Development and Implementation of an Integrated Cardiovascular Module in a PharmD Curriculum

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The development and implementation of an integrated cardiovascular module occurred over a four-year period. The cardiovascular module integrated the following subject areas: pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, therapeutics and pharmacy practice. In order to accomplish this integration, a total of twelve faculty representing several major subject areas participated in the design and implementation of the module. The present manuscript discusses the developmental phases, implementation, and preliminary assessment of the course. Throughout the module, the coordinator met weekly with a focus group consisting of five randomly selected students. Immediately following the focus group meeting, the faculty involved in the course met to discuss case-reports, exam-writing assignments, and the results of the focus group discussion. At the completion of the module, traditional course evaluations as well as nominal group evaluations were used to evaluate the course. The comparison of the two different forms of course evaluations suggests that the nominal group method provides similar feedback in a more efficient manner. Finally, problems identified during the module are discussed as well as strategies that were utilized to rectify the problems. This cardiovascular module shows that cross discipline teaching can indeed work as long as faculty are willing to work together in a team fashion with each other and the students.

INTRODUCTION

In order to understand the development and implementation of the cardiovascular module, an overview of the pharmacy curriculum at Ohio Northern University (ONU) is needed. The first three years (pre-professional division) of the curriculum are offered under the regular quarter system, and consist of 162 credit hours. The final three years (professional division) are a modified 18-credit/quarter structure for the fall and winter quarters of the fourth year (P-4) and the spring quarter of the fifth year (P-5). The other quarters (from the spring quarter of the fifth year on) are structured into 5.5-week modules with nine credits given for each. The total number of credit hours required for graduation thus totals 324 quarter hours.

Pre-professional Division. In the pre-professional division, the student takes 18 credit hours per quarter for nine quarters. The Profession of Pharmacy (POP) sequence consisted of material traditionally taught in orientation, drug information, pharmacy calculations, law and health care systems, and includes the new component of early experiential exposure in which both community service and professional experiential hours are required. The latter includes shadowing experiences, family or nursing home monitoring, field trips, pharmacy team monitoring with faculty/students at clinical sites through e-mail and video teleconferencing, etc. Although, the student may visit and/or communicate with distant sites, the student resides on-campus. The POP sequence provides student exposure to the practice of pharmacy and patient care. Table I gives a year-by-year and quarter-by-quarter overview of the courses offered in the pre-professional division. The student must have completed all pre-professional course work and general electives before entering the professional division. The objective of these pre-professional division courses is to develop the fundamentals and basic concepts necessary for continuation into the professional division.

Professional Division. The 13 modules in the professional division consist of required and basic skills units, therapeutic-oriented on-campus units, pharmacy administration, pharmacy practice units, elective research and teaching units, and elective clinical clerkships. Most modules last 5.5 weeks and three pairs of modules coincide with the normal quarter calendar. Some modules are offered simultaneously during the fall and winter quarters (e.g., Pharmaceutical Sciences, Biomedical Sciences, POP) others are offered as the only course during a 5.5 week period. Table II outlines the P-4 through P-6 year using the quarter system. The Biomedical Science Module introduces the students to the basics of pathophysiology, pharmacology, medicinal chemistry, and pharmacodynamics. The fourth year POP sequence is designed to expose the students to: (i) chart review including interpretation of lab values and communication skills (e.g., approach to the patient, conducting an interview, and disseminating drug information); and (ii) physical assessment including the concepts of drug therapy monitoring. The final module, known as the “capstone” module, integrates previous material (previous modules) in a comprehensive manner to reinforce the overall curriculum and examines comprehension of material from previous modules.

This manuscript outlines how the first therapeutic module, the cardiovascular module, was designed and implemented. Initially, the cardiovascular module was six weeks long and incorporated renal and pulmonary material. This was only for

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reduce repetition. The number of hours required to complete redundancy between faculty members was assessed in order to areas. Once time allocations were determined, the amount of number of hours each faculty member spent on the major subject weekly. The first order of business was to decide on the num-

next two academic years, the cardiovascular committee met the student perspective before the module began. During the tal committee to assist in identifying potential problems from student members. Students were included on this developmen-

involved in teaching of the cardiovascular material and two committee was formed and consisted of faculty that were of the entry-level PharmD. At that time, the cardiovascular discuss and develop a new curriculum for the implementation

Module Description of the Development of the Cardiovascular

Central Nervous System module.

