

**Category**

Best Startup

**Product/Solution Name**

Pentavere's AI - DARWEN AI

**Date of Approval**

N/A

**Indications**

Pentavere's best in class and validated AI is proven to identify patients and extract information buried in clinical text across indications and therapeutic areas.

**Therapeutic Categories**

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**Background information and need for solution/product**

The majority of patients fall through the cracks in healthcare systems and do not receive medications or medical interventions that would improve their outcomes and possibly save their lives.

- 80% of patients do not receive standard of care.
- 80% of health data generated is not analyzed at scale because it exists in unstructured clinical documents and text within an electronic health record.

This is a huge problem for patients, providers, health systems and pharmaceutical companies. The data required to identify the patients that are falling through the cracks is not trivial; it does not exist in available data sets such as structured Claims data, Prescription data, or Disease Registries. Rather, the data is buried in the notes in the EHR, is high volume, clinically complex, and in a terrible state. The AI required to solve this problem and identify patients to ensure that patients are receiving optimal care is hard to build.

Pentavere was founded as a result of a personal tragedy that led to a simple question: Why do we have all the information we need for financial markets to make billions of dollars using AI but in healthcare we do not have the information we need to save lives?

Pentavere has spent the last 5 years building and validating best in class AI technology that solves this problem and leverages the totality of EMR data (physician notes, pathology reports, transcriptions and many other sources) so that patients are not missed and do not fall through the cracks, but receive the care they deserve, so that patients have better outcomes.

Pentavere's world leading AI is the only AI NLP solution validated in over 25 real world AI clinical studies with over 15 publications in high impact peer reviewed journals. Pentavere's AI has received prestigious global recognitions and is in production today identifying patients who are eligible for but not yet on

approved medications or medical interventions, improving the lives and condition of patients across therapeutic areas.

By identifying patients, Pentavere is also reducing the burden on the healthcare systems, enabling greater equity by identifying underserved and marginalized communities who are falling through the cracks, and elevating financial sustainability by creating revenue generating opportunities for healthcare stakeholders .

Pentavere's impact so far for patients (and we are just getting started):

1. Powering an Oncology Learning Health system covering 2.5 million people where over 7 thousand women with breast cancer journey has been analyzed with evidence applied to improve care
2. Analyzed over 2 hundred thousand cardiology patients to identify patients with confirmed heart failure and reduced ejection fracture. 65% of patients identified were not receiving standard of care and 30% optimized as a result of data generated from our AI
3. Processed all lung cancer patients in the province of Alberta Canada creating the countries first AI generated fit for purpose real world data set on 8 thousand patients that has been accepted for regulatory and reimbursement submissions to increase patient access.
4. Fighting the opioid epidemic in Ontario Canada by flagging for physicians patients at the greatest risk of addiction based their daily opioid equivalent buried across clinical notes within their health record.
5. Selected by Takeda with the support of the Canadian Organization of Rare Disease to be their AI partner to accelerate earlier diagnosis of patients suffering from rare diseases.

### **History of the development of the solution/product**

Pentavere rapidly forged relationships with major pharmaceutical companies, securing support funding. The funding enabled Pentavere's strategy to build the world's best AI to discover breakthrough healthcare insights buried in multiple sources of complex, unstructured, siloed and hard-to-access clinical data.

Each collaboration Pentavere secured, and successfully delivered was designed so the development of Pentavere's AI could benefit from:

1. Exposure to as much data and as many different types of data as possible.
2. Exposure to as many disease domains as possible, including rare diseases.
3. Exposure to genomics data and opportunity to combine genomics with clinical text data.
4. Exposure to working with diverse IT departments- from large regional to small local healthcare provider with different systems and processes.
5. Experimentation with small and large data sets.
6. Experimentation with unsupervised and supervised AI approaches to solve specific high value real world problems.
7. Solve for Privacy, data governance, and ethical considerations.
8. Produce clinical endpoints that are clinically important and can have a big impact on patient outcomes.

9. Prove modular AI deployment in highly secure and highly regulated environments unique to healthcare.

10. Proves progress to personalized healthcare and system transformation.

As a result of this strategy, Pentavere's AI is unique and differentiated from other AI healthcare companies.

