

PROGRAMME DESCRIPTION

Comprehensive disease state reviews: A guide to live and virtual implementation in a therapeutics course

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Abstract

Background: Pharmacy curricula often teach disease states in silos, covering one disease at a time. This approach may inadequately prepare students for caring for patients with multiple coinciding disease states. The purpose of this “how-to” guide is to detail an approach to implementing a comprehensive, capstone-style disease state review into pharmacy therapeutics courses. **Methods:** This manuscript describes the use of a drug-class review, individual disease-state patient cases, and then layered, multi-disease-state cases that build upon individual cases in an integrated cardiovascular pharmacotherapy course. It also describes pre- and post-test assessments to supplement learning outcomes. **Results:** The educational activity significantly improved student performance between the pre- and post-tests. Informal feedback indicated appreciation for the real-world applicability of the activity. **Conclusion:** While cardiovascular examples are provided, this approach could be integrated into any therapeutics-type course. Benefits for students include providing a space to explore therapeutic decision-making for patients with multiple common, overlapping disease states. Faculty also benefit from this design, as once created, it is a robust and comprehensive review that can be used year after year regardless of changes in guidelines.

Introduction

Within pharmacy didactic curricula, therapeutics-based courses are often organised into a series of class sessions devoted to individual disease states. While most United States (US) pharmacy programmes report integration of basic and clinical science courses, most clinical topics will stand alone from other topics (Islam *et al.*, 2016). For example, heart failure is taught separately from coronary artery disease, and chronic obstructive pulmonary disease is separate from pneumonia. This approach helps students grasp the pharmacotherapy of the individual disease states; however, patients most often present with multiple comorbidities, which complicate the management of any one disease state alone, and students must be adequately prepared for comprehensive disease state management.

The Accreditation Council for Pharmacy Education (ACPE) Standards 2016 emphasise active learning and content integration to prepare students for knowledge and skills application in the context of complex decision-making (Accreditation Council for Pharmacy Education, 2015). Furthermore, the American Association of Colleges of Pharmacy states that students must demonstrate competence in several Core Entrustable Professional Activities (EPAs), including prioritising health-related problems and developing patient treatment plans; these competencies require working knowledge of disease states and critical thinking skills to determine their interplay (Haines *et al.*, 2017).

Patients with cardiovascular (CV) disease are often complex and rarely present with a single CV diagnosis. Similar drugs are used in various CV disease states but for different indications, and an additive approach to

pharmacotherapy may result in therapeutic duplication or increased rates of adverse events.

This curricular innovation was designed by faculty teaching and directing an integrated cardiovascular pharmacotherapy course. The faculty observed that as patient cases became more complex, students struggled to understand the complexities of managing multiple disease states concomitantly. For example, due to difficulty extracting the commonalities and differences between discrete CV diseases, some students recommended aspirin or statins for all patients with a CV diagnosis, even though this practice is not evidence-based. Some students also confused disease-specific assessments and treatments (e.g. inappropriately calculating the CHA₂DS₂-VASc score to determine antithrombotic eligibility for cardiovascular patients without atrial fibrillation). Furthermore, preceptors provided feedback to the University of North Texas Health Science Centre College of Pharmacy (HSCCP) Office of Experiential Education that students would refer to various CV disease states as “*heart disease*” on rotation and struggled with the specifics of complex disease state management.

The ability of students to identify and prioritise pharmacotherapy problems, understand the interplay of various overlapping disease states and medications, and problem-solve viable solutions for patients is critical. Within didactic curricula, this can be accomplished not only through case-based learning but also by intentionally intermingling overlapping disease-state activities and guiding students in their critical thinking skills (Persky *et al.*, 2019). However, there is a paucity of data available on the most effective methods for concomitant disease state teaching.

The rationale for this innovation was to address the siloed approach to CV disease states within a pharmacotherapy course through the implementation of a capstone comprehensive drug, disease state, and case review within PHAR 7442: Integrated Pharmacotherapy–Cardiovascular at the University of North Texas HSCCP. The ultimate goal was to improve student knowledge, skills, and ability to manage patients with multiple overlapping cardiovascular disease states.

The primary purpose of this manuscript was to detail the stepwise process for creating and implementing this educational innovation. The secondary purpose was to report on student learning and perceptions of the activity.

