INSTRUCTIONAL DESIGN AND ASSESSMENT

An Introductory Pharmacy Practice Experience on Improving Medication Adherence

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Objective. To evaluate the impact of a medication adherence activity on introductory pharmacy practice experience students' perceptions of patient adherence as well as student development of empathy and confidence in patient counseling.

Design. Students participated in a personal medication simulation using an automated medication dispenser. Students then identified a patient with nonadherence and provided counseling on use of the dispenser. After 4 to 6 weeks, students interviewed the patient about their experience with the dispenser and assessed changes in adherence.

Assessment. One hundred fifty-three students completed the assignment and 3 surveys instruments. Following the experience, the majority of students agreed or strongly agreed that they developed more empathy for patients with multiple medications and felt confident counseling a patient in the use of a dispenser (92.0% and 88.2%, respectively). Most students (91.4%) reported feeling that their patient education session was successful.

Conclusion. An introductory pharmacy practice experience involving an automated medication dispenser and patient counseling to improve medication adherence resulted in the development of empathy and improved student confidence.

Keywords: medication adherence, compliance, simulation, introductory pharmacy practice experience

INTRODUCTION

Medication adherence is the extent to which individuals take their medications as prescribed by their healthcare practitioner. Either deliberate or unintentional, nonadherence includes failing to fill a prescription, discontinuing a medication prematurely, taking an incorrect dose, and taking medication at the wrong time.¹ Medication nonadherence often leads to poor health outcomes and has a significant negative economic impact.²⁻⁶ Medication nonadherence accounts for more than 10% of older-adult hospital admissions, nearly 25% of nursing home admissions, and 20% of preventable adverse drug events among ambulatory elderly patients.^{1,7} Medication nonadherence results in an estimated 125,000 deaths annually and costs the US healthcare system \$100 billion per year.^{1,7,8}

Pharmacists are in an ideal position to positively impact medication adherence because of patient trust, access to medication profiles, opportunities for patient consultation, and knowledge on the consequences of nonadherence. Spending only minutes communicating with a patient can reveal reasons for nonadherence, and pharmacist intervention with a patient's healthcare provider often can resolve adherence issues. For example, recommending a lower-priced generic or decreasing the complexity of a patient's drug regimen can improve medication adherence.⁹

Introductory pharmacy practice experiences (IPPEs) have been identified as key opportunities for pharmacy students to practice patient-centered care and apply information learned in the curriculum.¹⁰ The Accreditation Council for Pharmacy Education's (ACPE's) accreditation Standards and Guidelines encourage pharmacy schools and colleges to identify or develop IPPEs that expose students to the assessment of medication adherence, the management and monitoring of drug regimens, the provision of patient education, and the use of technology to enhance patient outcomes.¹¹ The Purdue University

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College of Pharmacy PharmD Program Outcome Ability Goals include teaching students behavioral modification approaches for promoting medication adherence and disease prevention as well as identifying and implementing strategies to encourage patient adherence.¹²

Simulated healthcare experiences foster students' understanding of patients' difficulties and reasons for non-adherence.^{13-15,17,18} Various types of simulations have been used in health disciplines as a mechanism to help students understand patients and develop empathy.¹³⁻¹⁸ Students generally find these experiences valuable and believe they should be incorporated as part of the core curriculum.¹⁴

Because an estimated 20% to 50% of patients are nonadherent with prescribed medications, adherence training is a fundamental component in the education of pharmacy students.^{1-3,11} Adherence simulations and patient experiences provide a basis for understanding this concept as well as opportunities to apply patient-care skills and develop empathy. Only 1 of the simulations identified in the literature focused on medication use with an adherence dispenser. There is little published literature focusing on the integration of medication adherence within IPPE programs,¹⁷ and there is no published literature on students' opinions about the reasons for medication non-adherence. Additional research is needed in this area.^{2,7,8}

A student simulation and a patient-based experience focusing on medication adherence were developed to integrate specific ACPE-required domains and college-specific goals into the IPPE program. This manuscript describes the student assignment and learning from the student perspective. The objective is to evaluate the impact of the students' simulation and patient-based experience on their perspectives of medication adherence and the development of empathy and confidence when counseling a patient.

