Harnessing the power of community: The Genoox Quest to build the largest real-world evidence dataset

By Amir Trabelsi, co-founder and CEO, Genoox

Current state of genomic information

Data production has long worked to bridge the rift in the genomics industry between data and actionable patient treatment. Looking back twenty years ago, the data landscape was incomparably smaller and less complex than the one we see today. Living in today's era of rapid genome sequencing at a lower cost (as opposed to the thousands of dollars it once cost), has opened the path for a wealth of information (genomic data). As a natural evolution in the landscape, geneticists and professionals may become overwhelmed, specifically when it comes to understanding how this data is organized and more so how they are meant to interpret this information – and how to make it actionable. There is no one source providing all the information needed to make impactful change and offer genetic professionals well developed, already-existing, insights.

As is well-known, the state of available genetic data is currently siloed – located in various databases, some being publicly available while many others are hosted in fire-wall protected, proprietary knowledge bases. Finding the research,

although difficult, is less worrisome to clinicians. The larger issue at hand for the clinician – where the large gap truly exists – is finding research that guides treatment for a patient. Most patients are treated by clinicians who can only use general knowledge instead of seeing clinicians who have access to data to create a personalized treatment plan for their specific genetic ailment. Too often the patient experiences more strain or longer treatment times, or undergoes a strategy of treatment elimination until a sufficient treatment matches a patient's needs.

A solution for the Genomics Industry for Better Patient Care

Clinicians deserve access to the best available knowledge so they can deliver precision medicines to their patients for better, more personalized, care patients deserve. While the majority of genetic sequencing information may be found across multiple databases, not having a single, all-encompassing search capability limits a medical professional's ability to access and analyze data critical to their patients. Without advanced data aggregation and analytics that inform machine learning (ML) and artificial intelligence (AI) algorithms, it is more difficult to detect early-stage diseases as well as monitor and treat patients effectively.

Genoox Platform

In an effort to break this cycle of unorganized information and to turn data into an actionable resource, Genoox offers a community-based, genomics insights platform. Genoox's strategy capitalizes on low-cost genetic testing, sources all available data, and brings it to one central platform, thereby breaking the silos and enabling healthcare professionals to explore, research and share knowledge. The solution is a hosting interface for professionals around the globe to discuss treatment of previous genetic-based cases, and allows sharing what works (and what does not) to develop better treatment plans for patients suffering from genetic-based diseases. The Genoox global platform fuses advanced data aggregation and analytics with information available in the public domain on a single (and singular) platform, allowing for the complete analysis of the data and better patient care.

Franklin, an AI-driven variant interpretation engine (see also inset on About Genoox Platform Capabilities)

Genoox's community consists of industrial professional members. Unique to Genoox is that its members use the repository functions as a communication hub to contact other members to enrich their datasets as well as being able to group similar patients that share the same phenotypic characteristics. This hub is built on Franklin, an artificial intelligence-powered genetic knowledge base that facilitates comparison and interpretation of identified genetic variants from large genomic data sets. Franklin's variant interpretation engine supports Genoox's open genomic community that enables its users to leverage Genoox's vendor neutral, workflow-agnostic platform to create data insights across the genomic value chain. Genoox stores and analyzes case studies through Franklin that have helped institutions around the world to identify similar cases to facilitate diagnosis of hard-to-treat cases within contiguous families, for example, through more precise diagnostics for management of future pregnancies.

The homepage of Franklin, Genoox's genomic insights platform

How does Genoox work?

In brief, a clinician inputs the genetic information of a patient tentatively diagnosed with a suspected genetic disease into Genoox's Franklin platform to see if other clinicians have had patients with similar genetic markers or mutations. The clinician is then able to connect with other clinicians who have prior treatment experience to exchange knowledge and insights to prescribe a personalized treatment plan for his/her patient.

Genoox's platform, Franklin, functions through two main modes:

1) **Search mode** – In this mode, the clinicians use the database like a search engine; they can search for a specific variant of interest. The platform will then return with the information that is known and relevant on the input variant data.
2) **Case upload** – In this mode, a professional has the ability to upload a case that includes a DNA sequenced file, or even a report that was done via a third party. Uploading this file to Genoox's system initiates the platform to indicate everything in the database that is relevant and actionable with a more holistic perspective (a case often includes more than just genetic inputs).

