

RESEARCH ARTICLE

Multi-site Heart Disease Risk Assessment Service Provided by Pharmacy Students

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Objective. To evaluate a pharmacy student service focused on patient coronary heart disease (CHD) risk assessment.

Design. Fourth-year pharmacy students offered a CHD risk assessment service at 5 physicians' offices as part of ambulatory care advanced pharmacy practice experience (APPE). Patient acceptance of the service was assessed using a satisfaction survey instrument.

Assessment. Fifty-seven students educated 311 patients about CHD risk. Of the 258 patients who completed the satisfaction survey, 245 (95%) reported that the service was helpful in understanding CHD risk, and 79 (31%) learned of a personal CHD risk factor of which they were not previously aware. Student knowledge was assessed using a multiple-choice pretest and posttest focused on CHD knowledge recall. Students' test scores improved from pretest to posttest (mean 51.6 % \pm 1.1 vs. 64.8% \pm 1.0, respectively; $p = 0.01$).

Conclusions. A CHD risk assessment service provided by APPE students in ambulatory care settings was educational for both students and patients.

Keywords: coronary heart disease, ambulatory care, advanced pharmacy practice experience, clinical service

INTRODUCTION

Advanced pharmacy practice experiences (APPEs) in the ambulatory care setting are completed during the fourth year of the doctor of pharmacy (PharmD) curriculum at the Albany College of Pharmacy and Health Sciences. Ambulatory care APPEs provide pharmacy students with direct patient care opportunities, where students participate in pharmaceutical care services such as patient medication interviews, medication reviews, and patient counseling. Pharmacy students have demonstrated value as providers of clinical services.¹ Pharmacy students, working within a practice model where they function as less-experienced colleagues, can offer services not routinely provided by pharmacy staff members.² Although time devoted to training pharmacy students may initially decrease the pharmacist's productivity, overall output of the pharmacy service will increase as the students indepen-

dently provide services previously not offered. To best facilitate this model of practice, care must be taken to select services that previously had not been offered by the pharmacy unit, with activities that are straightforward and guideline or protocol driven, making them easier for a less-experienced colleague or student pharmacist to provide.³ The coronary heart disease risk assessment service described in this study was built around these premises.

Coronary heart disease (CHD) is the single leading cause of death among both men and women in America today, causing about 1 in every 6 deaths.⁴ In 2010, an estimated 785,000 American will suffer a new coronary attack, and nearly 470,000 will have a recurrent attack. About every 25 seconds in America, 1 person will have a coronary event, and about every minute, 1 person will die from a coronary event. This high prevalence of CHD suggests that a significant number of patients seen in the ambulatory care setting are likely to have coronary heart disease or predisposing risk factors. Among those who died suddenly of CHD in 2005, 50% of men and 64% of women had no previous symptoms of the disease, underscoring the importance of CHD risk factor identification

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and management in at-risk adults. The potential economic value of CHD risk reduction is real, considering the estimated \$177.1 billion in direct and indirect costs of CHD in 2010.

A physician-implemented CHD risk-factor evaluation and communication program to lower predicted CHD risks has proven to be effective.⁵ Computer-based educational software also may be acceptable to CHD patients of various ages, serving as an effective method for increasing CHD knowledge among persons with the disease.⁶

The 10-year risk for developing CHD can be predicted using the Framingham risk algorithm which assesses cardiovascular risk based on multiple risk factors including: the patient's age, gender, blood pressure, total cholesterol, HDL cholesterol, history of diabetes, history of left ventricular hypertrophy, and smoking history.^{7,8} Simple to administer, the algorithm uses computer software requiring specific laboratory and physical examination values readily accessible in the ambulatory care setting.

The purpose of this study was to assess the educational value of a clinical service provided to ambulatory care patients by pharmacy students. The CHD risk service was developed to increase patient awareness and educate patients about modifiable and non-modifiable risk factors using both paper and computerized presentations of patient-specific CHD risk. The study assessed patient satisfaction and pharmacy student learning associated with the service.

