

Instructor's Manual

Patient-Oriented Problem-Solving (POPS) System in Pharmacology (Third Edition)

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Patient-Oriented Problem-Solving (POPS) System in Pharmacology

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Acknowledgments

Some of the material in this Third Edition has been amended and reworded, or, in some cases, taken verbatim from the First and Second Editions. The important contributions of the original authors, editors, and consultants are hereby acknowledged.

Currently Available POPS Exercises

Title	Authors
<i>Antimicrobial Chemotherapy</i>	Claudine El-Beyrouty, Brian Roslund, and Bhavik Shah
<i>Cancer Chemotherapy</i>	Dennis Peffley
<i>Chemotherapeutic Challenges</i>	Katharina Brandl, Sarah Lerchenfeldt and Amit K. Tiwari
<i>Complications of Analgesic Therapy</i>	Mark J. Hernandez and Drew Zimmer
<i>Drug Therapeutics of Elderly Patients</i>	A. Laurel Gorman and Mariana B. Dangiolo
<i>Drug Treatment of Heart Failure</i>	Rob Rockhold
<i>Pharmacokinetics Applied to the Treatment of Asthma</i>	David C. McMillan
<i>Therapy of Diabetes Mellitus</i>	Jayne S. Reuben
<i>Treatment of Cardiac Arrhythmias</i>	June Yun
<i>Treatment of Essential Hypertension</i>	Mark A. Simmons
<i>Treatment of Psychosis</i>	Gagani Athauda, Autumn Ning and Timothy Holley

Table of Contents	Page
Primary Purpose of the POPS System	6
Description of the POPS System	7
Components of the POPS System	8
History of the POPS System	8
Peer Review and Educational Validation	9
Peer Reviewers	10
Faculty Activities Before a Problem-Solving Session	12
Faculty Activities During a Problem-Solving Session	14
Student Problem-Solving Activities	15
Suggestions for Maximizing Effectiveness of the POPS System	16
POPS Authors and Affiliations (2016)	17
Contributing Authors to Earlier Editions	19

Primary Purposes of the POPS System

1. To help students learn how to apply basic science knowledge to the solution of clinical problems.
2. To encourage students to find information necessary for solving problems by using sources (e.g., textbooks, online resources and peers) that are available to health care professionals throughout their careers.
3. To encourage students to work together and thus
increase their ability to evaluate their colleagues' opinions, thought processes, and diagnoses;
improve their communications skills; and
increase their skills in interpersonal and interprofessional relations.

It should be recognized that the exercises are simulations of clinical cases, intended mainly to provide a conceptual framework upon which to teach the value of a knowledge of basic pharmacology to drug therapy. As such, the cases are somewhat contrived, and are not intended to portray real-life situations. It is not the intent of these exercises to teach clinical medicine. Rather, the main thrust of the approach is to demonstrate how seemingly isolated facts and principles are used in a practical sense to solve the types of problems that confront clinicians in arriving at approaches to drug therapy.

Practical applications of pharmacological principles to therapeutics often involve the exercise of clinical judgment, wherein opinions between practitioners may differ. Often there are no absolute rights or wrongs. It is hoped that these exercises will provide some insight into the notion of controversy in clinical judgment. Faculty whose approaches may differ from those described in the exercises should feel free to point out their differing opinions to the students.

The principles and factual information conveyed in these exercises were considered by the authors to be current consensus at the time of their writing. As new knowledge on drug actions and uses becomes available, concepts and accepted patterns of drug therapy may be expected to change. Accordingly, faculty should be prepared to point out to students, where appropriate, alternative viewpoints or more current ideas and approaches.

Description of the POPS System

The POPS System in Pharmacology consists of a series of exercises that contain simulations of clinical problems. The exercises have been designed to be used in small group meeting sessions to supplement the teaching of pharmacology to first- or second-year students in the health professions.

The topics covered in the currently available POPS exercises are listed in the table on page 4.

Each exercise is designed for a group of four students. Each student is given one fourth of the information required to solve the problem. If a group has only three students, one of the students should take two parts. More commonly, the groups will have more than four students. In this case, two students should take turns with a part. Each of the four parts contains answers to a subset of the pretest questions and information about one episode in the clinical problem. Thus, the students must exchange information and work together to arrive at the solutions.

