ASSOCIATION OF COMMUNITY CANCER CENTERS

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Predictive Modeling: What, Why, and How?

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Envision a day that cancer clinicians can ask an app to advise on immuno-oncology (IO) treatment options for a patient. That day may not be far off. Big data, deep analytics, and predictive modeling methods are transforming how cancer clinicians weigh treatment options.

How can predictive models inform delivery of personalized medicine in immuno-oncology?

The next frontier in IO treatment lies in harnessing highly granular data to explore treatment options by answering questions that will increase the ability of clinicians to deliver personalized medicine. Those questions include: 1) Which options might apply to *this* patient, but also which do not, and why? 2) Why may some options work for *this* patient, but some not? 3) What is the relative effectiveness of each of these options for *this* patient, and how do they stack up against each other? 4) What adverse events can we expect, when, and why—for *this* patient? 5) Which treatment options can *this* patient tolerate physically and psychologically, and why? 6) How do treatments compare in balancing effectiveness and safety? This is where predictive modeling comes in: answering questions about unique patients and their IO treatments so that these treatments can be as individualized as possible.

Predictive modeling requires several types of datasets. There are the evident data: clinical, biological, and genetic variables; history and present status; and prior treatments, if any. There are the data about whether and how patients cope with cancer: psychological and social. There are the demographic data (think health disparities): where the patient lives and with whom; whether the patient works, goes to school, or is unemployed; where the patient gets health and social care; and where the patient volunteers, worships, and recreates. There are the economic data (think health inequities): income and insurance status, for example.

Both historically and today, many predictive models have focused on the negative: risk over opportunity and what could go wrong over how to improve. That is, on the "risk of," not the "opportunity to"; on "what may go wrong," not on "what will make this better." Instead, the questions to ask are: 1) What plays in this patient's favor, and why? 2) What do I need to be concerned about, and why? 3) What and where is the balance between efficacy and safety, and why? 4) What outcomes can I expect? 5) Can I predict what will happen to this patient after treatment – shortly after as well as beyond?

To caution, models may be statistical artifacts. Especially with big data, associations are easily found, equations easily constructed, and algorithms easily specified. But are the models plausible, both biologically and clinically? Predictive models may be acontextual: perhaps the best treatment in general, but not the most realistic for this patient – clinically and socially. Hence, it is critical that expert clinicians review models for their validity.

To end on a positive note - processing information in ways that humans cannot, predictive models can help clinicians identify the most appropriate treatment options for each patient wherein the models advise and explain. The clinician, however, must decide what to discuss, how to treat, and how to monitor each patient.

1. Abraham I. Big Data, Deep Analytics, Better Outcomes. Immuno-Oncology Insights (ACCC Immuno-Oncology Institute) 2019. https://www.accc-cancer.org/home/learn/resource-detail/big-data-deep-analytics-better-outcomes

2. VanderWalde A. Predictive Modeling to Inform IO Regimen Choice. Immuno-Oncology Insights (ACCC Immuno-Oncology Institute) 2019 https://www.accc-cancer.org/home/learn/resource-detail/predictive-modeling-to-inform-io-regimen-choice

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