Case Study: Finding the Needle in the Haystack

How Technology Can Help Match Cancer Patients with Cancer Trials

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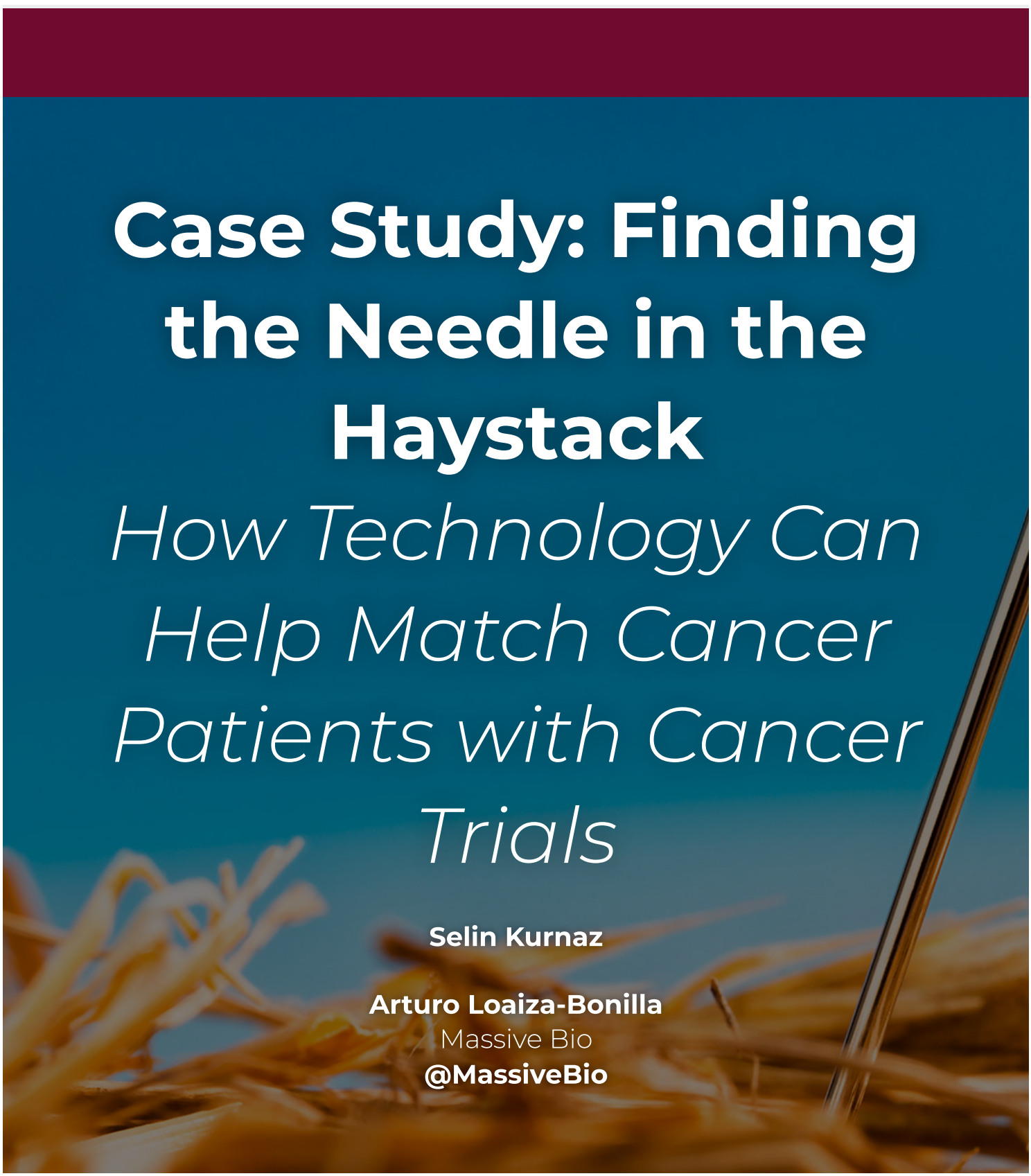

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More than 18 million Americans have been diagnosed with cancer in the past decade, according to the American Cancer Society. This is by any measure a staggering figure. And while the past century's scientific advancements have greatly improved detection, treatment, prognosis, and life expectancy for these patients, there is still much work to be done in the search for a cure.

Even with the recent Centers for Disease Control and Prevention (CDC) infusion of $215 million as part of a five-year, $1.1 billion grant to fund the first year of three national programs to improve cancer prevention, detection, diagnosis, and control, investment is not being directed to fix the most fundamental problems in cancer research.

For instance, one of the biggest roadblocks to a cancer cure is the struggle to recruit patients for oncology trials. Approximately 80 percent of clinical trials fail to meet enrollment timelines. Two-thirds of oncology trials fold before meeting their goals due to a lack of patients: less than 5 percent of adult cancer patients participate in clinical research. A startling analysis from the National Cancer Database (NCDB) discovered that out of more than 18 million potential patient participants, less than 0.1 percent are even *offered* the opportunity to participate in a clinical trial—a trial that may hold the potential for better quality of life or even survival itself.

These sobering statistics are symptoms of a clinical research system that lacks the tools, transparency, and trust required to give hope to more cancer patients. It is past time to overhaul this research engine.

Searching for the Needle in the Haystack

As science propels cancer treatments forward, clinical trials are increasingly designed around very small genetically defined subsets of cancers which, at certain stages, makes finding eligible patients difficult. Researchers are also tasked with enrolling patient populations that reflect the diversity of cancer demographics, further complicating patient identification. In addition, oncology trials typically require patients to have relapsed/refractory disease after standard cancer treatments at least twice before they'll be considered as candidates—in one trial, patients must have received at least three other therapies before becoming a candidate for a renal cell carcinoma trial.