Methods

Design

The HSCCP is a four-year public PharmD programme in Fort Worth, Texas, which enrolls approximately 100 students per graduating class. All students are required to complete the Integrated Pharmacotherapy (IPT) sequence during their second and third professional years. The IPT sequence is comprised of modular, organ system-based courses that integrate pathophysiology, medicinal chemistry, pharmacology, and pharmacotherapeutics in teaching disease state management.

This learning activity occurred in PHAR 7442: IPT Cardiovascular, a nine-week, four-credit-hour IPT module, sequenced during the Spring of the second professional year with eight hours of dedicated class time weekly. In prior years, all nine weeks were dedicated to individual cardiovascular disease state management. The course was modified in alignment with the American College of Clinical Pharmacy (ACCP) Pharmacotherapy Didactic Curriculum Toolkit in 2019 to cover fewer cardiovascular topics, making space for this curricular innovation (Flannery *et al.*, 2019). The activity included individual assignments and team-based learning (TBL) work in groups of 6-7 students and ultimately spanned three consecutive two- and three-hour class times during the final week of the course. Core CV disease states covered are aligned with tier one and two disease states from the ACCP Toolkit: hypertension, heart failure with reduced ejection fraction (HFrEF), acute coronary syndromes (ACS), atrial fibrillation (AF), and cerebrovascular accidents (CVA) (Flannery *et al.*, 2019). The components and sequence of the progressive education activity are described in detail below.

This project was approved by the North Texas Regional Institutional Review Board.

Pre-quiz

Before the activity, students completed a 10-minute, 5-question quiz on Canvas, HSCCP's online learning management system. Students were instructed not to prepare for the quiz as results would be used to gauge baseline understanding of complex disease state management, and all students would earn full participation credit regardless of their scores. Each question assessed students' ability to manage drug therapy in a patient with two concomitant CV diseases.

Drug class review

As a primer to the activity, students completed a drug class review in which they delineated the role key CV

drug classes have in managing tier 1 and 2 CV disease states (Table I) (Flannery *et al.*, 2019). Examples were provided in the worksheet, demonstrating that some answers might be simple, some might be complex, and in some cases (e.g. oral anticoagulants paired with dyslipidemia), there was no role for drug therapy. Students were required to upload their completed worksheets to Canvas before the combined patient case step.

Individual patient cases

Four distinct individual patient cases were incorporated into this activity: HFrEF, ACS, AF, and CVA. Course instructors assigned each student to one case, ensuring that at least one student in each TBL group was assigned to each case. The subjective and objective information about the patient in each case was identical, except for disease-specific symptoms, vitals, and labs. The patient also had stage 1 hypertension in each case. Students were instructed to provide pharmacologic recommendations to manage the patient's chronic disease states over the next several months by filling out the chart example in Table I. Due to the complexity of the worksheet, students were also

provided with an example case and key in which the patient's only disease state was hypertension to guide expectations for the depth and complexity of the worksheet and give clear formatting instructions.

To illustrate this activity, consider the example of a patient with HFrEF. Students considering the most appropriate beta blocker would list the three approved beta blockers for this disease state, i.e. metoprolol succinate, carvedilol, and bisoprolol, in the left column, along with appropriate starting and target doses. In the right column, students would select the one beta blocker they would ultimately recommend for their patient. In contrast, on the statin line, students would be expected to note that HFrEF alone is not an indication for statin therapy and that an ASCVD risk calculator must be incorporated into decision-making.

Students were required to upload their individual patient cases to Canvas before the combined patient case activity. Students presented their cases to their TBL groups on the day of the activity, and the course faculty debriefed the answers with the class to ensure baseline understanding before the combined patient case activity.