DESIGN

During the first year at Purdue University College of Pharmacy, students explore the concept of medication adherence in the classroom setting and complete 30 hours of pharmacy experience as part of the core curriculum. This experience provides the foundation for the Medication Adherence Assignment, 1 of several requirements within the 4-credit hour, second-year IPPE course, in which students spend a minimum of 160 hours in a community pharmacy completing assignments and exploring topics relative to practice. The IPPE Medication Adherence Assignment timeline is outlined in Figure 1, and student objectives for the assignment are presented in Table 1. The Investigational Review Board at Purdue University approved this project.

In the Medication Adherence Assignment, students applied conceptual knowledge by participating in a 2-part activity: (1) a personal medication adherence simulation, and (2) the selection, education, and follow-up with a patient experiencing nonadherence at the student's community pharmacy IPPE site. Throughout the assignment, students were asked to reflect on their learning experience and develop conclusions to apply to future practice; these activities constitute the theoretical basis of experiential learning.

Student Medication Adherence Simulation

For the initial simulation, students were supplied with a medication vial labeled with the directions "take one tablet twice daily." They filled the vials with their own "medication," which in most cases was candy or placebo capsules supplied by the instructor. Students were told to take doses at 12-hour intervals (eg, 7:00 AM and 7:00 PM) for 1 week and asked to chart how many doses were taken on time, taken late, and missed. For purposes

Figure 1. Medication-Adherence Assignment Timeline. Abbreviations: P1 = first professional year student; P2 = second professional year student; IPPE = introductory pharmacy practice experience.

Table 1. Learning Objectives of Medication-Adherence Assignment

Upon completion of this assignment, the student will:

- Simulate the role of a patient with a medication adherence issue to promote understanding and patient empathy
- Evaluate the use and practicality of an automated medication adherence device
- Analyze patient profiles for medication adherence issues
- Determine appropriateness of a medication adherence device for a specific patient and make sound recommendations
- Counsel a patient and demonstrate use of a medication adherence device
- Describe reasons for medication nonadherence
- Reflect on the value of pharmacist's involvement in patient care

of this assignment, a dose taken “on time” was defined as a dose taken within an hour of the scheduled time and a “late dose” as a dose taken more than an hour past the scheduled time. A “missed dose” was defined as a dose not remembered until time for the next dose. Students were instructed not to take 2 doses if a dose was missed. Following the first week, students were each provided with a (Med-E-Lert automated medication dispenser (<http://www.medelert.net/>, Xiamen, PR China) and instructed to track their adherence for the same medication regimen for an additional week. Students compared any differences in their own adherence with and without use of the dispenser.

The simulation was intended to enhance empathy for patients taking medications, to ensure familiarity with the dispenser in order to educate a patient in part 2 of the assignment, and to allow the students to begin formulating opinions about the design features of the automated medication dispenser. The dispensers were provided to the experiential learning program by the manufacturer as an in-kind grant for student learning. This dispenser is a round, tabletop model designed for home use. It has a flashing light for the visually impaired, a buzzer for the hearing impaired, and a medication-lock mechanism to ensure that patients with memory problems do not take more medication than prescribed. To ensure that students

would develop their own opinions about the device design, functions, and usefulness with their patients, they were not told prior to the IPPE that the dispenser was intended for specific patient populations. After the second week of simulation, students completed the first of 3 student survey instruments described below.

Patient Medication Adherence Experience

Following the personal simulation, students were asked to demonstrate use of the dispenser to the community IPPE preceptor and discuss specific patient populations likely to benefit from an adherence-assistance device. Each student then analyzed a minimum of 10 patient medication profiles for potential adherence issues for the purpose of identifying patients likely to benefit from use of the automated medication dispenser. The patient-selection criteria included: minimum age of 18 years, ability to understand and speak English (as agreed upon by the student and preceptor), nonpregnant status, history of taking at least 1 oral chronic medication (that would fit in the dispenser) for the past 6 months, history of refilling at least 1 oral medication excessively early or late for at least 4 of the past 6 months of use, and not being a close friend or relative of the student. The student then selected a candidate meeting the criteria and contacted the patient about participation.

Figure 2. Student late doses with and without an automated medication dispenser (AMD).

Figure 3. Student missed doses with and without an automated medication dispenser (AMD).

Once patients agreed to participate, students were instructed to set up a time to meet with their respective patients, discuss the educational project, and counsel the patients on use of the dispenser (provided at no charge to the patients). At initial patient meetings, the students clarified with the patient whether the IPPE preceptor was willing to assist patients with the dispenser after the student experience had ended. Students then completed the second survey instrument. Throughout the experience, patients were asked to record adherence information throughout the experience and, 4 to 6 weeks later, they were interviewed by their respective students regarding their successes and difficulties with the dispenser. After this interview, the students completed the third survey instrument.

