

## RESEARCH

# Second-Year Pharmacy Students' Perceptions of Adhering to a Complex Simulated Medication Regimen

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**Objective.** To conduct a simulated medication regimen with second-year pharmacy students to determine their anticipated versus actual difficulty in adhering to it.

**Methods.** Second-year pharmacy students were given 6 fictitious medications (jellybeans) and a drug regimen to adhere to for 6 days. Pre- and post-intervention surveys were conducted to compare participants anticipated vs. actual difficulty with adherence and changes in empathy toward patients.

**Results.** The 69 (96%) students who participated in the study missed on average 16% of all simulated medication doses and noted that adhering to the complex medication regimen was more difficult than they had anticipated. Eighty-nine percent of students agreed or strongly agreed the project was valuable in developing empathy towards patients taking complex medication regimens.

**Conclusions.** Pharmacy students participating in a simulated medication regimen missed a notable number of doses and reported a greater level of empathy for patients taking complex medication regimens. Finding meaningful ways to integrate adherence into the curriculum is essential.

**Keywords:** adherence, medications, pharmacy students

## INTRODUCTION

Nonadherence to prescribed medications, whether intentional or unintentional, contributes to patient morbidity and mortality and increases overall health care costs.<sup>1</sup> For example, the direct and indirect costs associated with a patient who has poorly controlled diabetes are approximately 3-4 times higher than the costs associated with attaining good glycemic control.<sup>2</sup> Gibson and colleagues found that adherent patients had lower rates of diabetes-related complications and that an inverse relationship existed between adherence and hospitalizations.<sup>3</sup> Likewise, poor medication adherence in patients with hypertension has been identified as the main reason for lack of blood pressure control.<sup>2</sup> Increasing patient adherence to hypertension and dyslipidemia therapies to rates greater than 80% would avoid 800 myocardial infarctions and 600 strokes per 100,000 patients.<sup>4</sup> Nonadherence rates for patients with asthma ranges from 30% to 70%, and exacerbations from poor asthma control can result in additional costs due to hospitalizations and emergency room visits.<sup>2</sup>

Adherence is greatest for patients taking medications with once-daily dosing compared to those taking medications with 2 or more daily doses.<sup>1</sup> Elderly patients are less likely than younger patients to take medications correctly. Patients who have multiple chronic conditions requiring 5 to 8 medications and a complex medication schedule have further reduced adherence rates.<sup>1</sup> Considering adherence averages 50% in developed countries for patients with chronic diseases, pharmacists alongside other health care professionals can be instrumental in impacting medication adherence by using various patient-counseling interventions.<sup>1,5</sup> For pharmacists to adequately inform and empathize with patients taking multiple medications, education at the pharmacy-student level must occur. Adequate training at this level may later translate to patient care that focuses on recognizing and improving poor medication adherence.

Divine and colleagues completed a 5-year study of a geriatrics elective course in which each class of pharmacy students participated in a simulated medication regimen and then completed a survey instrument about their experience and participated in a classroom discussion.<sup>6</sup> The majority of the feedback from the students was positive and indicated learning in the areas of empathy and adherence. O'Conner and colleagues found that medical and nursing students who followed a short-term medication regimen benefited from experiencing firsthand the

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challenges patients face in adhering to a prescribed medication regimen.<sup>7</sup> The authors found that this exercise served as a good adjunct to the curriculum on medication issues while minimizing the use of class time. Although these studies highlight the value of a simulated medication regimen to teach students the difficulty of adherence, Divine and colleagues studied only students enrolled in an elective course and O’Conner and colleagues studied medical and nursing students. The objective of our study was to determine the perceived versus actual difficulty of adhering to a complex medication regimen for all second-year pharmacy students at Northeast Ohio Medical University as determined by pre- and post-intervention surveys and pill counts. We hypothesized that the adherence rates would be < 80% and students would underestimate the difficulty in adhering to a complex medication regimen.

**METHODS**

All second-year pharmacy students enrolled in the Pharmacist Patient Care Experience 7 course (n = 72) were required to participate in this ungraded project; however, submission of results and completion of survey instruments was voluntary. The project took place near the conclusion of an 8-hour medication therapy management (MTM) training series. This timing was intentional as most MTM services focus on patients who are taking complex medication regimens. The institutional review board at Northeast Ohio Medical University granted exempt status for this study.

A pre-intervention survey was administered to students to assess their anticipated difficulty (1 = least difficult; 10 = most difficult) and ability (1 = not very

successful; 10 = most successful) to adhere to the complex medication regimen. Following completion of the pre-intervention survey instrument, students were given a prescription bag with 6 medications in amber prescription vials labeled with a pharmacy name, the student’s name, and medication information. Fictitious drug names, uses, route of administration, and directions were provided for each medication (Table 1). The medications were given various administration frequencies (eg once daily versus 3 times daily) and timing (eg with or without food) to mimic drugs commonly seen in complex medication regimens. Starburst jellybeans were used to simulate medications. Students were instructed to follow the regimen to the best of their ability. They were given no further instructions or advice about how to successfully adhere to the regimen. The prescription bags with the medications were passed out in one class and vials with any remaining pills were collected during the next class the following week. This timeframe allowed students to experience adhering to the 6-day medication regimen both during the week and on the weekend. After students turned in their medications, they completed a post-intervention survey instrument. The principal investigator then led a short informal discussion that focused on the challenges that students encountered as well as the steps they took throughout the week to achieve adherence.