Table I: Individual student assignments

| PART 1: Drug class review | | ACEI/ARB | Aldosterone Antagonists | Beta Blockers | Antiplatelets (ASA, P2Y12) | Oral anticoagulants | Statins |
|----------------------------------|---|--|--------------------------------|----------------------|-----------------------------------|----------------------------|--|
| 1 | Hypertension | First-line in non-black patients First-line in compelling indications | | | | | |
| 2 | Chronic heart failure | | | | | | |
| 3 | Dyslipidemia | | Not indicated | | | | |
| 4 | Venous thromboembolism treatment | | | | | | |
| 5 | Secondary stroke prevention | | | | | | |
| 6 | Peripheral arterial disease | | | | | | High-intensity statin recommended in most cases, except adults >75 years not at very high risk = moderate intensity (or continue high-intensity if previously on it) |

PART 1: Drug class review
Instructions: In the table below please provide a brief description of the place in therapy and any critical pearls on drug selection/dosing for each drug class & disease state pair. Your answers should be succinct, and this assignment should be no more than two pages after completion. Please refer to the examples for additional guidance. Please type “not indicated” into the box if there is no specific requirement to use the drug in the given disease state.

| | | |
|---|--|---|
| 7 | Stable ischemic heart disease – primary prevention | |
| 8 | Stable ischemic heart disease – secondary prevention | Indicated to prevent mortality and reduce CV remodeling |
| 9 | Atrial fibrillation | NOT recommended for prevention of stroke in the setting of AFib; can be used if patient has other indications |

PART 2: Individual patient case
Instructions:
 1. Under “Drug therapy OPTIONS,” list all classes & drugs reasonably used first-line for this patient, and add drugs/doses and any goal doses or titration parameters
 2. Under “Ultimate choice (drug & dose),” list your ultimate recommendation for this patient – this column should look like a “current medications” section on a SOAP note

| Assigned case #: ____ | Drug therapy OPTIONS | Ultimate choice (drug & dose) |
|-----------------------------|----------------------|-------------------------------|
| CV diagnosis in case: _____ | | |
| RAAS blockers | | |
| Beta blockers | | |
| Diuretics | | |
| Other antihypertensives | | |
| Antiplatelets | | |
| Anticoagulants | | |
| Statins | | |
| Other CV medications | | |

CV = cardiovascular; RAAS = renin-angiotensin-aldosterone system; SOAP = subjective, objective, assessment, plan

Table 1 is the worksheet individual students were expected to complete prior to participating in group work. Part 1 allows students to review drugs indicated in various disease states, and Part 2 challenges students to apply this information to a patient case. This worksheet can be adapted for application in other disease states.

Combined patient cases

Building on the individual assignments, students worked in TBL groups to solve a series of five different comprehensive cases where the patient had two concomitant CV disease states. Students worked in teams to determine how different pairings of the individual patient cases (e.g. ACS and HFrEF) may require adjustments to the initial therapy recommendations listed in the individual cases.

A five-page worksheet tool was created to facilitate this exercise (Figure 1), with one page dedicated to each overlapping case pairing. The worksheet was similar in structure to the individual patient case charts but with

three worksheet columns: one to list appropriate drug therapy options for each of the individual disease states, which students could quickly complete using their individual patient cases (two columns in total), and one column between the individual disease states where students would reconcile the recommendations from the individual case columns into a final recommendation for a patient with two concomitant CV disease states. A Venn diagram watermark was placed on the worksheet as a visual cue to prompt students to consider each disease state alone and in combination.

Students worked in teams to discuss each patient case pairing and compare and finalise the middle column of each worksheet page. Building on the previous example, students assigned to the ACS case might have selected metoprolol tartrate as an appropriate beta blocker, but if an ACS patient also has HFrEF, then the guidelines would recommend switching the beta blocker to one of the three agents shown to reduce mortality in HFrEF in landmark trials. Students would also need to carefully consider the chronological order of antihypertensive treatment recommendations, as a patient with HFrEF and ACS is a candidate for several blood-pressure-lowering therapies, and the initiation of all drugs at one time is likely to compromise patient safety.

The faculty structured the combined patient case worksheet to present the five overlapping patient cases in order of increasing complexity. For each subsequent case combination, more drug classes required critical appraisal to determine the best course of action for the patient. Solving the first two overlapping cases was intentionally fairly straightforward. Additional “grey areas” were introduced in the third and fourth cases, meaning multiple final recommendations could be considered correct. The final case was the overlap

between ACS and CVA, and students were asked to work through the complex problem of triple antithrombotic therapy.

Students were provided with 20-25 minutes to complete the first overlapping case to familiarise themselves with the worksheet and practice clinical decision-making and communication skills. The course faculty debriefed the first case with students to ensure understanding of the assignment and to model critical thinking skills. Students were expected to complete the remainder of the patient cases in approximately 10-15 minutes each. Critical points from the second through fifth patient cases were debriefed verbally by course faculty. No written key was provided to preserve the integrity of the assignment for subsequent years. TBL groups were required to submit one assignment per team via Canvas.