If a patient makes it past these early hurdles, they'll find that pre-screening is strict. A recent study found that roughly 80 percent of patients with advanced non-small-cell lung cancer did not meet the criteria for the trials included in the study; as a result, 86 percent of those trials failed to complete recruitment within the targeted time.

Oncology trials are notoriously stringent in their inclusion criteria. In fact, 40 percent of patients with cancer trials available to them (17 percent of total) are not eligible to enroll due to eligibility requirements, according to an industry report. While these criteria are intended

to ensure patient safety and create a homogenous study cohort, some industry leaders question whether cancer trial criteria are too rigid. In that same report, the U.S. National Cancer Institute (NCI) concluded that clinical trial eligibility criteria arbitrarily eliminate patients and should be simplified and relaxed. Eligibility criteria like age, HIV status, the presence of previous cancers, and other criteria are being re-examined to ensure that restrictions are not unnecessarily preventing willing patients from enrolling in trials.

To make matters worse, many patients do not know about Clinical Research as a Care Option® (CRAACO, a term coined in 2015 by life science industry research firm Conference Forum), which trials exist, how to find them, and how to determine their eligibility. Even some oncologists are not aware of trials unless they are happening at their own medical site, so they start their patients on standard-of-care treatments before considering a trial. In some pernicious cases, oncologists withhold referrals to another facility where a trial is taking place due to patient retention policies or fear of losing patients to the other clinicians running the trial.

Transparency and Trust in Cancer Trial Matching

In addition to challenges finding appropriate patients, two key problems exacerbate the difficulty of matching cancer trials to patients: 1) flawed existing databases and 2) disparate medical records. Electronic medical records are siloed and plagued with errors, and the process of extracting and ensuring the accuracy of information remains too manual and time-consuming.

Many will agree that the *de facto* US database ClinicalTrials.gov is neither thorough nor easy to use. While the database can be a powerful tool for finding trials and results reporting, it does not contain all clinical trials in the clinical research enterprise. Trial sponsors are responsible for updating information with little oversight by regulators, so there are delays and missing information. As such, the database will always be incomplete in two ways: first, individual studies may be missing from the database and, second, study information may be missing from the records. Further, the database still uses industry-specific nomenclature that is difficult for patients without research experience to understand.

While other websites from patient advocacy groups and larger medical centers have sprung up as repositories for clinical trials, these are often focused on specific disease types or locations, which exacerbates the fragmentation of clinical trials information.

We must address these specific challenges. But such fundamental change is daunting without greater transparency into real-time trial availability, criteria, and reasons for exclusion, which in turn will build trust in a system that most patients see as shrouded in mystery.

Technology in Action: NCI Case Study

Modern technology is available to help overcome these challenges and is poised to revolutionize clinical trial recruitment.

In 2020, the National Cancer Institute (NCI) sponsored implementation of an oncology-based clinical trial recruitment tool called the Deep Learning Clinical Trial Matching System (DLCTMS). With the partnership and support of Columbia University, NCI used this

breakthrough software platform to optimize patient matching beginning with three trials within its National Clinical Trials Network (NCTN).

Specifically, sponsors leveraged the DLCTMS to digitize all inclusion/exclusion criteria, each with multiple arms and multiple biomarkers. The system was then used to help analyze all potential barriers to enrollment and extracted patient-level data to allow for more in-depth, objective pre-screening in real time.

"Ultimately, our goal is to enroll as many patients as possible in potential clinical trials," said Richard D. Carvajal, MD, assistant professor of medicine at Columbia University Vagelos College of Physicians and Surgeons and director of Experimental Therapeutics at Columbia University Irving Medical Center. "This AI-enabled Deep Learning Clinical Trial Matching System platform is a promising solution to advance cancer clinical trial patient identification and matching."

Results to date in this ongoing study show a dramatic transformation from a fully manual, time-consuming, error-prone set of steps into an automated and optimized digital process for active enrollment to institutional cancer clinical trials. The platform's built-in artificial intelligence technology streamlined the process, while improving patient participation and outcomes.

Where nurses previously spent an average of 45 minutes per patient combing through criteria to select a potential trial, this time was slashed to 17 seconds to screen not just one but dozens of trials. Additionally, the process of moving a patient from initial identification to consent to enrolled participant was streamlined from as long as 48 hours per patient to mere minutes. (This study is ongoing; see Small Business Innovation Research [SBIR] Contract No. 75N91020C00016.)

The impact of these results across an entire medical practice or patient population becomes more meaningful because it frees up doctors and nurses to focus on patient care. The AI-powered system also bolsters the provider-patient relationship because each side has more confidence that they selected the best trial for that patient.

Within six months for a sample patient population, the DLCTMS helped NCI match patients to more than 111 studies with a 90 percent success rate. Since then, this advanced technology has helped match patients to an additional 213 studies in mere fractions of traditional matching times.

The Trust Imperative

The NCI's encouraging results demonstrate how modern technology can drive the wholesale changes in trust and transparency that today's oncology research landscape needs. Without technology and focused patient support services, connecting the right cancer patients to the right trials at the right time is literally like trying to find a needle in a haystack.

It will take broad and comprehensive effort to solve this issue. All players in the clinical trials ecosystem—patients, providers, sponsors, payers, sites, and research organizations—must embrace change. It will take time, require real change management, and create new ways of working. But if all parties keep at the center of their mission the patients' quality of life, access equity, and innovation, we can collectively transform oncology clinical trials and usher in a

new era of trust in research. This is in everyone's best interest, and there is no better time than now.