Supportive cancer therapy. Pain is covered in great detail in the treatment and is covered in the oncology module relative to cardiovascular module with regards to myocardial infarction the modules. For example, “pain” is briefly discussed in the that all predetermined subject material was covered throughout be determined. The College’s curriculum committee verified that all predetermined subject material was covered throughout the modules. For example, “pain” is briefly discussed in the cardiovascular module with regards to myocardial infarction treatment and is covered in the oncology module relative to supportive cancer therapy. Pain is covered in great detail in the Central Nervous System module.

Description of the Development of the Cardiovascular Module

In the fall of 1995, the curriculum committee convened to discuss and develop a new curriculum for the implementation of the entry-level PharmD. At that time, the cardiovascular committee was formed and consisted of faculty that were involved in teaching of the cardiovascular material and two student members. Students were included on this developmental committee to assist in identifying potential problems from the student perspective before the module began. During the next two academic years, the cardiovascular committee met weekly. The first order of business was to decide on the number of hours each faculty member spent on the major subject areas. Once time allocations were determined, the amount of redundancy between faculty members was assessed in order to reduce repetition. The number of hours required to complete the module was then reported back to the curriculum committe and they developed the 5.5-week modules.

The cardiovascular committee determined that the flow of the material should in general be presented in the following order: pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics and therapeutics. All subsequent modules are expected to follow a similar structure.

A Cardiovascular Retreat was held to discuss the establish-

ment of deadlines for lecture notes, weekly schedules, and to develop case reports. An example weekly schedule is pre-

ounced in Table III. Lecture material was due to the course are expected to follow a similar structure.

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Each session represents a 5.5-week period.

despite the first year of the modular system and allowed for timing to be determined. The College’s curriculum committee verified that all predetermined subject material was covered throughout the modules. For example, “pain” is briefly discussed in the cardiovascular module with regards to myocardial infarction treatment and is covered in the oncology module relative to supportive cancer therapy. Pain is covered in great detail in the Central Nervous System module.

Overall Design of the Cardiovascular Module

The Cardiovascular Module is summarized in Figure 1. The two main divisions of the module incorporate both facili-
Table III. Week 1 of the cardiovascular module

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>A 8:00-9:00</td>
<td>Overview and Goals</td>
<td>Pharmacology of Diuretics</td>
<td>Medicinal Chemistry of β-blocker</td>
<td>Medicinal Chemistry of Renin Inhibitors</td>
</tr>
<tr>
<td>B 9:00-10:00</td>
<td>HTN Introduction</td>
<td>of Diuretics</td>
<td>Pharmacology of ACE-I</td>
<td>Pharmacology of AgII Antagonist</td>
</tr>
<tr>
<td>C 10:00-11:00</td>
<td>JNCVI</td>
<td>β-blocker</td>
<td>Pharmacokinetics</td>
<td>Medicinal Chemistry of ACE-I</td>
</tr>
</tbody>
</table>

Only during the first week of the module were the students given a two hour period to work on drug information questions. During the rest to the module, this time period was used for case-reports.

Case-Report Development and Implementation

The case reports all had the same overall format (Appendix A) and followed the standard format used in the typical history and physical (H&P) found in any chart and comprised of the following: chief complaint (CC), history of present illness (HPI), past medical history (PMH), social history (SH), family history (FH), allergies, review of systems (ROS), physical examination (PE), and laboratory values. During the cardiovascular retreat, the design of the case-reports was determined. The committee decided that the cases should incorporate all the major subject areas of the module as well as pharmacy practice. Pharmacy practice was integrated into the case-reports via the use of a sample prescription. Students had to interpret the prescription and determine appropriate patient counseling issues.

During the summer retreat, several faculty members were assigned three case reports to write within the major subject areas: hypertension, coronary artery disease, congestive heart failure, arrhythmia, shock, peripheral vascular disease, and anemia. Each faculty member was instructed to follow the template established during the meeting. The case reports were due to the course coordinator within a relatively short period of time. The rapid turn around was required so that all faculty involved in the course could develop a facilitator key. This also allowed for some editing of the cases by colleagues.

The entire class of approximately 160 students was divided into eight sections. The eight sections were further subdivided into groups of six or seven students for a total of three groups per section. Each group within a section received a different case report to dissect. Each group was given two days to work on the case, and on the third day, the group presented the case to the rest of their section. Faculty were assigned different sections each week. The faculty served as a moderator to the students’ presentations and made sure that the correct answers were discussed by the students. Faculty facilitation was accom-
plished based on facilitator keys, which only the faculty member was provided.

At the completion of the module, student groups were responsible for peer and self-evaluation. A modified method of Krause and Popovich(1) was utilized. The evaluation criteria that the students used for evaluating themselves and other group members are presented in Appendix B.