Through real collaborations that delivered value to pharmaceutical companies, healthcare providers, and researchers Pentavere's AI has successfully:

- Ingested data from many different Electronic Medical Record (EMR) systems, consumer applications, device and diagnostic systems, and Health Information Systems (HIS) such as EPIC and CERNER.
- Ingested a wide range of data inputs and formats such as: standard APIs (e.g. FHIR), custom REST API, SQL, streaming via Kafka, batch input DOC/X, XLS/X, PDF/A, CSV, TXT, JSON etc.
- Ingested and analyzed all types of clinical documents such as: clinical notes, admission and discharge summaries, surgical notes, lab reports and imaging reports. These notes are considered to contain many of the hidden insights in the clinical domain, and data that may not be captured elsewhere in a readily usable way.
- Ingested and analyzed complete patient records across the following therapeutic domains: Oncology (multiple solid and non-solid tumours), Dermatology, Diabetes, Gastroenterology, Tuberculosis, Family Medicine, Rare diseases, Internal Medicine, Immunology, Psychiatry, Bone disease, and Clinical Trial data.
- Used to conduct real world clinical and validation studies, which include:
  - o Extracting clinical concepts from dictated ambulatory consult notes for Tuberculosis patients;
  - o Real World Treatment Patterns and Survival in Advanced Lung Cancer Patients based on biomarkers (KRAS, PDL-1, EGFR Exon 20 etc...);
  - o Real World Treatments Patterns and Outcomes of Patients with Metastatic Breast Cancer (Example: Patients receiving CDK4/6 inhibitors Combinations For HR+/HER2);
  - o Real-World Treatment Patterns and Outcomes in Acute Lymphoblastic Leukemia Patients;
  - o Analyzing mutational profiles of lung cancer patients to be replicated in fruit flies to identify optimal treatments for each lung cancer mutational profile;
  - o Developing Machine Learning Algorithms to Stage Cancer;
  - o Using Natural Language Processing to characterize the clinical course of breast cancer patients to support a Learning Health System;
  - o Analyzing the prevalence, treatment, and outcomes of Hereditary Angioedema with specific biomarkers;
  - o Analyzing the Effectiveness and Safety of treatments in Adult Patients with Short Bowel Syndrome based on Real World Evidence;
  - o Analyzing the Relationship Between Therapeutic Drug Monitoring, Biomarkers and Clinical Outcomes in the Real-World Setting captured through Patient Support Programs;
  - o Analyzing changes in Standard of Care for patients with Major Depressive Disorder during the COVID-19 Pandemic; and
  - o A National Quality Improvement Initiative to identify and optimize Heart failure patients treated in the community.

Such unique and diverse experience used to develop an AI engine gives Pentavere's AI a differentiated

competitive advantage. This is supported by a literature review of over 9,700 papers and publications.

"I have spent over 2 decades leading national and international research initiatives to identify the right treatments, for the right patients, at the right time. The data required to address these efforts have always been limited. Working with Pentavere we have generated Real World Data at an incredible scale, speed, and accuracy, providing me with data I need to improve patient care. We are just scratching the surface in what is possible with Pentavere's AI technology" -Dr. Geoffrey Liu, Medical Oncologist & Senior Scientist, Princess Margaret Cancer Centre

"Everyone talks about AI and is intrigued by AI but what I've seen from Pentavere is how we can actually apply AI. This technology and Pentavere's implementation strategy breaks down information barriers and unlocks valuable data revealing opportunities for improvement in patient care" -Dr. Shelley Zieroth, Director, Heart Failure and Transplant Clinics, St. Bonafice Hospital

"In a world drowning in data but thirsting for knowledge, Pentavere has cast a light on ways to alleviate this challenge. Companies like Pentavere will bring healthcare into the 21st century"-Dr. Nigel Hughes, Scientific Director, Observational Health Data Analytics/Epidemiology at Janssen. Head of European Health & Evidence Network

Pentavere has achieved incredible accomplishments to date, as a result of building best in class AI system to solve one of healthcare's greatest challenges:

- Completed 24 real world AI clinical studies
  - o Satisfied highest level of clinician review across multiple therapeutic areas-Oncology, Cardiology Immunology, gastroenterology, Family medicine, mental health
  - o Majority of these studies accomplished during the COVID pandemic when most non critical initiatives were shutdown
- Over 15 publications in high impact peer reviewed journals validating our AI NLP in real world settings with real world data covering millions of patients
- Partnerships with 6 of the top 10 largest global life science companies (5 MSA's in place)
- Support from the Canadian government and deployed in multiple hospitals, and provincial authorities across Canada.
  - o This demonstrates Pentavere's AI satisfies the highest level of security, privacy, governance, and ethics
- Preferred AI engine trusted to support public private healthcare initiatives in Canada. Examples of active breakthrough AI programs:
  - o A breast cancer learning health system ingesting data from 11 hospitals supporting a catchment area of 2.5 million people (<https://ascopubs.org/doi/10.1200/CCI.22.00182>)
  - o A pan Canadian heart failure quality improvement initiative in partnership with the Canadian Heart Failure Society and Novartis that has identified thousands of Canadians not receiving foundational care (<https://www.hfidoc.ca/>)
- 2022 Prix Galien nominee for Best digital health startup
- Already identified thousands of patients who have fallen through the cracks whose care has improved
- Providers are requesting and consenting that Pentavere's AI mine the EMR data to identify eligible patients, and provide them with a list of eligible patients at their practice to review so that they can optimize care

**Why this solution/product is innovative, the broad implications for future research, and/or how it will improve the human condition**

Preventable events and errors are a leading cause of death and harm to patients every year.

25% of all deaths each year are preventable and due to conditions that are treatable with changes in lifestyle, behaviours or access to proper healthcare.

33% of avoidable deaths are from cancers

23% of avoidable deaths are from heart disease

These avoidable incidents occur because patients are being missed in the healthcare system and are falling through the cracks. The ability to identify patients that are eligible for available medical treatments and interventions can revolutionize care and outcomes for patients, and save lives.

Pentavere has built a best in class trusted AI system that solves this specific problem, which can have as great an impact on the human condition as the discovery of the next breakthrough medical cure.

The data required to identify patients does not readily exist in available datasets that are currently industry standard and used to analyze, understand, treat, and optimize patients. The current standard available datasets are limited. Many of them have limited clinical information, and are missing outcomes and results or are aggregated and de-identified and cannot be used to impact individual provider and patient care. On the rare occasion that datasets do contain access to electronic health records that could potentially be used to identify eligible patients, the notes are not licensed and shared, and companies do not have the technology and ability to leverage the critical information required to identify patients because the information is captured in the notes which are high volume, clinically complex, and in a terrible state. As a result EHR data that is used today to understand patients is limited to the structured drop-down fields within the EMR, providing a fractured view of the patient and overlooking patients that may be eligible based on the totality of information captured in the notes.

Pentavere's unparalleled and validated AI solves this problem and identifies eligible patients by ingesting and analyzing the totality of the EMR data, including the notes. As a result, Pentavere's AI produces a list of eligible patients from the EMR data that goes back to the provider and/or health system so that providers can review and analyze their patients based on the totality of that patient's information. This is information that providers have never before been able to easily access, organize, review and leverage, in order to care for, assess and optimize the treatment of their patients.

"[Pentavere's technology] gave us goals to work towards: to improve our practice and bring better care to heart failure patients." - Dr. Amelia Yip, HF-iDOC Participant, MD

Pentavere is the AI engine behind a breakthrough pan-Canadian heart failure improvement initiative in partnership with the Canadian Heart Failure Society to identify heart failure patients that are not receiving foundational therapies and being treated according to standard of care. Pentavere's AI has already identified thousands of patients that have fallen through the cracks and were not being treated according to standard of care and medical guidelines. At just 22 clinics, 64% of patient identified with confirmed Heart Failure with Reduced Ejection Fraction were not being treated according to standard of care. As a direct result of Pentavere's AI identifying these patients and giving providers the list of eligible patients at their practice that were not being treated according to standard of care, 30% of patients have now successfully been optimized on standard of care, improving outcomes and quality of life for patients.

By mining the totality of EMR data available to identify patients across therapeutic areas that are

eligible for available treatments and interventions, Pentavere can ensure that all patients are assessed to receive the best treatment and care, so that no patient is left behind.

**Please provide appropriate references (ie Pubmed links)**

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