**RESULTS**

Sixty-nine students (96%) completed both the pre- and post-intervention survey instrument. Compared to the pre-intervention survey, students reported on the post-intervention survey a greater difficulty (mean score of

Table 1. Pharmacy Student Adherence to a Simulated Medication Regimen

Name/Strength of Simulated Medication	Directions	Use	Doses Dispensed, No.	Doses Missed, No.	Doses Missed, % <sup>a</sup>
Ipratropine, 25 mg	Take 1 tablet by mouth at bedtime	Hypertension	432	77	17.8
Synstap, 50 mg	Take 1 capsule by mouth three times daily	Osteoarthritis	1,296	242	18.7
LopoliX, 100 mg	Take 1 tablet by mouth in the morning on an empty stomach	Hypothyroidism	432	85	19.7
Maxtrip, 65 mg	Take 1 tablet by mouth once daily with food	Major Depressive Disorder	432	70	16.2
Triplor, 80 mg	Take 1 capsule by mouth twice daily	Dyslipidemia	864	120	13.9
NorvoX XL, 100 mg	Take 1 tablet by mouth once daily	Community Acquired Pneumonia	432	47	10.9

<sup>a</sup> Average doses missed = 16.2%

6.5 and 6.9, respectively) than anticipated, and lower ability (mean score of 6.2 and 5, respectively) than anticipated to adhere to a complex medication regimen. The mean number of day's students anticipated missing at least 1 dose of a medication was 2.3 days. The actual number of days on which at least 1 dose was omitted was 3.1. Sixty-eight percent ( $n = 47$ ) of students noted that they take prescription medications, nonprescription medications, and/or herbal or dietary supplements on a daily basis. Of the 68% that take a medication or supplement on a regular basis, the average number taken daily was 2.4. When asked about their schedules (including school, work, family activities, hobbies, etc.), 38% ( $n = 26$ ) of students indicated they were busy and 57% ( $n = 39$ ) indicated they were very busy. Nineteen percent ( $n = 13$ ) of the students agreed and 70% ( $n = 48$ ) strongly agreed that the project was valuable in helping them to develop empathy towards patients with complex medication regimens.

All students turned in their medication vials whether or not they had jellybeans left in them. The number of doses that were given, the number of remaining doses, and percentage of missed doses are reported in Table 1. Students missed an average of 16% of all doses. The simulated medication with the lowest percentage of missed doses (10.9%) was Norvox XL, 100 mg, which was to be taken once daily with or without food. The simulated medication with the highest percentage of missed doses was for Lopolix, 100 mg, which was to be taken once daily in the morning on an empty stomach (19.7%).

After all medications were turned in and the post-intervention survey instruments completed, the principal investigator led a short discussion with the students. The resounding message from students was that the project was much more difficult than they had anticipated and they had a new appreciation for the challenges faced by patients taking complex medication regimens. Several students had come up with ways to improve their adherence throughout the week such as creating cell phone reminders and using pillboxes.

## **DISCUSSION**

This is the first study to the authors' knowledge that assessed the ability and perceptions of an entire class of pharmacy students regarding adherence to a simulated complex medication regimen commonly encountered by patients. Overall, students had difficulty adhering to the regimen, considering that they missed an average of at least 1 dose of a medication on just over half of the days of the project. As expected, students had the most success (according to pill counts) with the simulated medication that was to be taken once daily regardless of meals (Norvox XL). In addition, students had the most difficulty

with regimens that had specific criteria for administration such as time of day (Ipotrine), with or without food (Maxtrip and Lopolix, respectively) or multiple doses per day (Synstap). Students missed 16% of doses on average, which is significant considering they had previous training on adherence and, as pharmacy students, have an understanding of the importance of taking medications as prescribed. While students noted having busy schedules, students did not have to deal with other factors commonly encountered by patients that may negatively impact adherence such as cost of medications and side effects. Overall, students had more difficulty adhering to the regimen than they anticipated. This should not be overlooked as it may indicate that pharmacists overall have a difficult time adequately empathizing with patients on complex medication regimens.

The overall response from students to the activity was overwhelmingly positive, highlighting the importance of pharmacy educators finding unique ways outside of traditional lectures to instill knowledge and empathy in students. This study used active learning and simulation techniques to teach a topic. If adequately constructed and delivered, these techniques provide a change of pace from the usual classroom regimen and allow students to actively participate in their own learning rather than passively sitting and listening to a lecture. While the benefits of engaging students via active learning and simulated activities may be apparent, these techniques may not always be well received if done without much thought and planning. In addition, several challenges exist to changing the dynamic of the traditional lecture-oriented class session such as students' comfort with receiving information via lectures or other traditional presentation styles and students' expectation for the teacher to tell them what they need to know. Therefore, careful planning and execution is integral to a successful active-learning activity.

There are a few limitations to this research project. First, students participated in a medication adherence seminar in the fall of their first year that may have impacted their knowledge and perception of adhering to a complex medication regimen. However, it would be expected that a session in the first year would have minimized the potential impact of this project and therefore it is likely that the results of this project are understated. Second, there was no tracking of whether students took the medications at the right time of the day during the 6-day regimen. For example, students may have been given credit for taking a medication even though it was taken at the incorrect time or day. Accuracy of students adhering to their regimens was only determined by the final count of jellybeans. In addition, medications were collected 9 days after being passed out although there

was only 6 days' worth of medications. Therefore, some students may have used the extra days to "catch up" on missed doses. Third, the discussion completed at the end of the post-intervention survey by the principal investigator was not structured and therefore did not allow for a thorough analysis. If this project is replicated, the researchers plan to hold a structured focus group with students to perform a qualitative analysis.

## **CONCLUSION**

Pharmacy students overall had more difficulty adhering to a simulated complex medication regimen than they projected, and the activity was a successful way of teaching them about the difficulties that patients face. Considering the impact that medication adherence has on the healthcare system, finding meaningful ways to integrate information on adherence into the curriculum is essential.

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