Drug Information Questions

During the cardiovascular module retreat, the committee decided that the students needed additional practice of their drug information and writing skills. Drug information is taught throughout the first three years of the POP sequence. In order to practice these skills during the module, the students were randomly assigned one drug information question that required a two-page written response.

Several faculty members were asked to write 24 drug information questions to be turned in at the same time as the lecture notes. Faculty members were then responsible for grading their own drug information questions at the end of the module according to a grading guideline sheet provided for consistency in grading (Appendix C). This distributed the burden of grading over a number of participating faculty members.

Examinations and Grading Policies

Each exam had at least one case report identical in format to cases utilized during the breakout sessions. Ten multiple choice questions were written consistent with the issues covered in each case report discussion.

Exam writing, coordination, and assignments were assigned during the weekly faculty meeting conducted throughout the module. One faculty member with a limited teaching load during the module undertook the duties of coordinating all exams and quizzes. Overall grading policies are presented in Table IV. Exams and quizzes were given on Wednesday mornings with the cutoff for exam material being the previous Friday. Each quiz contained one weeks worth of material and each exam contained two weeks worth of material. Tuesday afternoons were open for student study time.

Focus Group Meetings and Faculty Meetings

Five students were randomly selected from the class to serve on a focus group. The focus group met weekly for one hour with the course coordinator. The following questions were asked of each student:

1. What did you like least about this course?
2. What did you like best about this course?
3. What would you like to see changed about this course?
4. What would you like to see changed in grading?
5. To date, what would you like to see changed?
6. To date, what do you like least about this course?
7. To date, what do you like best about this course?
8. What did you like least about this course?
9. What did you like best about this course?
10. What would you like to see changed about this course?

Immediately following the weekly focus group meeting, the faculty involved in the course met to discuss exam assignments, upcoming case reports, other faculty concerns, and finally the focus group results. Typically, the entire class was provided feedback within 24 hours on concerns raised during the focus group and the faculty method of resolving each issue.

Course Evaluations

The course was evaluated using our traditional course evaluations (Table V) as well as nominal group evaluations. With nominal group evaluations, 24 students were randomly selected to serve on the nominal groups for the course evaluation. The twenty-four students were divided into two groups. These two groups met for three hours with a moderator from outside the college of pharmacy. Each student was then asked to respond to the following questions:

1. What did you like best about this course?
2. What did you like least about this course?
3. What would you like to see changed about this course?
4. What would you like to see changed in grading?
5. To date, what do you like least about this course?
6. To date, what do you like best about this course?
7. To date, what would you like to see changed?

Once each student had responded to these questions, the entire group voted on the responses. The top responses in each category were reported back to the cardiovascular module committee.

RESULTS

Peer Evaluations of Breakout Group Members: The overall class average for the peer evaluations was 48.9 out of 50 total points. In the whole scheme of grading, the peer evaluations had very little impact on students’ overall course grade. This average is much higher than those reported by Krause and Popovich(1). A self-evaluation was also conducted but was not utilized in the overall course grade determination.

Course Evaluation: The traditional course evaluation results are presented in Table V. This can be compared to the results of the nominal group discussions presented in Table VI. The results suggest that the same information obtained from the traditional course evaluations can be obtained in a more efficient fashion with the nominal group discussions.

Course Grades: The distribution of course grades are presented in Figure 2. The typical student in this course received an
overall course grade of a B or C after the faculty committee agreed to a minor adjustment based on the class average and the results of individual assessments.

**DISCUSSION**

The cardiovascular module presented in this manuscript suggests that an integrated course can be well received by students and participating faculty. The course evaluations, student performance on cases and overall course grades provided evidence for this success. Overall, the students appreciated the organization of the module and the willingness of the faculty to work together during the development and implementation of the course. Because most faculty attended each others’ lectures, the faculty were able to monitor for redundancy and assist in maintaining the cohesiveness of the course. The interdisciplinary barriers also dissolved because of faculty attendance. Communication and cooperation between faculty increased as well.

Through a formal feedback process (focus groups and faculty meetings), faculty and students alike thought that the flow of material also facilitated learning. In the traditional system, the medicinal chemistry class may have been discussing the structure activity relationship of antineoplastics while the pharmacology course was discussing cardiac glycosides. This was further hampered by the fact that therapeutics wasn’t even discussed until a year later. With the modular approach pathophysiology, pharmacology, medicinal chemistry, pharmacokinetics, and therapeutics were all integrated into a single cohesive package.

There was some perceived redundancy in the therapeutics section discovered from the course evaluations, student comments, and participating faculty. This redundancy was mainly between pathophysiology, pharmacology and therapeutics. In an effort to improve the flow of information to the student in subsequent years, the therapeutics section will be presented in a case format. This format will emphasize the following points:

1. Stress the therapeutic options of a particular disease state;
2. Cover disease state management issues including goals of therapy, drug therapy monitoring, side effect issues, and patient education.

