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STUDENT PHARMACIST SERVICE-LEARNING IN WESTERN KENYA:

The Implementation of Electronic Prescription Entry

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ABSTRACT

Purdue pharmacy students implemented a project incorporating electronic prescription entry in a rural HIV clinic pharmacy in Kitale, Kenya. Students evaluated the impact of electronic pharmacy inventory management as well as the effects on patient wait time for prescriptions. Primary outcomes included accuracy and efficiency of Kenyan pharmacy staff prescription entry. At the end of the project, students found a decrease in prescription errors as well as an increase in the speed of entry. The Kenyan pharmacy staff had few computer skills, yet after three months of using the system, the staff had improved overall patient care as well as efficiency within their workplace. This project demonstrated the impact of a student-led service project.

BACKGROUND

Purdue University offers an abundance of international opportunities for students to engage in and develop their career goals. These international opportunities allow students to expand their role and contribute to communities in various areas of study (Purdue University, n.d.). Purdue University College of Pharmacy (PU-COP) students have the opportunity to complete an eight-week advanced pharmacy practice experience in Eldoret, Kenya, working with the Academic Model Providing Access to Healthcare (AMPATH; Pastakia, Schellhase, & Jakait, 2009). AMPATH is a partnership between Moi University School of Medicine, Moi University Teaching and Referral Hospital, several U.S. medical schools, and Purdue University College of Pharmacy (AMPATH, n.d.; Einterz et al., 2007). AMPATH's mission is to provide and expand sustainable access to high-quality care. AMPATH has expanded to over 50 satellite clinics within a catchment area with a population of more than two million (AMPATH, n.d.). Pharmacy students who seek to pursue this rotation in their last year are actively engaged in service-learning projects to help further apply the role of the student in expanding sustainable access to health care. As students, we provide pharmaceutical care in an extremely resource-limited setting and develop new ways to help enrich the community. As part of a class project, each student designs a service-learning grant. Several of the grants have been submitted to the Office of Engagement for funding consideration.

For this service-learning project, our student group partnered with the Kitale pharmacy located in one of AMPATH's rural sites in Kenya. The Kitale clinic is one of the largest in the AMPATH care network. It cares for approximately 6,400 active HIV-infected patients. All of these patients fill their prescriptions at the Kitale pharmacy, making it one of the busiest in the AMPATH catchment area. The pharmacy at Kitale is staffed by two pharmacy technologists, who are licensed health care providers and who complete a two-year diploma-granting program before obtaining their license. Technologists are responsible for all parts of the pharmacy distribution process, including prescription entry, filling and dispensing, providing patient education on medications, and inventory management. During a typical day, the Kitale pharmacy fills and dispenses

Figure 1. A Purdue pharmacy student works with the pharmacy team in Kenya to computerize the medication dispensing process.

approximately 370 prescriptions and at times up to 570 medications, which is comparable to busy pharmacies in the United States.

Like all AMPATH clinic pharmacies, Kitale didn't have a computer-based dispensing system. Instead, they used a handwritten logbook to track the prescriptions dispensed for antiretroviral (ARVs) and non-ARV medications. Each logbook entry consisted of the patient identification number, the drug that was dispensed, the number of tablets dispensed, and the number of tablets remaining from the previous fill. Refill history, pill counts, and other non-ARV medications were not tracked for individual patients. Its sole purpose was to maintain adequate inventory records for monthly reporting requirements.

Since the inventory management system was not automated, inventory of drugs was performed by hand. When inventory was preformed, the staff would count the available stock on the pharmacy shelves. For ARVs, this method worked well enough to ensure that there were no stock outs of ARV medications. Inventory management for non-ARV medications was more challenging for a variety of reasons, such as budget cuts and restrictive funding policies (USAID, n.d.). The increased complexity of managing medications became readily apparent by the frequent stock-outs of the non-ARV medications needed to effectively manage patients. This problem was further complicated by the dramatic increase in transportation costs, which led to a decrease in the frequency of deliveries from daily to weekly or monthly. These factors created a pressing need for greater oversight and electronic tracking of medication prescribing and distribution. Despite the need and potential for patient care benefits, a real-time electronic prescription entry system took some time to implement.

DESIGN

Despite the vast accomplishments the AMPATH program has had in providing comprehensive patient care, there are still some areas of record-keeping that could be improved to enhance efficiency. Low computer literacy and limited computer access in this rural setting adds to the many barriers of electronic prescription entry, as we have in the United States. Furthermore, there are considerable limitations with space and availability of reliable electricity. While the inventory management of ARVs and the dispensing of medications is completely computerized in the central pharmacy in Eldoret, Kenya, the remaining rural sites continue to be tracked and documented manually on paper.