DESIGN

The study population consisted of adult patients presenting for a scheduled physician or pharmacist visit at medical practices specializing in internal medicine, family practice, or diabetes. Eligibility requirements included documentation of at least 1 Framingham CHD risk factor (age >45 years for men, >55 years for women, hypertension, dyslipidemia, left ventricular hypertrophy, smoking, diabetes), and a fasting lipid panel completed within the past 2 years. Patients were excluded if they could not speak or read English, had a medical or psychiatric disorder which required surrogate consent for office procedures, or if their medical record was not available at the time of the interview.

Each study clinic provided an APPE site for fourth-year pharmacy students, managed by faculty investigators from Albany College of Pharmacy and Health Sciences. Students assigned to an ambulatory care APPE participated in the study, with 2 students scheduled at each site during each APPE module. As part of the PharmD-required curriculum, CHD risk assessment was introduced briefly and practiced in the second-year pharmacotherapy curriculum.

Pharmacy students were trained about study procedures in group sessions on the second day of each scheduled 5-week APPE. The training session included a discussion of the assessment of cardiovascular risk by use of multiple-risk-factor assessment equations (ie, Framingham risk score estimates), training on the computer software program, reviewing the patient survey instrument, and becoming familiar with general study procedures.⁷ Software training included a discussion of the desired values for each of the risk factor variables and a demonstration of the effect of changing modifiable risk factors on the overall risk value. The Coronary Heart Disease (CHD) Risk Calculator, version 8.0, software program (Pfizer, Inc., New York, NY) was used for the study and training.⁹

As part of APPE activities, pharmacy students evaluated the medical records of patients scheduled for a physician or pharmacist visit to determine patient eligibility based upon the study inclusion/exclusion criteria. Eligible patients were approached to obtain consent for participation in the study. Students informed the patients that the study would include use of medical records to estimate CHD risk, along with a computerized counseling session to discuss the findings. If the patient agreed to participate, the student documented the response and assigned the patient a random number in the database.

Pharmacy students used medical record information to complete each patient-specific CHD risk assessment. The 10-year CHD risk estimate was calculated for patients without known CHD; a short-term (ie, 1- to 4-year) risk estimate was calculated for patients with a history of CHD. Students presented personalized CHD risk estimates to individual patients using the Coronary Heart Disease Risk Calculator with patient-specific data. The patient counseling session included a demonstration of how changing modifiable risk factors could potentially decrease overall CHD risk. For example, students demonstrated to current or past smokers how tobacco use influenced the overall estimate for CHD risk. Patients were provided with a printed copy of the CHD risk assessment to keep for their records and as a reminder to discuss personal CHD risk with their medical provider. Students asked patients to complete an anonymous satisfaction survey instrument at the conclusion of each counseling session. The survey used was a modified version of a published satisfaction survey instrument written on a 7th grade reading level.¹⁰ Two of the survey questions were modified to include reference to patient satisfaction with the computer presentation of CHD risk (survey available from author upon request). Patients placed the completed 1-page survey form in a secure locked box prior to leaving the counseling room or practice location. At regular intervals during the study, faculty investigators removed the

forms from the box and gave them to the primary investigator for data entry.

EVALUATION AND ASSESSMENT

Between July 2006 and April 2007, 57 students educated 311 patients at 4 practice sites on individual CHD risk factors and overall CHD risk (Table 1). The average patient age was 55 ± 12 years (range 25 to 86 years). Fifty-one percent of patients were female. One hundred sixty-four (53%) patients had a diagnosis of diabetes and 61 (19.6%) were smokers. The mean and median patient 10-year CHD risks were $11.8\% \pm 7.8\%$ and 10.3%, respectively. The minimum and maximum CHD risk estimates reported were 0.08% and 44%, respectively.

