacists' credentials.¹⁶

Preparing pharmacists for the increased collaboration that awaits them has not been particularly straightforward – a result of the rigidity of each discipline's respective curricula. The rigors of each program haven't yet, for the most part, fully embraced scheduling that allows for the level of collaboration between all types of health professionals. Other challenging factors include the differences in ages and experience between similarly-ranked students of different programs as well as the differences in performance standards among disciplines.¹⁷ And while many universities are creating comprehensive health science campuses, not all schools of health science have easy access to programs from all related disciplines.

Despite the barriers and challenges, schools of health science, in small and large degrees, are attempting to collaborate in the ways that their graduates will be expected to collaborate in hospitals and clinics. Moreover, pharmacy schools would benefit from collaborating with hospitals and health systems to ensure that appropriate pharmacy informatics principles are embedded in the curriculum.

The University of Minnesota's 1Health program¹⁸, the University of Virginia¹⁹, the University of Pittsburgh School of Medicine²⁰, and many others have, in the last 10 years, developed interprofessional education programs to prepare health professionals for the team-based working environment that awaits them. In Nashville, Belmont University and Lipscomb University Colleges of Pharmacy, the Tennessee State University Department of Social Work, and Vanderbilt University Schools of Medicine and Nursing have created a pilot interprofessional program that lasts the entire duration of their students' degrees. For a half-day a week and a half-day a month, students work on interprofessional teams in the clinic and the classroom, becoming fully exposed to the practice of team-based care.²¹

With regard to technology, higher education is in a similar boat as healthcare when it comes to the speed of development. The cost of keeping pace with technology that changes dramatically and quickly is exorbitant, and current students will not learn technology in the same way that generations before them did. Pharmacists must know that technological training regarding operation and deployment,

and with specific inclusion of informatics, will be an essential part of their careers, and educators should keep abreast on advances in healthcare technology. Educators in this area would be wise to present healthcare technology coursework as a series of guest lectures from active practitioners, recent readings from respected health and science news media, and partnerships with technologically advanced healthcare providers.

Conclusion

As the PPMI achieves a critical level of support from inside and outside the pharmacy, and more empirical research emerges regarding the improved outcomes and cost savings of increasing the roles of both clinical pharmacists and pharmacy technicians, the industry sectors of healthcare technology and healthcare design stand ready to assist in the execution of this new model.

No one believes that the implementation of the PPMI will be fast or easy, as there is and will continue to be resistance to change from outside and inside the pharmacy profession – those who do not wish to relinquish control, those who do not wish to take on more responsibility, those who are uncomfortable transferring their faith to a different medical professional, and those whose fiscal sensitivities are holding them back from taking that first courageous step. However, the institutions that are bravely stepping into this new territory are reporting positive results, and as those reports grow, more hospitals will follow. Technology and facility design stand ready to make the transition easier and more successful.

The fortunate and timely rise of interprofessional collaboration is a climate in which the PPMI can expect great success. By encouraging pharmacists, doctors and nurses to work together – and all caregivers to work with facility designers, biomedical engineers and IT specialists, there is the increased likelihood of these fields turning to each other to problem-solve together, all for the ultimate benefit to patients and their families.

References

1. De Rijdt T, Willems L, Simoens S. Economic effects of clinical pharmacy interventions: A literature review. *Am J Health Syst Pharm*. 2008; 65(12):1161-72.
2. American Society of Health-System Pharmacy. PPMI. www.ashpmedia.org/ppmi/ (accessed 2013 Aug 5).
3. National Research Council. Preventing Medication Errors: Quality Chasm Series. Washington, DC: The National Academies Press, 2007.

4. U.S. Department of Health & Human Services, Agency for Healthcare Research and Quality. Patient Safety Network: Patient Safety Primers - Medication Errors. psnet.ahrq.gov/primer.aspx?primerID=23 (accessed 2013 Oct 1).
5. Bond CA, Raehl CL. Clinical Pharmacy Services, Pharmacy Staffing, and Adverse Drug Reactions in United States Hospitals. *Pharmacotherapy*. 2006; 26(6):735-47.
6. Edwards R. In Struggle to Cut Expenses, Hospitals Eye the Pharmacy. *Hosp Health Netw*. 2011; November.
7. World Health Organization. Framework for action on interprofessional education and collaborative practice. www.who.int/hrh/resources/framework_action/en/ (accessed 2013 July 31).
8. Institute of Medicine. Educating for the Health Care Team. Washington, DC: Institute of Medicine, 1972.
9. Institute for Healthcare Improvement. Institute for Healthcare Improvement: IHI Triple Aim Initiative. www.ihp.org/offering/Initiatives/TripleAim/Pages/default.aspx (accessed 2013 July 31).
10. PwC. The emerging benefits of electronic medical record use in community-based care. Toronto: Canada Health Infoway, 2013.
11. Freeman G. The Pros and Cons of Rx Robotics. *HealthLeaders Media*. 2012; April. <http://www.healthleadersmedia.com/content/MAG-278910/The-Pros-and-Cons-of-Rx-Robotics> (accessed 2013 Oct 1).
12. Poon EG, Cina JL, Churchill WW, et al. Effect of Barcode Technology on the Incidence of Medication Dispensing Errors and Potential Adverse Drug Events in a Hospital Pharmacy. Paper presented at AMIA Annual Symposium Proceedings Archive, 2005.
13. Gregory D. Clinical Coaching for Healthcare App and Device Developers. *Nashville Medical News*. 2013; March.
14. Burns G, Hogue V. Wellstar Paulding Hospital Intensive Care Unit Case Study: Achieving a Research-Based, Patient-Centered Design Using a Collaborative Process. *Criti Care Nurs Q*. 2014; 37(1):93-102.
15. Vlasses P, Patel N, Rouse M et al. Employer Expectations of New Pharmacy Graduates: Implications for the Pharmacy Degree Accreditation Standards. *Am J Pharm Educ*. 2013; 77(3):47.
16. Knapp K, Schommer JC. Finding a Path Through Times of Change. *Am J Pharm Educ*. 2013; 77(5):91.
17. Poirier TI, Wilhelm M. Interprofessional Education: Fad or Imperative. *Am J Pharm Educ*. 2013; 77(4):68.
18. 1Health. University of Minnesota Academic Health Center. www.ahceducation.umn.edu/1Health/index.htm (accessed 2014 Jan 9).
19. University of Virginia Interprofessional Education. University of Virginia. ipe.virginia.edu (accessed 2014 Jan 9).
20. University of Pittsburgh School of Medicine Office of Medical Education Interprofessional Education. University of Pittsburgh. www.omed.pitt.edu/curriculum/interprofessional.php (accessed 2014 Jan 9).
21. Vanderbilt University School of Medicine. Vanderbilt Program in Interprofessional Learning. <https://medschool.vanderbilt.edu/vpil/> (accessed 2014 Jan 9).

Figure 1 caption: "Collaboration hubs" can be as simple as small standing tables, around which professionals can easily and spontaneously interact.