Despite the number of complications to implementing a computerized prescription entry system into the rural care site pharmacies, including Kitale, we saw this as an opportunity. The decision was made due to the need for increased tracking of medications as well as the need for greater patient care functions within the pharmacy system—a computerized system would be beneficial. The prescription entry database implemented was called the ART Dispensing Tool, a Microsoft Access database programmed by Management Sciences for Health, an international nonprofit organization focused on strengthening health care management. This program allows users to track inventory management and patient prescriptions. The database allows pharmacy staff to enter the patient name, unique identification number, starting weight, current weight, starting and current ARV regimens, and non-ARV medications. At the pharmacy visit, each medication is entered into the database, including the date filled, number of tablets dispensed, and remaining ARV medications (pill counts) from the previous fill. The database also

Figure 2. A Purdue pharmacy student works on medication supply and inventory in Eldoret, Kenya.

has an alert system, which notifies the pharmacy staff of unintended changes in the ARV regimen, greatly adding to patient safety. This system is designed to facilitate the electronic recording of inventory along with automatically generating reports to meet the requirements for donor agencies.

With the considerable training and assistance required to ensure successful implementation in rural sites, the community partnership with PU-COP was used to facilitate this task. Kitale was one of the initial sites chosen because of its high patient volume. An organized plan was used to guide implementation.

We were tasked with assisting in training the Kitale pharmacy staff on how to use an electronic prescription entry system. In addition to carrying out the implementation plan, we assisted with pharmacy duties, such as drug distribution, counseling, inventory management, and prescription entry. We also timed the entry speed of the Kenyan pharmacy staff and retrospectively checked prescription entry for accuracy.

CONDUCT/EVALUATION

Our outcome measures focused on assessing both the accuracy and efficiency of Kenyan pharmacy staff electronic prescription entry. Secondary objectives were to determine the association between experience with the system and entry speed, and measure the satisfaction of community partners with the newly implemented system. The interpretation of these results can be used to study the impact that student-led service-learning projects can have within a community.

We assessed prescription entry accuracy by direct retrospective verification of prescriptions at least once weekly to provide corrective feedback to pharmacy staff. This assessment focused on the identification of errors in prescription entry, such as the wrong amount of medication dispensed and the improper inventory measurement. To assess inventory accuracy, the manual hand count was compared to the computer-generated inventory count three weeks after the initiation of computer-based prescription entry. Prescription entry speed was monitored by us without the staff's knowledge. Stopwatches were used to measure the time taken for each entry during weeks one and three. Observations made during these weeks were compared to any improvement in filling time against to the average Kenyan pharmacy. The baseline characteristics and prior computer experience of the Kenyan staff were assessed prior to implementation

Rural Site	Kitale		
Number of Pharmacy staff	2		
Average number of medications per day	338		
Range of number of medications entered per day	40–560		
Number of adult patients receiving care	5,121		
Number of pediatric patients receiving care	1,203		
Percentage of computerized medication stock records within 15% of physical stock	51%		
Week	Percent error by week		
	1	2	3
Retrospective	11.0%	13.2%	7.3%

Table 1. Patient and prescription volume and accuracy of prescription entry.

of the database system. Six weeks after the initial implementation of the database, Kenyan pharmacy staff members were surveyed to evaluate their perceptions on this newly introduced system. This allowed for continual improvement for program expansion to other rural sites.

Descriptive statistics were used for all assessments of prescription accuracy. A weighted average was calculated to adjust for the variation in the number of medications per prescription. The STATA version 10.0 (StataCorp, College Station, Texas) statistical software package was used to perform all statistical calculations. Linear regression was performed to compare the prescription entry speed of the Kitale pharmacy staff during the first week of electronic entry compared to the third week of electronic entry.

The data from this study also can be utilized to evaluate the impact of our student-led projects. The implementation of computer prescription entry is credited to this service-learning project. The pharmacy

	Weighted Average Time/Medication (seconds)		Linear Regression, Week 1 Times versus Week 3 Times	
Kitale Week 1	62.5	R^2	Adj R^2	*P* value
Kitale Week 3	23.04	0.50	0.46	<0.005

Table 2. Prescription entry speed comparison of Kitale week 3 times versus week 1 times versus PU-COP week 3 times.

