How Data and Technology are Accelerating Cancer Research to Improve Patient Outcomes

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When I started medical school nearly 30 years ago, cancer treatments were typically one-size-fits-all approaches of surgery, radiation, and chemotherapy with significant side effects for patients. Today, with the advent of precision oncology, we have a better understanding of cancer biology, which has enabled the discovery of a range of mechanisms—from targeted antibodies and small molecules that stop cancer cells from dividing to medicines that harness the immune system to kill cancer cells—and treatments are more likely to be tailored to the individual patient and become more well tolerated. All of this means the outlook for patients has never been better. Yet, with advancing age, cancer remains one of the leading causes of death globally and many cancers have few effective treatment options.

Like most, cancer is personal for me because of its effect on my loved ones and that is why I'm passionate about our relentless focus on bringing new treatments to market as quickly as possible. This process of cancer drug discovery and development is complex, lengthy, and costly, and, despite significant advances in cancer research, only about five percent of investigational medicines that enter phase I clinical trials ultimately achieve regulatory approval.[i] For patients, healthcare professionals, and everyone involved in the quest for new treatment options, enhancing the efficiency and precision of this process—especially in the earliest stages—is crucial.

Cancer is a multifaceted disease, and delivering the next generation of treatments requires an integrated—or multimodal approach—that takes into account the tumour type, biomarker status, and stage of disease, along with a deeper understanding of individual cancer biology and how innovative molecular design and treatment mechanisms (e.g., immuno-oncology, small molecules, antibody drug conjugates, etc.) may be harnessed to improve patient outcomes.

The healthcare ecosystem generates about 30% of the world's data, offering valuable insights for cancer drug development. However, the volume and complexity of this data exceed traditional evaluation methods. Advanced technological approaches are needed to efficiently and accurately analyse this data, with the goal of enabling faster delivery of cancer treatments and improved patient outcomes.[ii]

This ability to analyse and interpret complex datasets, using artificial intelligence (AI) and machine learning (ML), is crucial for drug discovery and optimising patient selection in clinical trials to maximise the likelihood of success. In GSK's oncology translational research strategy, we see this coming together in the following ways:

1. Better Target Choice

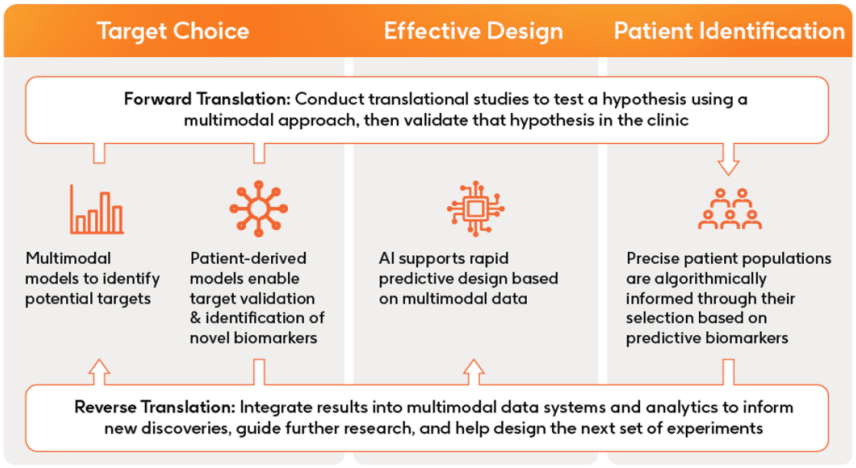
Many cancer therapies target specific genetic alterations or proteins in cancer cells. Our research integrates patient data from various sources, such as tumour characteristics, clinical disease, imaging, and real-world outcomes, to identify potential treatment targets. This approach aids in target identification and validation early in drug discovery. Machine learning helps find associations across datasets, enhancing drug discovery and the design of new medicines.[iii]

2. Precise Patient Identification

At GSK, we are pioneering the use of AI to formulate predictive models that guide new discoveries in cancer research. Through our research into patient-derived organoids, miniature biological models that are grown from a patient's individual tumour cells, researchers can test various treatments in a lab setting to identify whether the tumour might be likely to be responsive to a particular treatment. By exposing organoids to different treatments, researchers can observe responses that may mirror how an actual patient might react, which can accelerate the drug discovery process and enable more informed decision-making regarding which therapies to pursue in the clinic.

3. Effective Trial Design

When designing clinical trials to evaluate medicines for their potential in treating cancer, we are leveraging a sophisticated process known as forward and reverse translation to help determine how best to design the trial for the most impactful outcomes. This process involves conducting translational studies where we test a hypothesis generated outside the clinic using a multimodal approach. We then validate this hypothesis in the clinic (forward translation). The results from these trials are integrated back into our multimodal data systems and analytics. These outputs inform new discoveries, guide further research, and help us more effectively design the next set of experiments, thus completing the feedback loop (reverse translation).



AI/ML is instrumental in analysing, refining, and interpreting data from multiple sources and developing models that can learn continuously from this feedback loop. Research teams can use AI/ML-generated information to identify factors impacting treatment responses and improve clinical trial design. The use of AI/ML to more effectively interpret vast amounts of information has led to a shift in oncology R&D with the potential to improve the probability of clinical trial success in the design phase. Early-stage trial success means we can design better late-stage studies with higher probabilities of positive outcomes. This is a game changer in clinical development for patients who stand to benefit from new and better oncology treatments that are delivered faster.

By strategically applying data and technology, we can accelerate the development of novel medicines and fully harness the innovative potential of precision oncology. This helps us to deliver the right medicine to the right patient at the right time. These approaches allow us to observe better outcomes from the earliest phase of the lengthy clinical trial process through to the final phase before a medicine is made available to patients.

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