Each exercise includes a pretest and a posttest, thus providing a mechanism for measuring learner achievement. Both the pretest and the posttest are designed to be completed by the students individually. The answers to the pretest are discussed as part of the exercise. The posttest answers may be posted or made part of the feedback in an online quiz.

One problem-solving exercise or simulation usually requires one group meeting period of 2 to 3 hours.

The student groupings either may be kept the same or else may be changed for each different problem solving exercise session. Some users have found it convenient and useful for the students to retain the same groupings. Others see an advantage to change the groupings with each exercise, so as to enable the students to work with as many of their classmates as possible.

Components of the POPS System

Instructor's Manual The *Instructor's Manual* is the document you are now reading.

Learning-Package PDFs The "learning packages" are divided into seven sections.

A. Introduction to the POPS System, introduction to and objectives of the clinical simulations, a pretest, and review topics

B-E. Four different color-coded sections, each with answers to some of the pretest questions and one part of the clinical problem

F. Posttest

G. Posttest answers

Instructions are integrated throughout the workbook so that the activity is self-instructional for the group.

History of the POPS System

The original POPS System, *Patient-Oriented Problem-Solving System in Immunology*, was developed by Parker A. Small, Jr., MD; Susan M. Johnson, PhD; and Eldon J. Ullmer, PhD, at the University of Florida. (See *Federation Proceedings*. 1974;33:2008 for a description of the early system).

Pharmacology POPS System exercises were developed by a team of 11 pharmacology faculty from six eastern medical schools from Nova Scotia to Florida. The exercises were sponsored and supported by The Upjohn Company through an agreement between the company and Drs. Allen H. Neims and Parker A. Small at the University of Florida. The initial workshop, in April, 1981, was attended by 11 faculty authors and several educational consultants from the University of Florida and The Upjohn Company. The effort resulted in six exercises, edited by Burford and Kepler with associate editor Neims, which were published and distributed in 1985. Three of the original six exercises were later updated and rewritten. Six additional topics were added to the original six topics, with Ingenito as coordinator and editor, along with coeditor Wooles. The exercises were originally available as paper booklets that were obtained, free of charge, by contacting regional Upjohn Company Medical Services Liaisons. Upjohn merged with Pharmacia in 1995, with Monsanto and Searle in 2000, and the joint companies became part of Pfizer in 2002.

A description of the development and evaluation of the original six Pharmacology POPS System exercises has been published (Burford HJ, Ingenito AJ, Williams PB. Development and evaluation of patient-oriented problem-solving materials in pharmacology. *Academic Medicine*, 1990 Nov;65(11):689-693). This paper contains details on the educational validation of the exercises and contains data establishing that the exercises do in fact improve learning of the subject materials.

The results of a survey taken in 1993 of pharmacology department chairs and pharmacy school deans on the use of the POPS have also been published (Ingenito AJ, Wooles WR. Survey results of POPS use in United States and Canadian schools of medicine and pharmacy. *Journal of Clinical Pharmacology*, 1995 Feb;35(2):117-127).

In the 1990s, the rights to the POPS exercises were transferred to the pharmacology chairs group, the Association of Medical School Pharmacology Chairs (AMSPC), and Adrian Dunn became the "curator" of the POPS. At the turn of the century, twelve POPS exercises were available with revision dates ranging from 1985 to 2000.

Several recent developments have led to revising the POPS for the 21st century. These include a continued interest in giving students opportunities for active learning, a need for pharmacology-specific activities, and new technologies for communicating with students. The revisions began with an update of the *Treatment of Essential Hypertension* POPS following the release of the Joint National Committee 8 guidelines in late 2013. The revised version was made Blackboard-compatible and field-tested as part of the cardiac pharmacology block for pharmacy students at the University of Maryland Eastern Shore.

After consulting with several pharmacology educators, a formal proposal was developed to revise all of the exercises in cooperation with the American Society for Pharmacology and Experimental Therapeutics (ASPET) and the AMSPC in 2014. Authors were recruited through the next year with all of the exercises having commitments for authors by August, 2015. During the fall of 2015 the exercises were completed and sent out for peer review. The first five revised exercises were rolled out at an ASPET Division for Pharmacology Education symposium on the POPS at Experimental Biology 2016 in San Diego, CA.