The patient satisfaction survey instrument was completed by 258 (83%) patients enrolled in the study. The completed survey forms represented each of the participating sites (Table 1); however, 1% of the survey forms did not include a site name. Two hundred forty-five (95%) patients found the CHD risk assessment helpful. Thirty-five percent of the patients indicated that the last time a health care provider reviewed CHD risk factors was more than 1 year ago or never. Forty-one percent of patients indicated that the last time a health care provider reviewed CHD risk factors with them was within the last 12 months, while 22% reported that a review had been completed that day. Two percent of the patients did not answer this question on the survey instrument. Seventy-nine (31%) patients reported that the service had identified a CHD risk factor previously unknown to them. Forty-one percent indicated that they planned to follow up with their primary care physician regarding the findings. Sixty-one percent of patients found the service useful for understanding heart disease risk, and 96% indicated they would recommend this type of assessment to a friend or family member.

To assess pharmacy student learning, a 5-question case-based, multiple-choice test of CHD risk assessment

knowledge was administered at the start (pretest) and completion (posttest) of the 5-week APPE. Ten test questions were originally developed and tested by faculty investigators, who subsequently agreed on the final 5 questions to be included on the identical pretest and posttest, and on the answer key. Pretests and posttests were administered and collected by the faculty investigators, with the pretest completed before study training and the posttest completed within a few days before or after the APPE ended. Students were not aware that the pretests and posttests would be identical. The pretest was completed in print format only, while faculty members had the option of providing students with either electronic or printed versions of the posttest. Students were asked to sign a consent form which authorized the use of summary test results for publication of the study data. Study results were not reviewed with the students nor included in the students' APPE evaluation or grade.

Statistix, Version 8 (2003 Analytical Software, Tallahassee, FL), was used to conduct the statistical analysis, and a Wilcoxon signed-rank test was used to determine the difference between the students' pretest and posttest scores. A *p* less than 0.05 was considered significant. The institutional review boards at the Albany College of Pharmacy and Health Sciences and Albany Medical Center approved the study.

Forty-five (79%) students completed both the pre-APPE and post-APPE knowledge tests. The reasons students did not complete either the pre-APPE or post-APPE test were failure to complete the APPE (1 student) and failure to submit the posttest to faculty investigators after the APPE (11 students). Students who failed to submit posttests to faculty investigators were allowed to submit the posttest electronically after completing the 5-week APPE. Only the completed test pairs were included in the statistical analysis. There was a significant (*p* = 0.01) increase in the students' CHD knowledge posttest score compared with pretest scores (Table 2). Students' CHD knowledge scores on the posttest were significantly higher (*p* = 0.01) than their scores on the pretest (Table 2).

Table 1. Patient Enrollment and Survey Completion for a Coronary Heart Disease Risk Assessment Service

Site #	Practice Type	Patient Enrollment, No. (%)	Patient Satisfaction Survey Completion, No. (%)
1	Family Practice	54 (17)	50 (19)
2	Endocrine Specialty	75 (24)	57 (22)
3	Internal Medicine	123 (40)	111 (43)
4	Internal Medicine	59 (19)	40 (15)
Total		311 (100)	258 (99)

Table 2. Pharmacy Students' Coronary Heart Disease Knowledge Test Scores Before and After Providing a Heart Disease Risk Assessment Service to Patients (N = 45)

	Pretest Score ^a	Posttest Score ^a
Percentage Grade	51.6 ^b	64.8 ^b
Score, Mean (SD)	2.6 (1.1)	3.2 (1.0)
Median	2.0	3.0

^a Score is based on a total possible score of 5

^b *p* value = 0.01 (Wilcoxon signed-rank test)

DISCUSSION

The patient satisfaction survey response rate in this study was 83%. The high response rate was probably due to the survey being administered to patients at the same time the service was provided, and included a mechanism for anonymous submission. Response rates to mailed satisfaction survey instruments assessing clinical pharmacy services related to asthma, antibiotic education, and venous thromboembolic disease have ranged from 35% to 76%.¹¹⁻¹³