EVALUATION AND ASSESSMENT

Three electronic student survey instruments were designed for use throughout the assignment. Students completed the first survey instrument (65-item) after their personal medication adherence simulation with and without an automated medication dispenser. They rated the ease in setting the automated functions on the dispenser as well as their experience using the device. They classified automated functions as advantageous or disadvantageous and rated their confidence in explaining operation of the dispenser to a patient. In addition to quantitative responses, the first survey instrument contained qualitative items asking students to reflect on specific patient populations likely to benefit from use of this automated medication dispenser as well as potential reasons for medication nonadherence.

The second survey instrument (129 items) was completed following students' initial meetings with their patients who were experiencing medication nonadherence. These survey questions were similar in content to those of the first survey instrument but reflected patient rather

than student responses. It also solicited patient demographics, medical conditions, and information about the patient's personal support system. Responses were submitted electronically by the student.

Following 4 to 6 weeks of dispenser use by the patient and verbal follow up by the student, the student completed a third survey instrument (94 items). This survey instrument compared patients' initial responses prior to using the medication dispenser with their actual experience and asked students to reflect on changes in their own perceptions before and after the activity.

PASW Statistics 18.0 for Windows (IBM, Armonk, NY) was used for data analysis. Descriptive statistics were conducted on all quantitative survey items. An *a priori* level of significance was established at $\alpha = 0.05$. Paired *t* tests were performed to identify differences in students' empathy and confidence in explaining the dispenser prior to and after completion of the patient-education session.

Students' open-ended responses regarding the reasons for medication nonadherence as well as the single most important thing that they learned from the assignment were reviewed for commonalities or themes. All investigators reviewed and coded these responses individually and then compared response codes until they reached a consensus. Because students were able to cite multiple reasons or lessons learned in response to a question, a single response could be coded with multiple themes.

The majority of students were female (68.0%), Caucasian (77.8%), and less than 25 years of age (88.9%). Approximately 15% of students indicated that English was their second language. In addition to the 30 hours of required pharmacy experience, 77.1% of students self-reported additional community pharmacy experience and/or hospital pharmacy experience (32.7%). Patient demographics are described in Table 2.

Table 2. Demographics of Patients Who Participated in a Medication Adherence Program Administered by Pharmacy Students (N = 152)

Demographic	No. (%)
Gender	
Male	49 (32.2)
Female	103 (67.8)
Age	
18-30 years old	22 (14.5)
31-50 years old	26 (17.1)
51-70 years old	64 (42.1)
>71 years old	40 (26.3)
Highest educational level	
Less than high school degree	7 (4.6)
High school degree or equivalent	61 (40.1)
Less than 4 years of college or associate's degree	40 (26.3)
Bachelor's degree or more	44 (29.0)
Marital status	
Single/never married	22 (14.5)
Married or living with partner	90 (59.2)
Divorced, separated, or widowed	40 (26.3)
Ethnicity	
African American	3 (2.0)
Caucasian	141 (92.8)
Latino	3 (2.0)
Asian	2 (1.3)
Other/mixed	3 (2.0)
English a second language	
Yes	31 (20.4)
No	121 (79.6)

The difference in students' perception of empathy development was not significant between the first and third survey instruments. However, a higher percentage of students strongly agreed that they developed more empathy for patients taking multiple medications after directly interacting with them than beforehand (55.6% vs 49.0%, respectively) (Table 3).

The difference in student confidence in explaining the medication dispenser was significant between survey 1 and survey 2 ($p < 0.01$), indicating that the students' confidence increased following the patient-education session. Following their personal simulations with and without the device, the majority of students (81.1%) agreed or strongly agreed that the dispenser would improve a patient's medication adherence. Another 14.4% felt unsure after using the device, and only 4.6% disagreed. The majority of students (91.4% agree/strongly agree) felt their patient-education session was successful (Table 3).

Students were asked to identify reasons for nonadherence both before and after meeting with their patients. Prior to the patient interaction, 38% of students identified multiple reasons for patient nonadherence, but following the interaction, 58% of students identified multiple reasons. Students identified 11 additional areas of nonadherence after the patient interaction (Table 4). All themes were included to show the breadth of student-identified reasons for nonadherence.