About Genoox Platform Capabilities

Precision medicine is all about tailoring one's treatment to one's clinical condition. Genoox, one of the world's largest real-world genomic evidence has widest reference when it comes to humans' genetic conditions and therefore, can help as many patients as a platform can. By using Genoox, clinicians may be able to provide patients with a treatment protocol that is right for their unique genetic profile. Working across almost every genetic indication, and considered to be an indication agnostic platform, their wide offerings currently being utilized by genetic professionals are able to create personalized treatments and provide genomically guided healthcare in various areas including clinical genetics and Biopharma.

With Genoox clinicians now have the ability to treat patients with oncological conditions, reproductive health conditions, as well as rare inherited disease cases. Genoox was actually founded to cater specifically to the demographic suffering from rare genetic or orphan diseases and has the largest dataset and expertise in the segment furthermore, they have been able to grow across all segments.

In addition to clinical genetics the platform pushes BioPharma companies to utilize its technology to optimize clinical trial candidates, selecting effective candidates and dramatically shortening the drug development timelines and substantially reducing the discovery phase time.

What Role does Genoox play in research clinics?

Genoox's platform is currently being used by clinicians and research teams in more than 1700 healthcare organizations. Like others in the field, Genoox's mission is to advance precision medicine at these organizations by harnessing the genomics industry through housing the largest available real-world evidence database.

Since Genoox's platform is updated on a daily basis, healthcare professionals have the ability to integrate recent advanced findings into their studies. Furthermore, Genoox's database, Franklin, allows research institutions to query biobanks and genetic repositories. For example, Vanderbilt University Medical Center uses Franklin as a search engine that prioritizes suspected variants for cardiomyopathies from thousands of patient genomes. Franklin facilitates the selection process of candidate genes or variants for further research with powerful analysis and interpretation toolsets.

Ethical considerations

As bioinformation is highly sensitive, the ethical pillars that support Genoox's mission ensure Genoox operates as a security and privacy company first. By calling on their collective prior IT experience, the company's leaders makes certain that stored data is risk-protected, secure, and complies with HIPAA, GDPR, and ISO 27001 Information Security Certified.

Example of a Genoox's Variant interpretation UI, taken from Franklin's platform

Case Studies

About 60% of the population will benefit from genetic risk programs that include genetic screening for hereditary cancer, cardiovascular diseases, diabetes and other diseases. Recognizing this risk, Genoox has geared up to process more than six thousand genetic tests monthly with 15% growth month over month. The market base for these genetic tests is 45% in North America (between 25-30% from the United States), 25% European, 20% APAC, and 10% Latin American. Approximately 35% of cases logged in the system to date are for patients suffering from rare diseases, while 25% are cancer related mutations. The ease of use of Franklin, and our automated AI-based curation and structuring engines reduces the barrier for registering real-world information into structured databases, thus allowing Franklin to present key insights for underrepresented populations on publicly available data sets such as Gnomad.

The number of data points analyzed per genetic sequence is in the range of hundreds of thousands of variants for exome based tests, millions for genomes, thousands for large cancer

panels, and hundreds for small cancer panels. Each variant is annotated using hundreds of publicly available, community-generated, and manually curated data sources, resulting in an incredible amount of evidence attached to the genomic raw data sample. Patient data is consequently growing monthly, putting pressure on genetic institutions to install and maintain a robust data pipeline and a prioritization engine to keep up to date with the science and scale of data to improve patient care.

Case Example

A molecular geneticist (based in Israel) who uses Franklin for Prenatal testing had encountered a rare variant in a fetus with cardiomyopathy-related phenotypes. The variant was not previously reported in curated data sources (e.g., ClinVar). By the guidelines, the condition should be classified as a VUS (a variant of uncertain significance). The gene mechanism, however, turned out to fit well with other reported phenotypes. The geneticist reached out to the Franklin community members to ask if others had any insights that might help upgrade the classification risk and to determine the causal variant or pathogenicity for the case.