Peer Review

The production and review of the POPS System exercises was done primarily by members of the Division for Pharmacology Education of ASPET with the endorsement of the Association of Medical School Pharmacology Chairs.

Authors were selected on a volunteer basis from experts in the respective topic areas. First drafts of the exercises were reviewed by the Editors, and returned to the authors for revisions if necessary. After editorial revisions, the exercises were sent for substantive review by content experts, usually consisting of a pharmacologist and a clinician. The exercises were then returned to the authors to address the reviewers' comments. The revised versions underwent a final editing by the Editors prior to distribution by ASPET and the AMSPC. In reviewing the exercises, special attention has been given to congruency between the stated learning objectives, the contents of the exercises and the pretests and posttests.

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Faculty Activities Before a Problem-Solving Session

Become Familiar with the Exercise

Read the entire exercise before it is used by the students.

Schedule the Group Problem-Solving Sessions

The exercises are designed to be completed in about 2 hours, assuming that the pretest has been completed before the group session. Some groups may take longer, while others may finish more quickly. Periodic checks on the groups' progress by faculty are useful to ensure timely completion. Other time factors include whether the students are familiar with the POPS organization and whether they are expected to complete the posttest within that time period.

Assign Students to Groups

Divide the class into groups. Each exercise is designed for a group of four students with each student having one fourth of the information required to solve the problem. Groups may be larger or smaller depending on class size and rooms available. If a group has only three students, one of the students should take two parts. If the groups will have more than four students, two students should take turns with a part. We have found that with two students per part, one student can serve as the reader and one as the note-taker denoting important facts on a whiteboard or flipchart for the rest of the group to see. Remember, each student has the answers to some of the pretest questions and information about one clinical episode. Thus, they must effectively communicate that information to the other students. Students can work in the same groups for all POPS sessions, or the groups can be changed for each problem.

Select an Optimal Classroom Arrangement

If a large laboratory with facilities to separate working groups of four is available, this is ideal, as it allows for noise reduction and relative privacy of the groups. The additional advantage of this arrangement is that it is convenient for faculty to be accessible for consultation by the students. Alternatively, small conference rooms work well except that it makes it more difficult for faculty to move between groups. A third possibility would be enclosed carrel study spaces within a library, although the noise from the discussions may prove to be a distraction to others using the library. Using a large laboratory without facilities to separate out the groups has not worked well. Lack of available space has been a major challenge in some schools.

Distribute Appropriate Sections of the Learning-Package Workbook

Each student should receive a copy of part A of the exercise, which includes an introduction to the POPS System, introduction to and objectives of the clinical simulation, a pretest, and review topics, at least one day before the group problem-

solving session. If desired, the second section (parts B-E, the color-coded booklets with pretest answers and the clinical problem) may also be given to the students to review before the group session. In an unpublished study at the University of Florida using the *POPS System in Immunology* learning packages, there was no difference in posttest scores or the time required to complete the exercise between the two methods. Distribution of only the first section before the group session may encourage more background study and more exchange of information in the groups. If the second section also is distributed early, students usually are better prepared for the session and feel more secure. However, this approach may lead to file sharing among the students in a group, diminishing the requirement for effective communication during the session.

Students should read about each of the review topics *before* each problem solving session to avoid the frustrations of searching for information during the sessions. Reading assignments are described in terms of topics, and in many cases no specific references are listed. There are many good pharmacology resources available, and students should be encouraged to develop skill in using them to find the information they need. The problem-solving sessions are "open book," and students should be advised to access various sources of information during the exercises.

Establish a System for Return of Posttest Answers

Feedback on the extent of student learning, as assessed by posttest scores, may be useful. These scores may be used also to grade student participation. Posttests should be taken no later than 1 day after the problem-solving sessions. A mechanism for the distribution, return and feedback on the posttests should be established.

Faculty Activities During a Problem-Solving Session

Beginning a Session

No formal activity is required to start a problem-solving session if prior logistical tasks have been completed—that is, if appropriate materials have been distributed; student numbers and groups have been assigned; and room assignments have been designated. Students are merely directed to assemble at their assigned spaces or rooms and follow the directions provided in the exercises.