When asked the single most important thing they learned from this assignment, students indicated that they were better able to understand the reasons for nonadherence (24.8%) as well as patient difficulties in adhering to medication regimens (23.5%). Students recognized the impact of pharmacists in patient care (19.0%) and the importance of individualizing care to the patient (15.0%). Additional themes are presented in Table 5.

Of the 7 assignment objectives, 2 were process related: objective 3 (analyzing patient profiles) and objective 5 (counseling the patient and demonstrating use of a medication dispenser). These objectives were met by all students through completion of the assignment. Although students were not specifically asked if they believed they met each of the assignment learning objectives, several students described learning that was pertinent to the objectives, such as the importance of individualized care (objective 2), reasons for nonadherence (objective 6), and the impact pharmacy can have on patient care (objective 7). Students also identified areas of learning that

Table 3. Student Responses After the Student Simulation and After the Patient-Interaction Experience

	After Student Simulation/ Prior to Patient Experience		After Patient Experience	
	No.	Mean (SD) ^a	No.	Mean (SD) ^a
My empathy for patients who take multiple medications increased.	153	4.4 (0.8)	151	4.4 (0.8)
I feel confident explaining how to set up an AMD with my patient.	153	3.9 (0.9)	152	4.2 (0.7)
I believe this AMD could improve a patient's adherence.	153	4.0 (0.8)	—	—
I felt the educational session was successful.	—	—	152	4.2 (0.7)

^a 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree

Abbreviation: AMD = automated medication dispenser

Table 4. Student-Identified Reasons for Patient Nonadherence After the Student Simulation and Prior to the Patient-Interaction Experience

Reasons for Nonadherence	After Student Simulation /Prior to Patient Experience, No. (%)	After Patient Experience, No. (%)
Medication Regimen Issues		
Regimen complexity	38 (24.8)	19 (12.4)
Multiple medications	24 (15.7)	19 (12.4)
Inconvenient timing of doses	5 (3.3)	14 (9.2)
Availability of water	1 (0.7)	—
Patient-Related Issues		
Forgetfulness/difficulty tracking doses	60 (39.2)	57 (41.8)
Patient's schedule	37 (24.2)	51 (37.3)
Can't feel a difference with drug		5 (3.3)
Age/physical or cognitive impairment	10 (6.6)	10 (6.6)
Lack of knowledge or recognition of importance of medication	6 (3.9)	7 (4.6)
Confusion about medication use	6 (3.9)	1 (0.7)
Don't think they need medication	—	5 (3.3)
Takes medication only when they feel they need it	—	5 (3.3)
Other priorities	—	4 (2.6)
Frustrated	—	3 (2.0)
Medication doesn't work	—	2 (1.3)
Distracted	—	1 (0.7)
Doesn't like taking multiple meds	—	1 (0.7)
Depressed/disease avoidance	—	1 (0.7)
Not sure when to pick up prescriptions	—	1 (0.7)
Medication-Related Issues		
Cost	4 (2.6)	11 (7.2)
Side effects	2 (1.3)	4 (2.6)
Difficulty swallowing the medication	—	1 (0.7)
Adherence-device issues	27 (17.6)	9 (5.9)

were beyond the specified learning objectives, such as the link between patient adherence and outcomes and the difficulties involved in changing patient behavior (Table 5).

Students recognized that this automated medication dispenser was not appropriate for every patient and expressed opinions about the device's design and functions. They indicated that this experience helped them critically evaluate the appropriateness of this device for their respective patients. Students often cited the need to individualize care to improve patient adherence. When they were asked if they or a close relative had ever had a problem with medication adherence, 57.5% of students responded "yes," while 42.48% responded "no." When asked if they had ever provided assistance to someone with a medication adherence problem, 45.8% responded "yes," and 54.3% responded "no."

DISCUSSION

The personal simulation with the automated medication dispenser helped students understand how the device

worked and allowed them to critically evaluate the device for patient use. In addition, the simulation allowed them to relate their own experience to the patient and increase their confidence when explaining its use. The patient interaction appeared to be essential in increasing the students' confidence in providing patient education and enhancing the students' understanding of the reasons for patient nonadherence. The number, types, and depth of student-identified reasons for patient nonadherence increased after the patient interaction. Students also began to recognize and note the importance of the patients' lifestyle and beliefs, which often differed from their own. This outcome would not have been achieved by simulation alone.

