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RESEARCH ARTICLE

Advanced Processes for Clinical Pharmacology Evaluation in Board Exams

Frederick J Goldstein, PhD, FCP

Professor of Clinical Pharmacology, Philadelphia College of Osteopathic Medicine, Philadelphia, Pennsylvania, USA

Email: fredg@pcom.edu

ABSTRACT

As a medical educator for over 30 years, and a member of the National Board of Osteopathic Medical Examiners (NBOME) for 20 of this time, I am concerned about the burden placed on those taking boards. In the USA, an increase in Biologic License Applications (BLAs) plus New Molecular Entities (NMEs) over these past two decades is extensive. Considering that there was not an equivalent number of agents withdrawn from the market leaves a large net amount of new medicines to be learned in addition to what we are already teaching.

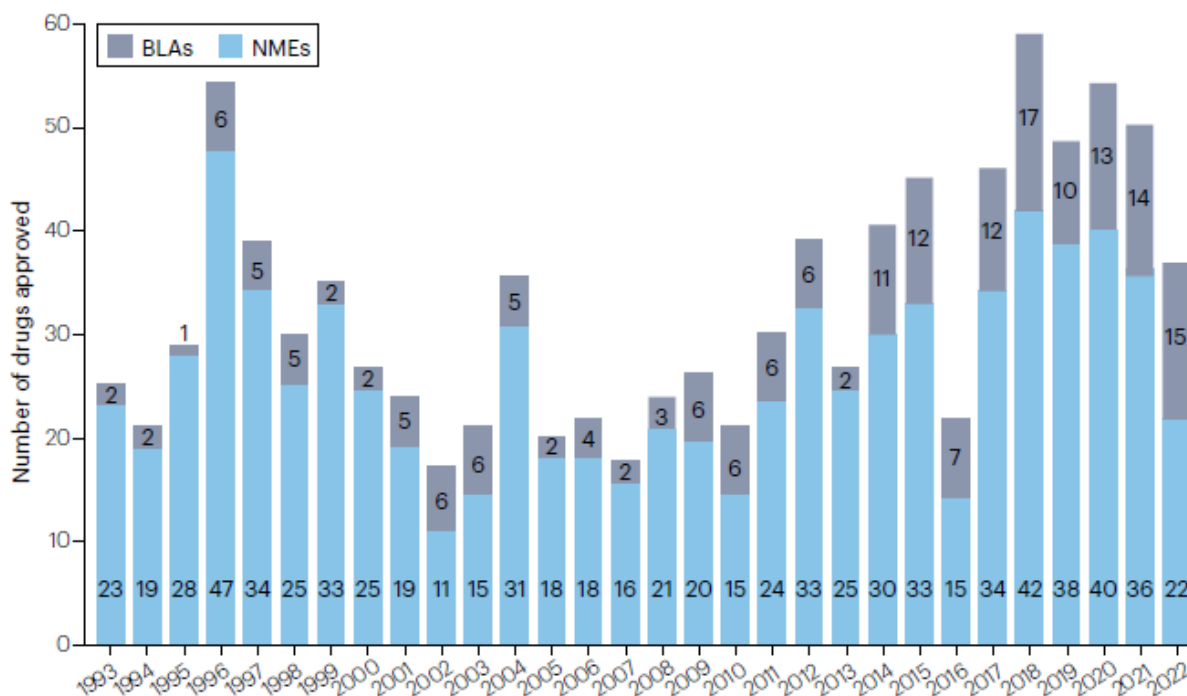
In my opinion, this is an overload and one of the causes contributing to increased burnout among young physicians-to-be. As recently concluded, “*Advances in medicine and technology mean that medical students are expected to learn significantly more information than their predecessors in the same amount of time*”¹. Other contributory factors cited in this article include participation in extracurricular, research and leadership activities, all designed to improve chances for admission into targeted residencies.

Issues

INTRODUCTION OF NEW DRUGS

I congratulate pharmaceutical companies who have offered new molecules efficacious for conditions

where pharmacotherapy was limited or non-existent. However, from 1993 to 2022, the US Food and Drug Administration (FDA) approved a total of 1,006 new drugs which translates to an average of 34 drugs annually!