Patient responses on the satisfaction surveys were positive, with 95% considering the assessment useful. These results were obtained despite the wide range in study patients' ages (25 to 86 years) and CHD risk (0.08% to 44%). A large number of enrolled patients had not been educated on CHD risk by a health care provider recently, including 35% who reported never or more than 1 year ago. These data indicate the usefulness of the CHD risk assessment as part of a daily service that pharmacy students can provide. The educational service resulted in the identification of a previously unappreciated risk factor for 31% of the participating patients, thereby improving their knowledge base related to CHD risk. In comparison, Cerulli and colleagues, using the same survey instrument for assessing cardiac risk when promoting women's health in a community pharmacy, identified a previously unrecognized cardiac risk factor in 17% of female patients.¹⁰ Our participants included both genders and had a higher average CHD risk than Cerulli's participants.

Information on the types of newly identified CHD risk factors was not collected in this study. Whether the identified CHD risks were modifiable or not would likely have influenced the patients' plans to seek further medical provider visits or provider counseling sessions. Only 41% of the participants in the study with a newly identified risk factor indicated they planned to follow up with their primary care physician. The student counseling session focused on personal CHD risk and demonstrated the impact of modifiable risk factors to patients. The pharmacy students were responsible for emphasizing to patients the importance of following up with a medical provider to address identified CHD risk. The study protocol did not include assessment of patient follow-up visits with their medical providers, although students may have done this as part of their usual APPE activities. Assessing the impact of CHD risk factor counseling on the occurrence of related follow-up visits with medical providers, particularly among patients with newly-identified risk factors, would have documented the value of the service.

Students at some sites were not able to enroll as many patients as students at other sites, and even among sites with greater enrollment, enrollment was sporadic during

some months (eg, summer). The level of enrollment may have been related to several factors including, but not limited to, students' comfort level with the study procedures, their familiarity with the workflow and staff members at the practice sites, and the varying pace of different practice sites during different times of the year. As a result, our sample of patients was a convenience sample that may not be representative of a broad patient population.

The student CHD risk assessment service was effective at educating fourth-year PharmD students about coronary heart disease risk during APPEs. PharmD student participation in the CHD risk assessment service provided direct patient interaction, chart review experience, and CHD risk assessment knowledge and skills. Student posttest scores were significantly higher compared to pretest scores that were recorded before service involvement, suggesting that student knowledge of CHD risk assessment increased as they provided the service.

The primary outcome measurement of pharmacy student pretest and posttest comparison was chosen because of its consistency with previous studies of educational methodology. Cough and colleagues evaluated the utility of a poison center clinical APPE in improving pharmacy students' knowledge.¹⁴ They demonstrated that learning occurred by displaying a significant 26.9% improvement in posttest scores on average compared to pretest results. In another study by Gordon and colleagues, medical students were given pretests prior to randomization to either simulator-based learning or traditional lecture learning for the same topics.¹⁵ An 8.8% improvement in posttest scores with traditional lectures and 11.3% with simulators was shown. In our study, the mean test score improvement of 13.2% was a significant indicator that the CHD risk assessment service provided effective education for participating students. Since experiential teaching more actively engages students in the learning process than lectures or simulators, it was surprising that students did not achieve much higher posttest scores after 5 weeks of providing the CHD risk assessment service. The explanation may be that 5 posttest questions in a multiple-choice format may not have been an adequate method of capturing the students' skill development and acquisition of CHD risk knowledge. Improved assessment might be achieved by asking a larger number of multiple-choice questions, using other written assessment methods (eg, memory matrix or directed paraphrasing), or using a standardized observational method of student learning.¹⁶ In addition, although faculty investigators provided students with informal feedback and suggestions when starting each APPE, documenting the perceived educational value of the CHD risk assessment service would have been useful, including formal faculty evaluations of student

knowledge and skills pre- and post-intervention, and asking students to assess their own learning and satisfaction with the service.

Using multiple-choice questions on the assessments further limited the study. Although students did not know that the same questions would appear on the posttest, they had time during the APPEs to discuss pretest questions with other APPE students or use resources to look up answers to the questions for their own knowledge. To reduce this potential confounder, students were not provided with copies of the pretest, nor were they made aware that the pretest and posttest were identical. In addition, the completion rate for both pretests and posttests was 79%. The major cause of failure to obtain posttests was providing students with an option to submit them on paper or electronically after the completion of the APPE. In future studies, faculty investigators should require a single method of posttest collection prior to completion of the APPE.

