From Dogs to Humans: AI-Powered Drug Response Prediction Technology Demonstrates Improved Clinical Outcomes in Oncology

Key Takeaways

- AI-powered drug response prediction technology enhances personalized cancer treatments in veterinary oncology, improving outcomes for canine lymphoma and leukemia.
- The technology's expansion to human cancers involves ex vivo drug sensitivity testing and machine learning, showing promising results in optimizing treatment selection.
- Transitioning to human applications required enhanced data collection, cancer-specific models, and clinical validation, with ongoing efforts to integrate PK/PD data.
- Early studies indicate AI models improve treatment outcomes in human blood cancers, with future work focusing on multi-drug regimens and broader applications.

AI-powered drug response prediction technology is revolutionizing veterinary and human oncology by enabling personalized treatment plans through live cell testing, machine learning models, and data-driven precision medicine approaches.

Pharmacy Times interviewed Sungwon Lim, PhD, co-founder and CEO of ImpriMed in Palo Alto, California, on the impact of AI-powered drug response prediction technology (ImpriMed) on veterinary oncology by enabling personalized cancer treatments for dogs. This approach uses live cancer cell testing and validated AI models, trained on a large database of canine clinical outcomes, to predict the efficacy of treatments for conditions such as lymphoma and leukemia. This drug response prediction technology has significantly improved outcomes, as evidenced by a study showing a 4-fold increase in complete response rates and a 3-fold extension in median survival times for dogs with relapsed B-cell lymphoma receiving AI-predicted therapies.

Building on this success, the company has expanded its platform to human cancers, including multiple myeloma (MM), acute myeloid leukemia (AML), and non-Hodgkin lymphoma (NHL), leveraging similar methodologies like ex vivo drug sensitivity testing and machine learning. Early data from studies, such as those published in *npj Precision Oncology*, indicate promising outcomes, with AI models optimizing treatment selection and improving survival rates.

The transition from veterinary to human applications involved enhancements in data collection, development of cancer-specific predictive models, and rigorous clinical validation. While the current technology does not incorporate pharmacokinetic/pharmacodynamic (PK/PD) data, systematic biomarkers are used to refine predictions, with future plans to integrate more comprehensive datasets. At the EHA-SfPM Precision Medicine Meeting, this technology was showcased for its value in treating NHL, demonstrating its utility in predicting treatment responses and survival outcomes, with future work aimed at expanding its application to multi-drug regimens.

***Pharmacy Times*:** How has AI-powered drug response prediction technology been used in veterinary care?

Sungwon Lim, PhD: AI-powered drug response prediction technology enables veterinary oncologists to identify the most effective treatments for individual cancer patients before treatment begins, avoiding costly and time-consuming exploratory or “wait-and-see” approaches.

We are currently the only veterinary oncology company leveraging AI and anticancer drug testing to facilitate personalized drug response predictions. Our Drug Response Prediction service, based on the response from the patients' live cancer cells, tests the efficacy of 13 of the most prescribed blood cancer drugs. The predictions are based on our validated AI models, which have been trained on an extensive, proprietary database of real-world clinical outcomes collected from thousands of canine lymphoma and leukemia patients. This personalized approach moves beyond a one-size-fits-all approach, improving treatment outcomes while enhancing a patient's quality of life.

Our recent study published in *Frontiers in Oncology* validated the efficacy of our response predictions, finding a 4-fold higher complete response rate and 3-fold longer median survival times for dogs with relapsed B-cell lymphoma that received AI-predicted treatments. These results underscore the power of AI for drug response predictions and the potential to transform veterinary oncology with more accurate and timely therapeutic decisions.

***Pharmacy Times*:** How is this AI-powered technology now being applied to human blood cancers, such as MM and AML?

Lim: We have expanded our AI-powered platform to human blood cancers through translational technology applications. Our human precision medicine services utilize the principles, techniques, and learnings from our veterinary oncology services, such as ex vivo drug sensitivity testing, genomic analysis, and machine learning. The deep, practical expertise gained through developing AI algorithms for veterinary oncology has also significantly streamlined the pipeline for building predictive models for human cancers. Our prototype technologies currently target complex human blood cancers such as newly diagnosed MM (NDMM), AML, and NHL. Our AI-powered drug response prediction software is currently pending approval by the Republic of Korea's Ministry of Food and Drug Safety, and we also hope to achieve FDA approval for commercialization in the US in 2025.