Surprisingly, the students did not value extra time to work on the case reports. Many groups would divide the case reports

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**Table VI. Nominal group course evaluation results**

<table>
<thead>
<tr>
<th>What did you like best about this course?</th>
<th>1. Organizations and flow of material</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Receptive to the needs of class</td>
<td>3. Student Focus Group</td>
</tr>
<tr>
<td>4. Web page and links</td>
<td>5. Notebook</td>
</tr>
<tr>
<td>6. Big Picture Applications</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What did you like least about this course?</th>
<th>1. Therapeutic coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Arrhythmia material was rushed</td>
<td>3. Everyone studying different case reports</td>
</tr>
<tr>
<td>4. Books were not utilized sufficiently</td>
<td>5. Duplication of material</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What would you like to see changed about this course?</th>
<th>1. More time on arrhythmia</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Include more patient counseling</td>
<td>3. One case study to be discussed in class with professor leading discussion</td>
</tr>
</tbody>
</table>

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**Fig. 2. Distribution of grades in the cardiovascular module.**

questions and an individual student would answer only one or two questions. This could be due to a lack of communication on how the breakout group was intended to be conducted. In subsequent years, the students will be required to work on the cases during the breakout session and to present to the rest of their section at the end of the breakout period.

The results of the peer/self evaluations were much higher than those seen by Krause and Popovich(1). This may be the result of the overall lack of weight put on the peer/self evaluations in the overall determination of the course grade. Also, because of the intensity of the course the students may not have wanted to harshly grade each other. Some comments made by students suggested that the 50 points from the peer evaluations were looked upon as “give me” points. In the future, the faculty will have to convey to the students the overall importance and methods for conducting peer/self evaluations.

The results of the nominal group and traditional course evaluations of the cardiovascular module suggest that the combination of the nominal group reports with the rated questions of the traditional course evaluations may be a useful way to evaluate a course such as the cardiovascular module. The similarities between traditional evaluations and nominal grouping are apparent when examining individual student comments and comparing those to the nominal group results. One advantage of the nominal group evaluation is the students’ vote on all comments to be reported back to the faculty. This eliminates poorly conceived comments that are sometimes made by students. For example, comments like, “I do not like the professor’s hairstyle.” However, individual comments to faculty are lost using this method. The questions used in the nominal group evaluations could be modified in the future to obtain this information for individual faculty.

One concern raised by both the faculty involved in the teaching of the course and the students was the issue of information overload. This was a concern raised by both the students and faculty for three reasons: (i) The sheer volume of material covered over a relatively short period (six weeks); (ii) The fact that the module was a nine credit hour course worth a single grade added additional pressure on the students; (iii) In the module format, afternoon lectures depend on the morning lecture content; therefore the student has very little time for the processing of the material. This concern over information overload will be addressed in the future when the students take the capstone module. The goal of the capstone module is to review and further enhance material from all the previous modules. Also, a true feel of the overall impact of the information
overload effects can not be determined until post-graduation surveys can be completed. The results of the three integrated modules that have followed the cardiovascular module would suggest that this was only a problem for the first module due to the novelty of the new teaching method.

The overall all impact of the adoption of the modular system cannot be determined until the first class has completed all the modules and have taken the licensure exam. Further assessment of the modular system and the cardiovascular module will also be developed in the post-graduation survey. In the future, evaluations in the modules will use both nominal and focus groups. However, the questions utilized will be modified to include: What aspect of this module aided you in learning the material? What aspect of this module hindered your ability to learn the material? What changes could be made that would facilitate future students’ ability to learn the material?

Although the cardiovascular module still has areas for improvement, the willingness of the students and faculty to work together (through focus groups, etc.) to solve problems and develop strategies proved to be a very power resource in the development and implementation of this course. We would recommend to others attempting to develop a completely integrated course to remember to include student input for the development and implementation stages of the course. This input will assist the faculty in understanding the student’s perspective and allows the students to contribute some ownership in the course.

Acknowledgments. The authors would like to acknowledge the entire faculty involved in the development and implementation of this course and are writing on behalf of the cardiovascular committee. We are also grateful to the classes of 2000 and 2001 for their patience and thoughtful contributions throughout the development and implementation of this module. The thoughtful comments of Dr. Nicholas Popovich are also appreciated.