An optional, individual extra credit assignment incorporated three disease states (ACS, AF, and CVA) using a similar structure to overlapping cases. Students were asked to review at least two clinical guidelines to select and justify an antithrombotic therapy plan, introducing a layer of evidence retrieval and reconciliation of differing recommendations among publications.

| Comprehensive Case A | Case 1 (HFrEF) | + | Case 2 (ACS) |
|-------------------------|----------------|---|--------------|
| RAAS Blockers | | | |
| Beta Blockers | | | |
| Diuretics | | | |
| Other Antihypertensives | | | |
| Antiplatelets | | | |
| Anticoagulants | | | |
| Statins | | | |
| Other CV medication | | | |

ACS = acute coronary syndrome; CV = cardiovascular; HFrEF = heart failure with reduced ejection fraction; RAAS = renin-angiotensin-aldosterone system.

Figure 1 is the worksheet utilised during the group activity portion of the learning activity. Students fill out the Case 1 and Case 2 columns based on their individual group work, and then work together to identify how to best reconcile differences between these two columns when the disease states overlap in the center of the Venn diagram.

Figure 1: Combined patient case Venn diagram worksheet

Exam questions

The final examination for PHAR 7442 included five comprehensive disease-state questions. The questions were mapped to assess the same disease state pairings from the pretest, but the patient cases and clinical pearls differed between the pretest and the final exam.

Resources

There was no additional monetary cost for this curricular innovation, but faculty time was required in the creation, delivery, and grading of the activity. After the initial offering, preparation time was minimal and involved only small tweaks to the assignments. However, the activity required a higher level of in-class facilitation than traditional lectures in previous course iterations. Each year, both course faculty attended the patient case portion of the activity to facilitate TBL discussions, ask probing questions, and encourage critical thinking. Additionally, one or two fourth-year students or pharmacy residents on rotation with course faculty were trained to facilitate classroom discussions. With this model, facilitators were able to dedicate significant time to each TBL group discussion. Finally, grading the activities presented an additional workload to the course faculty. However, the TBL-based nature of the assignments reduced the overall grading burden, as only one assignment required grading and feedback for each group of 6-7 students.

Assessment

The overall student performance on the applicable pre-quiz and exam questions was compared using the paired *t*-test (IBM SPSS version 28) to evaluate the preliminary effectiveness of this drug and disease state review activity. Additionally, qualitative feedback was collected via post-course evaluations.

Results

Quantitative feedback suggests this implementation improved student learning. The percentage of students solving disease-state overlap questions successfully increased between the pre-quiz and the final exam for four out of five of the pairings. One exam question was thrown out each year after a review of item statistics. When the means of the four valid question pairs were analysed, students performed significantly better on overlapping disease states on the final exam as compared with the pre-quiz (pre-quiz mean = 48.2%, exam mean = 67.9%, $p = 0.043$).

Qualitative feedback was provided in the form of course evaluations. All comments on the class session were positive. Select examples are:

"I did think the comprehensive cases were good to help review the disease states. I do enjoy learning about the material when explained with logic rather than straight memorisation";

"[the instructor was] clear as to her expectations with us [...] and her reviews have pushed me to learn the material more effectively";

"[the professor] had some really awesome review sessions that combined cardiovascular disease states together, which really showed us what a 'real world' patient would look like, and it helped me a lot."

Additionally, one student emailed the course director to comment on his experiences with the activity:

"The review session you held [...] was particularly helpful to me because I really saw what these combined disease states, that were taught as individual components, might look like in a 'real world' patient with multiple conditions. I really appreciate you all for putting together that review."

Discussion

This report guides the creation, implementation, and assessment of a progressive drug class and disease state review incorporating individual and team-based learning. One advantage of this approach is the integration of the pharmacists' patient care process (PPCP) within case-based learning (Joint Commission of Pharmacy Practitioners, 2014). Through the drug class review, students can refresh the baseline knowledge needed. Transitioning to individual patient cases enables students to practice aspects of the PPCP, including collecting, assessing, and planning. Once students step up to the complex, combined patient cases, they integrate learned knowledge from the first two activities and elevate their assessment and planning thought processes by making therapeutic decisions based on new patient information collected. This step is especially crucial in emphasising the PPCP, as it calls for students to highly individualise the plan for a patient based on multiple factors.