***Pharmacy Times*:** What have data (real world or clinical trials) shown regarding the efficacy of AI-powered drug response prediction technology in human blood cancers, and is this efficacy data indicative of future efficacy if the AI-powered technology evolves?

Lim: Early data from clinical studies and real-world applications are extremely promising. For example, our AI-driven NDMM technology has been proven to predict NDMM patient response and/or survival time following first-line treatment by predicting the probability of early disease progression and stratifying patients into high vs low-risk subgroups. The results, published in *npj Precision Oncology*, indicate that AI models trained on clinical data available at diagnosis can optimize first-line treatment selection for transplant-ineligible patients with NDMM. We've seen similar outcomes with our AML and NHL technology, which evaluate drug sensitivity tests for 21 and 18 anticancer drugs, respectively, to predict patient drug responses and facilitate more precise treatment protocols. As AI algorithms evolve and we gather more patient data, we expect the accuracy and efficacy of these predictions to improve even further, leading to more personalized and successful cancer therapies.

***Pharmacy Times*:** What was required to shift the technology from veterinary cancers to human cancers in terms of development?

Lim: The shift from veterinary to human cancer applications required several key developments:

- **Expanded Precision Medicine Services:** We expanded our precision medicine approach specifically to address complex human blood cancers. This involved adapting existing AI-driven technologies to predict drug responses and prognosis for cancers like MM, AML, and NHL.

- **Enhanced Data Collection and Analysis:** For human oncology, we partnered with major hospitals to collect human clinical samples and patients' medical records. Similar to the veterinary oncology space, this close relationship with human cancer oncologists is essential to develop precision medicine services that integrate ex vivo drug sensitivity testing with machine learning models. This combined approach ensures personalized treatment by leveraging each patient's unique genetic and biological profiles.
- **New Cancer-Specific Models and Testing Platforms:** We developed targeted software and AI models for human-specific cancer responses, including a software-as-a-medical device for NDMM, which predicts treatment outcomes without biological samples. For AML and NHL, we optimized drug sensitivity testing across a wider range of anticancer drugs (21 for AML and 18 for NHL), tailoring predictive models specifically to these human cancers.
- **Clinical and Prognostic Validation:** The transition included clinical validation studies, such as those presented at the American Society of Hematology, confirming that AI predictions in human cancers could enhance survival and treatment outcomes, similar to successes seen in veterinary applications.

***Pharmacy Times*:** How does this AI-powered technology make use of PK/PD data in its drug response predictions?

Lim: Currently, our AI-powered technology does not include PK/PD data. To compensate for the absence of PK/PD data, especially for blood cancers, we add systematic biomarkers such as complete blood count and blood chemistry data. As we gather additional data and continue to refine our models, we may integrate PK/PD information to improve the accuracy of our predictions.

***Pharmacy Times*:** What was the focus of the presentation discussing this AI-powered technology at the EHA-SfPM Precision Medicine Meeting in Copenhagen, Denmark?

Lim: At the EHA-SfPM Precision Medicine Meeting, we highlighted our expansion into human oncology, with a particular focus on our technology application in treating NHL. Our presentation titled "Predicting treatment-specific outcomes for naïve NHL using ex vivo drug sensitivity analyses" outlined the potential of ex vivo drug sensitivity testing in guiding therapeutic decisions for patients with naïve NHL. Our study performed ex vivo drug sensitivity analyses on 52 patients with NHL, consisting of both aggressive and indolent lymphoma, and confirmed the high utility of drug sensitivity results in predicting treatment-specific response and survival of the NHL. The results were highly promising for single-drug standard therapies, but future work is needed to determine predictive results for multi-drug regimens and non-standard therapies.

News Source:

https://www.pharmacytimes.com/view/from-dogs-to-humans-ai-powered-drug-response-prediction-technology-demonstrates-improved-clinical-outcomes-in-oncology