CONCLUSIONS

This study demonstrated that, in the ambulatory care setting, a pharmacy student service focused on personalized patient CHD risk assessment was valuable for both patients and students. The service was well-received by patients and led to the identification of previously unappreciated CHD risk factors. Involvement in the study resulted in significant improvement in pharmacy student CHD risk knowledge during experiential education. This valuable service was easily incorporated into the existing clinical pharmacy services in physicians' offices.

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REFERENCES

1. Pham DQ. Evaluating the impact of clinical interventions by PharmD students on internal medicine clerkships: the results of a 3-year study. *Ann Pharmacother*. 2006;40(9):1541-1545.

- Slack MK, Draugalis JR. Models for estimating the impact of clerkship students on pharmacy practice sites. *Am J Hosp Pharm*. 1994;51(4):525-530.
- Bock LM, Duong M, Williams JS. Enhancing clinical services by using pharmacy students during advanced experiential rotations. *Am J Hosp Pharm*. 2008;65(6):566-69.
- American Heart Association. Heart disease and stroke statistics - 2010 update. Dallas, TX: American Heart Association; 2010.
- Benner JS, Erhardt L, Flammer M, Moller RA, Rajcic N. A novel programme to evaluate and communicate 10-year risk of CHD reduces predicted risk and improves patients' modifiable risk factor profile. REACH-OUT (Risk, Evaluation and Communication Health Outcomes and Utilization Trial). *Int J Clin Pract*. 2008;62(10):1484-1498.
- Beranova E, Sykes C. A systematic review of computer-based softwares for educating patients with coronary heart disease. *Patient Educ Couns*. 2007;66(1):21-28.
- Grundy S, Pasternak R, Greenland P, Smith S, Fuster V. Assessment of cardiovascular risk by use of multiple-risk-factor assessment equations: a statement for health care professionals from the American Heart Association and the American College of Cardiology. *Circulation*. 1999;100:1481-1492.
- Anderson KM, Wilson PWF, Odell PM, Kannel WB. An updated coronary risk profile: a statement for health professionals. *Circulation*. 1991;83:356-362.
- Day D. Population based screening with a Coronary Heart Disease Risk Factor Calculator. *Adv Ther*. 2001;18(1):21-32.
- Cerulli J, Malone M. Women's health promotion within a community advanced pharmacy practice experience. *Am J Pharm Educ*. 2008;72(2):Article 25.
- Zed P, Filiatrault L. Clinical outcomes and patient satisfaction of a pharmacist-managed emergency department-based outpatient treatment program for venous thromboembolic disease. *Can J Emerg Med Care*. 2008;10(1):10-17.
- Liu M, Jennings P, Samuelson W, Sullivan C, Veltri J. Asthma patients' satisfaction with the frequency and content of pharmacist counseling. *J Am Pharm Assoc*. 1999;39(2):493-498.
- Rodis J, Green C, Cook S, Pedersen C. Effects of a pharmacist-initiated educational intervention on patient knowledge about the appropriate use of antibiotics. *Am J Health-Syst Pharm*. 2004;61(13):1385-1389.
- Cobaugh DJ, Goetz CM, Lopez GP, Dean BS, Krenzelok EP. Assessment of learning by emergency medicine residents and pharmacy students participating in a poison center clerkship. *Vet Hum Toxicol*. 1997;39(3):173-175.
- Gordon JA, Shaffer DW, Raemer DB, et al. A randomized controlled trial of simulation-based teaching versus traditional instruction in medicine: a pilot study among clinical medical students. *Adv Health Sci Educ*. 2006;11(1):33-39.
- Angelo TA, Cross PK. *Classroom Assessment Techniques*. 2nd ed. San Francisco, CA: Jossey Bass; 1993.