Questions in the survey instruments were not identical, which limited the comparisons that could be made across components of the learning activity, including measurement of changes over time, such as the development of empathy. Regarding the insignificant difference in empathy development between the first and third

Table 5. Students' Responses to "Single Most Important Thing Learned"^a

	No. (%)	Corresponding Course Objectives
Understanding the reasons for nonadherence	38 (24.8)	6
Difficulties in adhering to medication regimens	36 (23.5)	1
Impact of pharmacy in patient care	29 (19.0)	7
Importance of individualized care	23 (15.0)	2
Device will not work for everyone	16 (10.5)	2
Importance of getting to know patients	15 (9.8)	7
Link between adherence and patient outcomes	13 (8.5)	NA ^b
Importance of clear communication	11 (7.2)	NA ^b
Tools available to help with adherence	11 (7.2)	4
Difficulty in changing patient behavior	7 (4.6)	NA ^b
Development of empathy	3 (2.0)	1
Prevalence of nonadherence	3 (2.0)	NA ^b

^a All students met process-related objectives 3 and 5.

^b Not applicable. Student-identified areas of learning that were beyond the specified learning objectives.

survey instruments, a high percentage of students rated themselves as empathetic (91.5% agreed/strongly agreed) after their own simulation, perhaps leaving little room for improvement after the patient experience. With respect to understanding the difficulties of adhering to a prescribed regimen, the student simulation was possibly more enlightening than working with a patient. Empathy is discussed in a companion course, which could have contributed to social-desirability bias in the students' responses. Surveying the students' perceptions of their empathy prior to the assignment would have been beneficial in assessing whether the personal simulation or the patient experience resulted in a more significant increase in patient empathy. Item modifications are planned to address these limitations in future experiences.

Promotional materials for the automated medication dispenser were withheld from the students in an attempt to allow them to draw their own conclusions about specific patient populations for which this dispenser might be most appropriate. This dispenser has design features intended for those who are homebound and/or those with visual, hearing, or cognitive impairment. Almost 20% of the students indicated that they were unsure or disagreed that this device would improve a patient's medication adherence. Approximately one third (31.6%) of the patients selected by the students were under 50 years of age and may not have been ideal candidates for this particular device. It would have been interesting to know whether any of the "age 50 and under patients" selected fit any of the target demographic parameters intended for this automated medication dispenser.

Although students were given criteria when selecting a patient, some students had difficulty with the selection process, and in some cases, preceptors provided

assistance. Some students commented that their patient was selected because he/she was nice or would be likely to come to a training session with the device and return for later assessments. As a result, the instructor believes that not all patients had true nonadherence issues, which may have influenced students' responses and their learning.

The survey instruments were quite lengthy, which could have contributed to respondent fatigue. When the IPPE assignment was introduced to the students, the survey instruments were discussed and students knew responses would be reviewed. As with any reflective assignment, there is risk that some students put forth more effort than others, potentially influencing the results. Reasons for nonadherence were collected qualitatively to allow students to identify nonadherence without guidance, but this method limited their ability to respond to all cited reasons for nonadherence and contributed to a wide variation in the number and depth of responses.

As is true for all colleges and schools of pharmacy, the amount and quality of each student's previous pharmacy experiences is variable upon entrance into the professional program. Designing early experiences suitable for all students in the early phases of the core curriculum is challenging but important to achieving a level playing field as students progress to the next level of IPPEs. The placement of this experience so early in the curriculum also may have contributed to the wide differences seen in the depth and breadth of the student responses.

Future directions for the assignment include administering a validated empathy questionnaire to better assess changes in empathy from the different assignment components. The instructor also plans to expand the learning objectives based on student responses to questions in survey instrument 3 regarding the "single most important

thing you learned.” Clearly, the students learned lessons beyond the stated expectations (Table 5), demonstrating the need to incorporate additional discussion at a higher learning level. Consideration will be given regarding where in the curriculum this topic should be further explored.

SUMMARY

This IPPE using an automated medication dispenser improved student understanding of the concept of medication adherence. Students met the learning objectives of the activity and identified reasons for nonadherence beyond the scope of the objectives. Students explored factors affecting medication adherence and provided patient-centered care, which resulted in the development of empathy for some students (although not significant for the entire class) and improved their confidence in providing patient education.

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