Reference

APPENDIX A. CARDIOVASCULAR MODULE CASE REPORT DESIGN

Hypercholesterolemia Case Report

CAD Case Report #3

Chief Complaint:
“I was at a health fair the other day with my wife and she wanted me to take a cholesterol test. I said my cholesterol’s just fine, but after 20 minutes of nagging I gave in. The technician who did the cholesterol test said I was a walking time bomb. If I didn’t get to a doctor soon, I’d be dead in 6 months. She said she could hear the fat sloshing through my arteries.”

HPI
T.D. is a 44-year-old male truck driver with a history of hypertension. He has been taking Dyazide QAM for about 12 years. His patient profile shows that he receives a refill of 30 Dyazide capsules every 50 days or so. He knows his lifestyle isn’t the healthiest, but life on the road is tough. It’s a quick bite from a greasy spoon twice a day combined with 12-16 hours on the road.

PMH
Twelve-year history of hypertension.

FH
Father died of a stroke at the age of 53
Mother is still living and has experienced 2 minor heart attacks

SH
T.D. is about 60 pounds over his ideal weight.
T.D. sleeps in his truck while on the road and loves fried food
T.D. has smoked about 2 packs of cigarettes a day since he was 18. His favorite hobby is watching television.

MEDS
Dyazide QAM
Nicorette as needed

ALL
PCN

ROS
Denies any chest pain, SOB, or dizziness.

PE
Gen
Patient is a 44-year old white male
VS
BP 145/94, P 82, RR 12, T 37.1 °C, HT 6’0”, WT 260 lbs
HEENT
WNL
PULM
Clear
CV
No data
Abd
+BS, no mass, no bruits
EXT
WNL
NEURO
WNL

LABS

Fasting Lipid Profile
Total cholesterol 265, HDL 35, LDL 200, triglycerides 600
The doctor chooses to prescribe Mevacor 20mg QAM

Questions concerning case:
1. What is the pharmacological rationale for the use of this agent(s) in this patient?
2. Is there any reason why or why not this agent was the most appropriate for this patient?
3. Compare the structure of this agent with others in the same chemical class.
4. Compare and contrast the pharmacokinetic/pharmacodynamics of this agent(s) with others in this pharmacological class.
5. Is the dosing regimen appropriate for this patient?
6. What are the pharmacological mechanisms involved in the production of this agents adverse reactions?
7. What are the monitoring parameters that should be monitored by the health care provider and/or patient?
8. Do you agree or disagree with the therapeutic plan for this...
9. His physician sends her home with the following prescription. How would you interpret this prescription?

For T.D.

Address __________________________ Date 9/19/98

Rx Mevacor 20mg #30 i po Q AM

Refill 1 year Dr. Timmit

DEA No ______ Address ______

7. This person does not monopolize group discussions.
8. This person is prepared for case reports each week.
9. This person has helped in planning the group’s answers.
10. This person works well with the other group members.

A = Student is consistently effective with excellent contributions in this area (could serve as a model).  
B = Student is somewhere between A and C.  
C = Student is generally effective with satisfactory contributions in this area (appropriate for a student at this level).  
D = Student is somewhere between C and E.  
E = Student is inconsistent or provides inappropriate contributions in this area.

APPENDIX C. DRUG INFORMATION PAPER EVALUATION FORM

Name ____________________________ Question ____________________________ Date ____________________________

_____ /20 pts. Mechanics
Appearance  
Spelling  
Grammar

_____ /20 pts. Organization
Topic Selection  
Focus  
Depth  
Thoroughness

_____ /40 pts. Introduction
Background  
Perspective  
Relevance

_____ /40 pts. Development/Delivery of Major Thesis
Clarity  
Flow  
Critical Analysis  
Validation

_____ /40 pts. Conclusions
 Appropriateness  
Credence

_____ /40 pts. References
Sufficient Research  
Appropriate Resources  
Citation Mechanics

_____ /200 pts. OVERALL

Sample Drug Information questions:

1. A patient comes into your pharmacy and says they recently read in Prevention Magazine that garlic is good to treat hypertension and high cholesterol. What are the risks, benefits, side effects, potential drug interactions, and dosages regarding the use of garlic to treat hypertension and high cholesterol?

2. A 40 year-old male patient comes into your pharmacy very upset. His physician has told him he has mild hypertension. The doctor said the patient should follow a low salt, low fat diet, but did not provide the patient with such a diet. Devise a diet plan for the patient focusing on which foods they should eat more of and which ones they should avoid and why?

3. A patient comes into your pharmacy with a question regarding alcohol use and its effect on blood pressure. Your patient says they heard on television that alcohol may raise your blood pressure. Your patient drinks 4-5 beers per night. What is the relationship between alcohol and blood pressure and what would you advise your patient?