In fact, another Israeli hospital had encountered the exact same mutation in another patient (a young boy) who featured the same phenotypes. The hospital was just in the last phase of submitting their case study as a publication to a respected journal (it had not been released at that time) and were willing to share their details with the geneticist, who used this information to produce a more accurate report to the physician and the patient. Given the similarity of the cases, after providing the family with the potential outcome and consequences of dealing with such a mutation in a child, the doctor recommended aborting the pregnancy.

Who is utilizing Genoox now?

Genetics, a key indicator for risk factors for health and wellness, may affect patients at any point during the course of life. To address this lifetime risk, Genoox is currently being utilized by a host of hospitals and health care institutions to progress the practice of precision medicine. Washington University School of Medicine's[1] technical development and support team is currently supported by the Genoox platform. The university's team utilizes a customized platform system to conduct its specific clinical research and workflows. The Genoox Enterprise Level implementation represents a comprehensive effort to provide Washington University with an opportunity to centralize and harmonize NGS data from clinical testing in oncology, rare and complex inherited disease, reproductive medicine, and pharmacogenetics, alongside the institution's wide-ranging genomics research.

Genoox has also partnered with Aspira Women's Health,[2] a bioanalytical-based women's health company to develop solutions to advance women's health with rapid results, diagnosis, and insights. Aspira leverages Genoox's knowledge base to expand on its proprietary algorithm development across multiple product lines and enabling new test development fueled by groundbreaking data solutions. Aspira extensive biobank, has expanded the platform's wealth of data, aiding in test discovery and validation. JoPM

About Genoox

Genoox was founded with a mission to create the world's largest genomic database powered by real world evidence answering any clinical and genetic questions by harnessing the power of the community to and serving healthcare professionals, clinicians, genetic experts and pharma to enhance patient care. Genoox was recently selected by Washington University as its "platform of choice" to power its genomic analytics in clinical and research related activities. CEO and Co-founder, Amir Trabelsi and CTO and Co-Founder, Moshe Einhorn met while serving in an elite unit of the IDF. Both were working in technical positions and led large scale research and development teams for several years.

Following their time in service, they knew they wanted to create something together. Opting first for jobs in the cyber security industry, they still kept in touch during the following years, always discussing how to make an impact in the world. Moshe pursued advanced studies in computational biology. During the same time period, Amir studied the shortcomings of healthcare systems. He soon understood that advanced technology would have an enormous potential to improve the healthcare system and that applying his skills to genetics would have the most impact. Moshe, who specialized in advanced computational genomics, was totally on board.

They came up with a vision to create something that would impact patients' lives by enabling actionable genomic data at the point of care. The duo quickly had 'buy-in' from some of the brightest minds in the Israeli tech and computational biology scene and the company took off. To date, Genoox is used by over 1,700 health organizations, hospitals and medical facilities in 44 markets across the globe. The company is headquartered in Palo Alto and in Tel Aviv, employs 40 full time employees, and has some of the industry's best investors on its cap table. Most recently, Andy Page, the industry leader and former president of 23andMe joined the company to lead the advisory board.

Three Key Takeaways:

1. The state of available genetic data is currently siloed – located in various databases, some being publicly available while many others are hosted in fire-wall protected, proprietary knowledge bases. Genoox aggregates and makes any relevant data available.
2. Genoox automatically updates real world data into its ever growing database, this constant data expansion reduces the unknowns and increases diagnostic yield.
3. Genoox, by design, enables healthcare professionals to connect and collaborate to solve medical cases together on its platform, ultimately promoting precision healthcare.

Amir Trabelsi

Amir is co-founder and CEO of Genoox. He co-founded the company in 2014 as a healthcare and technology company on a mission to make genetic sequencing more accessible. Amir leads the company's vision, strategy, and growth. He strongly believes in building products that provide small teams with great power, and is always looking for creative solutions to challenge the status quo. Prior to Genoox, Amir held several senior managerial and technology positions in global technology firms including his role as head of product development and strategy for Safend (acquired by Wave Systems), an AI data analytics and information security company. Amir served in an elite technology intelligence unit for the Israel Defense Forces (IDF) and graduated with a B.Sc degree in Computer Science.

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