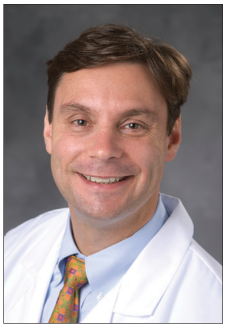
Computational Faith



I have always had great reverence for our colleagues in biostatistics. Whether my reverence derives from the limitations of my own statistical training or from the tremendous talent of the people I have worked with over the years, I am consistently amazed at the plans that biostatisticians are able to generate on the basis of what I view as rather pedestrian discussions of research proposals. Biostatisticians know how to examine and ask about routine factors—the purpose of a study, its population, variables, and interventions—and then generate an elegant and robust study design and analysis plan. Sometimes, their plans rise above my level of understanding, particularly in the case of high-dimensional analyses involving bioinformatics. At this point, following the advice of the statistical experts is simply a matter of faith.

Faith in science, much like faith in other aspects of life, involves a degree of trust in the process and belief in the capabilities and integrity of one's collaborator. But what happens when that collaborator is a computer? In this issue of *Clinical Advances in Hematology & Oncology*, Dr Daniel Spratt, chair of the department of radiation oncology at the UH Seidman Cancer Center and a professor at Case Western Reserve University in Cleveland, Ohio, discusses his work with artificial intelligence to predict which patients who have localized prostate cancer will benefit from the addition of androgen deprivation therapy to radiation therapy and which will have equally good outcomes with radiation alone. This interview is well worth the read, as Dr Spratt walks us through how AI can identify patterns in pathologic specimens that cannot be detected by the human eye. He then describes how subtle differences can be collated over thousands of specimens and correlated with different treatments and outcomes to identify the most robust set of variables for predicting which patients will benefit the most, or not at all, from the addition of androgen deprivation therapy.

The results with AI are impressive. The model that Dr Spratt and his colleagues studied was able to predict an increase in distant metastasis–free survival after the addition of androgen deprivation therapy to radiation, with a clinically significant benefit (HR, 0.33) in patients who had biomarker-positive disease by AI vs no benefit (HR, 1.00) in patients who had biomarker-negative disease. Although the data are retrospective, replication across several studies supports their robustness. Prospective validation may be tricky, however, because the model is fluid—constantly learning from additional data and fine-tuning its results. With the addition of novel hormonal agents, the AI model will continue to update and learn from the effects of more potent inhibition of androgen signaling through a process known as machine learning, or deep learning. Although this iterative process can result in greater accuracy and relevancy to evolving practice patterns, it does create a challenge from a regulatory perspective. As Dr Spratt points out, the question of regulation will require "more out-of-the-box thinking," which could delay or restrict approval.

AI is not a threat to our practice, but rather an aid to optimizing patient care. How this new information is used will ultimately be up to the provider, including the provider's comfort level with the tools and understanding of their limitations. I believe we are at the dawn of a new information age in medicine, in which greater emphasis will be placed on the importance of big data that are not limited to clinical trials, but rather stretch into real-world settings. AI has the potential to inform our practice in ways we cannot yet imagine, and navigating this future of medicine will require a healthy degree of both skepticism and faith.

Sincerely,

Daniel J. George, MD