

# How to Fix the Dangerous Lack of Clinical Pharmacology Education in the Medical Profession: The Generation of Core Entrustable Professional Activities in Clinical Pharmacology for Entering Residency

The Journal of Clinical Pharmacology  
2016, 56(10) 1177–1179  
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Clinical Pharmacology  
DOI: 10.1002/jcph.748

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## Keywords

drug interactions, entrustable professional activities in clinical pharmacology, medical education, medical misadventures, prescribing practices

## Overview

The past decades have seen the exponential development of virtually every aspect of the practice of medicine. Included among these developments has been an exponential expansion in the number of available pharmaceuticals, and so the discipline of clinical pharmacology must assure that education of medical students and training of medical residents increases concomitantly. This is an exciting time for the American College of Clinical Pharmacology (ACCP) and other medically related societies. It is a time in which there is the opportunity to play a key role in reshaping the medical school curriculum to take advantage of all of the new information about pharmacogenomics, pharmacokinetics, pharmacometrics, and other parts of clinical therapeutics. Medical training must reflect the indispensable role of clinical pharmacology in the practice of medicine. During this critical time, we as well as others have noted a dangerous lack of clinical pharmacology education in current medical education curricula.<sup>1–4</sup> Further, many contemporary clinical pharmacology educational articles advocate educational interventions designed to improve medical students' perceptions of clinical pharmacology and improve prescription writing by providing small study group sessions.<sup>5</sup> Although laudable, this approach is no substitute for providing succinct analytical reviews of each key concept, such as basic pharmacokinetic and pharmacodynamic principles, dosing adjustments, and complication resulting from lack of adherence. We propose that it is more effective to focus on educational

interventions that mimic real-world prescribing competency than to rely on students' self-assessments of competency as an endpoint. To quote Walter Kraft, MD, Associate Professor, Thomas Jefferson University School of Medicine, and Director, Clinical Research Unit, "At the end of the day the measure should be the ability of new residents to recognize and make higher-order decisions around proper drug dosing."

Therapeutic interventions in all medical subspecialties are complex due to unforeseen toxicities, drug-drug and drug-food interactions, dosing in special patient populations, and the increasing use of biological therapeutics. Medical professionals are also asked to operate in compliance with institutional evidence-based guidelines, which may be restrictive and/or too vague to provide guidance in cases that do not fit the description

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Submitted for publication 1 April 2016; accepted 5 April 2016.

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of an average patient. Working under the tyranny of 15-minute appointments, both the newly minted physician and more experienced clinicians hoping to take advantage of new therapies, determined to comply with the well-intended but restrictive guideline, may be channeled into the kind of medical misadventure that the guidelines were intended to avert, all resulting in the patient's fall "into a relentless downhill medical care spiral fueled by interventions based on 'evidence-based' guidelines."<sup>6</sup>

We are facing these challenges at a time when medical schools devote less time to teaching the basic pharmacological principles that are so relevant to a rational and optimal use of medications.<sup>4</sup> Furthermore, the number of faculty with appropriate training in pharmacology has decreased dramatically.<sup>7</sup> Consequently, clinical pharmacology has been significantly condensed or eliminated entirely from medical school curricula. This leads to a limited awareness of the critical importance of clinical pharmacology within the medical community, which may result in adverse patient safety issues including medication misadventures. Professional societies are ideally suited to fill some of the gaps in both the initial and continuing education of prescribing clinicians.

## Solutions

Education is one of the greatest strengths of the American College of Clinical Pharmacology in addition to its interprofessional and multidisciplinary approach to clinical pharmacology. Our goal is to improve the knowledge, skills, and professional practice of physicians, scientists, pharmacists, and other healthcare-providing professionals working in drug development and evaluation and treatment of patients. To this end, we seek to provide guidelines and competencies for teaching the underlying principles of clinical pharmacology. We propose to develop a set of clinical pharmacology standards representing the entrustable professional activities that medical students need to know when entering the first year of residency training. The proposed topics to be mastered include (1) basic pharmacokinetics and pharmacodynamics, (2) dosage adjustment for age and for organ impairment, (3) drug-drug interactions, (4) biologics, including vaccines, (5) adherence, (6) identifying, understanding, and interpreting drug information sources, (7) summarizing common *problem* drugs, and (8) how to work within an interprofessional health care team. In the February 2016 issue of the *Journal of Clinical Pharmacology*, David Greenblatt, the Louis Lasagna Endowed Professor in the Department of Integrative Physiology & Pathobiology at Tufts University School of Medicine, describes key topics in pharmacokinetics and pharma-

codynamics and provides 3 real-world examples illustrating how familiarity with the basic pharmacokinetic and pharmacodynamic principles enables optimal and rational therapeutic interventions.<sup>8</sup>

Selected clinical vignettes representative of the proposed topics will be published as Case Series and Review by the *Journal of Clinical Pharmacology*, authored and discussed by academic physicians and leaders in the field of clinical pharmacology. Key concepts in each topic will be reviewed, and at least 3 clinical cases will be provided to illustrate the problem and to offer the correct and the most optimal solutions. The target audience for this article series consists of medical students, residents, and medical educators, but the series will also provide continuing education for other healthcare professions involved in prescribing, administration, and/or monitoring of medication use. Further, these articles will provide a valuable resource as the Association of American Medical Colleges revises its *Core Entrustable Professional Activities for Entering Residency Curriculum Developer's Guide*.

## Discussion

Contemporary drug therapy is advancing too quickly and is too important to be learned solely through experience.<sup>4</sup> By refocusing and optimizing clinical pharmacology core entrustable activities, we offer an additional tool to improve knowledge, skills, and professional practice of physicians and other health care professionals working in drug development and evaluation, positively influencing the treatment of patients. Future clinicians must have a solid understanding of clinical pharmacology and therapeutics so that they are well prepared to use and study today's therapeutics as well as those on the horizon. Without such training, it is likely that inappropriate prescribing and the incidence of adverse drug reactions will continue to rise, with an attendant increase in medical misadventures and cost of healthcare. ACCP is uniquely positioned to serve its membership, the medical community, and the medical education community by providing a succinct yet comprehensive set of guidelines, termed Core Entrustable Professional Activities in Clinical Pharmacology, that every fourth-year medical student should master before entering residency.

## Acknowledgments

The authors would like to acknowledge the helpful discussion and insights from the Special Committee for Medical School Curriculum of the ACCP. We would also like to acknowledge the ACCP Executive Director, Krista Levy, for her administrative assistance and helpful suggestions. We would also like to thank Drs Walter Kraft and Francis Achike for their

critical reading of the manuscript and helpful comments and acknowledge the Association of American Medical Colleges for providing a framework for this endeavor.

## Disclosures

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