Statements	Response
1. It is feasible to enter prescriptions in the computer before dispensing.	1
2. If prescriptions were entered prior to dispensing, you would be able to provide better care for patients and prevent errors.	4.5
3. The electronic entry of prescription entry is quicker than the previous practice of paper-based recording in the logbook.	4.5
4. You feel very comfortable with computer entry now after six weeks.	4.5
5. The implementation of electronic prescription entry has made your job easier.	3.5
6. The management of inventory has become easier through the use of the computer.	3
7. The requirement to enter prescriptions electronically has decreased the amount of time you spend talking and interacting with patients.	2
8. I spend more time talking to patients now than I did before we had electronic prescription entry.	2.5
9. I spend less time talking to patients now than I did before we had electronic prescription entry.	2.5
10. I spend the same amount of time talking to patients now as I did before.	3
11. The presence of American pharmacy students from Purdue University was helpful in the initial implementation of the system.	4.5
12. PU-COP students should continue to come to the sites to assist us.	4.5
13. PU-COP students should continue to come and verify prescription entries.	3.5
14. You prefer entering prescriptions before dispensing medications.	4
15. You prefer entering prescriptions at the end of the day after you've already dispensed medications.	3.5

Table 3. Staff perceptions on electronic prescription entry and PU-COP student involvement (median responses).
Note: 1=Strongly Disagree, 5=Strongly Agree

staff at the Kitale pharmacy had some computer exposure prior to the implementation of electronic prescription entry, but did not have any computer training in school or home computer access. The staff had limited experience and utilization of computers.

In assessment of inventory accuracy, 51% of the computer-generated medication inventory figures were within 15% of the physical inventory count recorded by the site after three weeks of electronic prescription entry. The percentage of prescription entries with an error declined from 11% to 7.8% by the fourth week as pharmacy staff became more experienced with computer entry (Table 1).

The weighted average of entry speed per medication for the pharmacy staff dropped from 62.5 seconds to 23 seconds by the third week. Linear regression was used to determine that 50% of the variation in times could be accounted for by the increased experience gained after three weeks of use (Table 2).

FEEDBACK

The survey results illustrate the staff's opinions that the time-intensive requirements of real-time electronic prescription entry were too cumbersome to make this a feasible process within the constraints of the system at the time, although they did believe it would improve patient care and reduce errors. However, staff felt electronic prescription entry, even after dispensing of the medication, was superior to the previous system of logbook entry and made their job easier. In addition, the staff welcomed us to the workforce and encouraged pharmacy administration to continue sending PU-COP students to the rural site to assist with many of the daily duties (Table 3).

Overall, our Kenyan service-learning experiences have been positive. In an evaluation of PU-COP advanced pharmacy practice experiences, 86% of past student participants stated that they were able to improve the resource-constrained setting during their time as a student. Additionally, 91% of former students stated that they have an interest in completing the program again as part of a later professional position or on their own time (Schellhase, Miller, & Kim, 2011).

CONCLUSION

While American pharmacists have become accustomed to the functionalities and requirements of electronic prescription entry, implementation of this technology in rural Sub-Saharan Africa is difficult as the majority of rural practitioners are not familiar with computer operation. Despite inexperience using computers, we were able to train Kenyan pharmacy staff members to efficiently enter prescriptions electronically. Significant improvements were noted in use of the system after two weeks of experience.

There were limitations specifically related to the resource-constrained setting, which made implementation challenging. Transportation and lack

of consistent electricity were some of the logistical barriers to implementation. Rising fuel costs and budget cuts also posed a problem. Rural clinics experience frequent electrical outages, which impede the provision of uninterrupted electronic entry. Implementation of laptop computers with extended battery life helped to minimize interruptions in electronic prescription entry.

Despite these limitations, we were able to train pharmacy staff effectively. Staff reported comfort with electronic entry and preferred this method to recording in a logbook. Additionally, Kenyan pharmacy staff responded favorably to the training we provided, suggesting the value of these services. The foundation of AMPATH is based on the principle of sustainability. Our student-led service-learning project laid the ground work for future prescription entry. The Kitale pharmacy is still utilizing electronic prescription entry, and it has helped with the efficiency of prescription entry and record-keeping. This project also highlights the marked progress that can be made in this resource-constrained setting despite the many obstacles. PU-COP students on advanced pharmacy practice experience rotations are continuously present in Kenya, allowing for follow-up training and education when necessary. The success of our student-led engagement initiative demonstrates the impact of student pharmacists completing an international service-learning experience.

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DISCLOSURES

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