Source: FDA. In: Nature Reviews Drug Discovery; <https://doi.org/10.1038/d41573-023-00001-3>
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In 2022 (most recent year for these data), the total was 37; targets included infectious diseases (e.g., COVID-19, HIV, smallpox, influenza, *H. pylori* infection), neurological conditions (e.g., ALS, spinal muscular atrophy), endocrine diseases (DM1, DM2), autoimmune, inflammatory, and lung conditions (e.g., IBD, lupus nephritis, arthritis, eosinophilic esophagitis, psoriasis) and cancers (lung, prostate, breast, PROS, melanoma) [FDA-2022]. Twenty of these 37 were for patients suffering from rare diseases such as acid sphingomyelinase deficiency (Niemann-Pick disease type A, B, A/B), generalized pustular psoriasis, obstructive hypertrophic cardiomyopathy, metastatic or unresectable uveal melanoma, hepatorenal syndrome.²

INCREASED INFORMATION IN OTHER DISCIPLINES

There are also increased levels of information in other fields of medicine, e.g., biochemistry, physiology, microbiology, immunology and pathology.

To counter negative aspects of such expansions, we all recognize without any doubt that diagnoses and treatments are more exacting and, therefore, more

beneficial to our patients today. They live not only longer but also healthier. As a medical scientist who conducts clinical investigations designed to reduce chronic neuropathic pain, I appreciate this advancement.

However, this burden placed upon on our students is significant. Ask any doctor who graduated 20 or more years ago how they feel about this current medical education load; I'm certain you will hear that they are glad to have completed their medical education when they did.

Based on this current pedagogical matrix, what should we as medical educators do?

Processes for Improvement

DECREASE DEPTH OF CLINICAL PHARMACOLOGY EDUCATION

Several years ago, I proposed a realistic approach to educating medical students in clinical pharmacology. In *“Depth of Clinical Pharmacology in Undergraduate Medical Education”*³, I expressed my opinion that teaching mechanisms of drug actions to future physicians should be limited –

where possible -- to actions at receptor levels. Knowing physiologic functions of receptors is key; what clinical effects occur when they are activated or blocked will, in fact, provide doctors with sufficient knowledge of all necessary therapeutic actions, including – but not limited to -- adverse effects and drug interactions. I firmly believe it is not necessary to drill down to ultimate subcellular biochemical reactions unless, of course, such knowledge is absolutely necessary to understand a relationship between drug and efficacy.

PROVIDE ACCESS TO STORED INFORMATION

For the boards, I now strongly advocate embracing a process that is currently available to all health professionals in their respective practices: quick access to medical formation.

Every medical student who sits for a board exam should be given an electronic unit containing current levels of medical information. It should not have internet access; just stored facts. This will *not* reduce creative thinking in development of optimal approaches to diagnosis and treatment. In fact, it will *enhance* such decisions, making them more accurate and, ultimately, more beneficial for their future patients.

In regard to board cases involving clinical pharmacology, medical students will still have to consider pharmacokinetic data, drug-drug and drug-food interactions, warnings, and

contraindications. However, they will be able to locate such necessary information quickly and accurately to develop their best solution. It will remain a timed test so students still must have clear and deep knowledge of all areas of medical education to proceed quickly into exploration of a posted condition and its solution ... but they will have improved 'tools' to assist in their decisions.

In my opinion, this is the minimum we must do to educate our physicians-to-be so that they are highly capable of treating their future patients.

What about tomorrow?

Tomorrow's challenge is expanding faster than anyone (or at least most of us) thought possible: *artificial intelligence* (AI) spreading quickly into medical decisions. Development of certified, correct AI systems will allow development of deeper and more comprehensive board cases, thus providing more realistic challenges to the board-taker. However, there are concerns about AI including privacy and security of healthcare data, and utilization of biased and discriminatory algorithms that must be addressed and solved.⁴

In summary, there are electronic systems in existence that will facilitate improvement in both medical education and board-testing. It is time to implement them.

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