The results of this study confirm the benefits of team-based learning, which have been described extensively in the health professions literature (Parmelee & Michaelson, 2010; Dolmans *et al.*, 2014). Team-based learning mimics real-life, team-based healthcare and simulates real discussions about medical decision-

making for patients for whom consensus must be reached. The immediate nature of feedback through debriefing and group discussions with facilitators clarifies concepts that may be challenging for some students (Dolmans *et al.*, 2014). Team-based approaches to solving complex patient cases have been examined previously in the literature, but to the authors' knowledge, not through an overlapping patient case methodology. However, educational interventions using progressive disclosure of patient cases emphasise similar critical thinking skills and have been shown to improve confidence but not exam performance in the PPCP (Howard & Gaviola, 2018).

Numerous benefits are associated with this progressive, comprehensive capstone case review. Firstly, the time to build materials was minimal, as once worksheet shells and individual cases were built, much of the onus was on the student. The creation of clear activity materials with detailed instructions limited the time needed to orient students to the activity. Additionally, this activity can be reused year after year, as even with changes to guidelines, minimal worksheet changes, if any, would be needed. Because faculty elected to debrief answers in class but did not provide a key to maintain the integrity of the activity year after year, there is also no need to update the key annually. Additionally, the in-class review allows for significantly more discussion and clarifying points as compared to the release of a written key.

Benefits for the student learning process are also essential to consider. As this activity is a capstone, it requires students to synthesise knowledge from the entire course (or multiple courses). This activity was structured the week before the course's final exam, providing a thorough opportunity for students to integrate material from the entire course. In addition to knowledge, this type of review also promotes clinical decision-making skills for complex situations or overlapping disease states. This activity also organically incorporates EPAs and PPCP experiences into the curriculum.

There are also some limitations to consider with this activity. Although no specific faculty training would be required to implement this activity, experience in moderating team-based learning and critical thinking skills is vital for the success of this activity. Several of the components of the activity are best conducted in student teams to allow for efficiency in using class time and to promote shared discussion; some students may not participate as much or may work at a slower pace than other classmates. The application may be challenging for programmes that do not incorporate team-based learning often. This activity could also be scaled towards individual work but would take

significantly more time either in class or through feedback on submitted assignments. Additionally, the extra credit assignment with three overlapping cases was a valuable learning opportunity that many, but not all, students took advantage of. It may be beneficial to add time to the in-class debrief portion to review the three overlapping cases. The extra credit activity could easily be scaled for more advanced learners, such as those on APPE rotations, or used in layered learning.

This novel approach to a comprehensive drug and disease state capstone review utilises a stepwise framework to ensure students review key medication knowledge before solving simple and then complex cases. The progressively more complex skills allow for the integration of EPAs and the PPCP into the curriculum. While this "how-to" guide on a comprehensive drug and disease state review highlights cardiology, it could be applied to multiple disease states and drug classes within other therapeutic courses. For example, students could learn to select the most appropriate diabetes medication based on overlapping disease states, which are also indications for agents such as sodium-glucose cotransporter-2 (SGLT2) inhibitors or glucagon-like peptide-1 (GLP-1) inhibitors. Many medications for chronic kidney disease (CKD) also overlap with additional disease states; a similar approach could be taken in examining complex CKD patients. Finally, disease states, such as infectious diseases or oncology, with similar medications used to treat numerous disease states could apply this activity type to help students apply drug and disease state matching. Course faculty may easily create and facilitate this type of capstone review that can be used year after year.

Conclusion

Within the Integrated Pharmacotherapy-Cardiovascular course, students demonstrated improved abilities to solve complex patient cases after the activity, but the long-term benefits and impact on experiential skills are unknown. Future studies should examine whether repeated exposure to this teaching model across therapeutic courses further strengthens critical thinking skills. Additionally, studies should determine if this approach translates into more advanced patient management skills on experiential rotations by examining student evaluations of managing complex patients. Finally, future studies would benefit from multi-site interventions to strengthen the external applicability of this intervention.

Conflict of interest

The authors declare no conflict of interest.

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Ethics approval

This project as approved by the UNTHSC IRB

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