During the Session

The role of the faculty during the exercise is to: facilitate student-to-student interaction; suggest sources of relevant information; and serve as information sources when the students have exhausted their patience or their reference sources.

With the *POPS System in Immunology*, one of the most effective "teachers" was a faculty colleague from a discipline other than immunology who came to observe one of the sessions. A group of students, recognizing his faculty status, asked him about the Coombs' test. He acknowledged his ignorance of the procedure but asked to see one of their textbooks. He looked up "Coombs" in the index, briefly read about it, and handed the book to the group, suggesting that the indicated paragraph answered the question. A few minutes later, another group asked him a similar question, and he referred that group to the group who had just read the book. As a result of his approach, students from groups all over the lab were consulting with other groups, discussing, arguing, exchanging interpretations, and, in general, learning in a very active way. Students need this kind of help, since they are so used to asking questions of the faculty and getting immediate answers that they do not develop the habit of using reference material efficiently.

The converse of the student-centered interaction described in the preceding paragraph also can occur. If faculty members respond automatically with answers to students' questions, the lab soon will consist of a series of groups vying for the faculty member's attention to get the necessary facts to solve the problem so they can all go home. This obviously defeats one of the purposes of the system. The faculty must exercise judgment as to when students need answers and when they need to be directed to their textbooks.

Student Problem-Solving Activities

Part A - *Introduction to the POPS System, Introduction to the Clinical Simulation, Learning Objectives, Pretest, and Review*

These sections of the workbook should be distributed at least 1 day before the problem-solving session. Students should be instructed to study the objectives by reading texts, complete the pretest, and review the topics listed at the end of the pretest before coming to the lab. This saves working time and increases the probability that students will be prepared for the problem-solving session.

Parts B-E - These color-coded sections that contain the pretest answers and clinical episodes may be distributed for review before the group session along with part A or on the day of the group session.

Discussion of the Pretest Answers. Each student in the group has about one fourth of the correct answers to the pretest. Thus, the students in the group must share information and discuss the correct answers in order to maximize benefit from the pretest and ensure that all are prepared to solve the problem. This discussion is "open book."

Solving the Clinical Problems. Each student in the group also has about one fourth of the data necessary to solve the problems, so again the students must share information. Each participant must be prepared to explain in detail his or her portion of the data.

Part F - *Posttest.* The posttest is completed individually and is usually "closed book." The posttest may be given online through a learning management system or as a paper test.

Part G - *Posttest answers.* The correct answers may be used as feedback for the online exam, posted online, or distributed by email.

Suggestions for Maximizing Effectiveness of the POPS System

Sequence

The problem-solving sessions should be incorporated into the usual sequence of the pharmacology course to replace or supplement usual methods of teaching the topic. Many faculty have found the *POPS System in Pharmacology* to be effective reinforcement of material covered in lectures.

Schedule

Ideally, each problem-solving session should be scheduled at the end of the morning or afternoon for a period of 3 hours. This allows students to work at their own pace. In many institutions, students have completed the problem-solving sessions in 2 hours or less. In these cases, posttests were taken after the group meetings.

Mandatory or Optional Student Participation

A survey conducted by the AMSPC/POPS Committee revealed that there were no differences in faculty ratings of the value of the POPS System exercises on the basis of "mandatory" or "optional" student participation. However, students gave a higher value rating to the exercises when their participation was required. Student ratings were positively correlated with faculty ratings of the value of the exercises, which underscores the importance of assigning interested and dedicated faculty to monitor the problem-solving sessions.

Graded or Non-graded

The above-mentioned survey also established a lack of correlation between student assessment of the value of the exercises and whether or not a grade was assigned for participation. A few schools include questions based on the POPS System exercises on their in-course examinations. Others have used the posttest results to assign student grades. Some faculty feel that student interest and motivation increase if grades are assigned. Dr. P. A. Small, Jr., originator of the POPS approach, has devised a peer-evaluation system for students doing immunology POPS at the University of Florida. Students evaluate each other's knowledge, preparation, and ability to interact during the sessions. Readers interested in peer evaluation of POPS System exercises are referred to the *Instructor's Manual: POPS System in Immunology*.

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