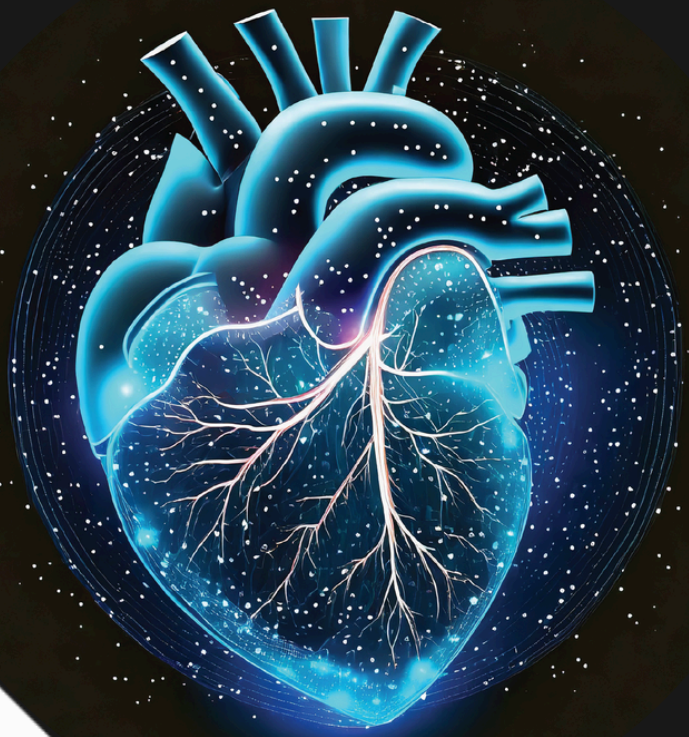

IMPROVING CARDIOVASCULAR OUTCOMES AND ECONOMIC EFFICIENCY THROUGH PREDICTIVE & INTERVENTIONAL ARTIFICIAL INTELLIGENCE:
A CASE FOR DELOREAN AI'S CARDIO AI SOLUTION

deloreanai.com

2025

DELOREAN AI

Table of Contents

Executive Summary

Cardiovascular disease (CVD) remains the leading driver of healthcare costs and mortality in the United States.[1] DeLorean AI's predictive analytics platform offers insurers, cardiologists, and primary care physicians a validated method to improve outcomes and reduce costs by identifying high-risk patients before costly cardiac events occur. This white paper integrates proprietary claims and medical data with peer-reviewed literature to support the clinical and financial case for adoption.

DeLorean AI analyzed over 12 million members with a diagnosis of one or more of the following disease conditions: hypertension (I-10), hypertensive heart disease (I-11), hypertensive chronic kidney disease (I-12), hypertensive chronic kidney disease and heart failure (I-13), secondary hypertension (I-15), chronic ischemic heart disease (I-25), other acute ischemic heart disease (I-24), hyperlipidemia (E-79), and disease events: Heart failure (I-50), cardiac arrest (I-46), acute myocardial infarction (I-21), hemorrhagic stroke (I-61), hypertensive crisis (I-16), ischemic stroke (I-63), current complication following MI (I-23), and subsequent myocardial infarction (I-22), and angina pectoris. (I-20).

Based on the latest published prevalence between 2017-2020, cardiovascular diseases and events afflict 127.9 million U.S. adults or 48.6% of the US adult population[2] and account for 941,652 deaths, accounting for 1 in every 3 deaths in the U.S.[3] The burden of cardiovascular diseases and events not only takes a toll on the individual and his/her family but also on the entire healthcare ecosystem and society.During 2020-2022, the combined direct and indirect cost of cardiovascular diseases in the U.S. was $417.9 billion annually, with direct medical costsof $233.3 billion and indirect costs (lost productivity due to morbidity and mortality) of $184.6 billion. The cost of coronary heart disease alone accounted for $129.3 billion annually during the same period.[4] Heart disease specific expenditures (2022) for adults aged 18 and older treated for heart disease reached $100.0 billion, with an average of $4,900 per treated adult.Hospital inpatient care accounts for 46.1% of the total cost, prescription medications account for 20.5% of the total cost, with Medicare paying 57.6% and private insurance paying 24.2% of the overall cost.[4]

If we look specifically at heart failure (I50), it generally incurs the highest per individual cost per year. Based on the latest published data, heart failure (HF) was a contributing cause in 425,147deaths, accounting for 45% of cardiovascular deaths in the U.S. in 2022.[5] Approximately 6.7 million Americans over 20 years old have HF, and the prevalence is expected to rise to 8.7 million by 2030,10.3 million by 2040, and 11.4 million by 2050.[9] The lifetime risk of HF is increasing with approximately 1 in 4 will be diagnosed with HF in their lifetime.[5] The risk of developing HF is increased in individuals with obesity, diabetes mellitus (DM), hypertension, and chronic kidney disease (CKD). There were 1.2 million primary HF hospitalizations among 949,075 unique patients in 2021.[5] Heart failure accounted for an estimated $32 billion in direct medical costs and $14 billion in indirect costs in the U.S. in 2020, with projections that HF costs could reach $142 billion by 2050.[5] However, other analyses suggest total direct costs for HF may be as high as $227 billion in 2020, with projections up to $858 billion by 2050.[5] HF mortality rates and their related costs have been increasing over time revealing an immediate need for improved HF prevention, implementation of guideline-directed therapies, and research.[5] DeLorean AI has a credible solution to address this growing medical and financial challenge.

There are significant deviations in the use of guideline-recommended therapies for HF. Less than 25% of eligible patients with HF are receiving guideline-directed medical therapy. Optimal implementation could save an estimated 1.19 million lives a year globally and billions of dollars in medical expenses.[5] Our solution can seamlessly integrate with any EHR systems, identifying discordance with current treatment and internal guidelines and established or emerging evidence-based medical guidelines. Additionally, if prescribed care is not compliant with evidence-based recommended care, the solution will flag the patient and recommend steps for the patient to become compliant with guidelines. These next best actions (NBAs) offer decision support to assist the provider with patient-specific recommendations to consider based on the patient's profile, EHR structured and unstructured information, and current evidence-based medical literature. Through continuous identification and patient-specific suggested actions, patient health care quality of care can be improved. This ultimately results in providers and payers realizing a substantial return on their investment.

Challenges

Based on the 12 million members analyzed with a diagnosis of one or more of the following cardiovascular conditions: hypertension (I-10), hypertensive heart disease (I-11), hypertensive chronic kidney disease (I-12), hypertensive chronic kidney disease and heart disease (I-13), chronic ischemic heart disease (1-25) and heart failure (I-50), it becomes clear that heart disease does not follow a single linear pathophysiological progression complicating timely identification and treatment of those who are most at risk of progression and adverse outcomes. It is also important to note that the vast majority of patients will generally start their cardiac condition journey with hypertension, but will present to the clinician in different stages of progression along their individual continuum, with very different outcomes based on interventions or the lack thereof.

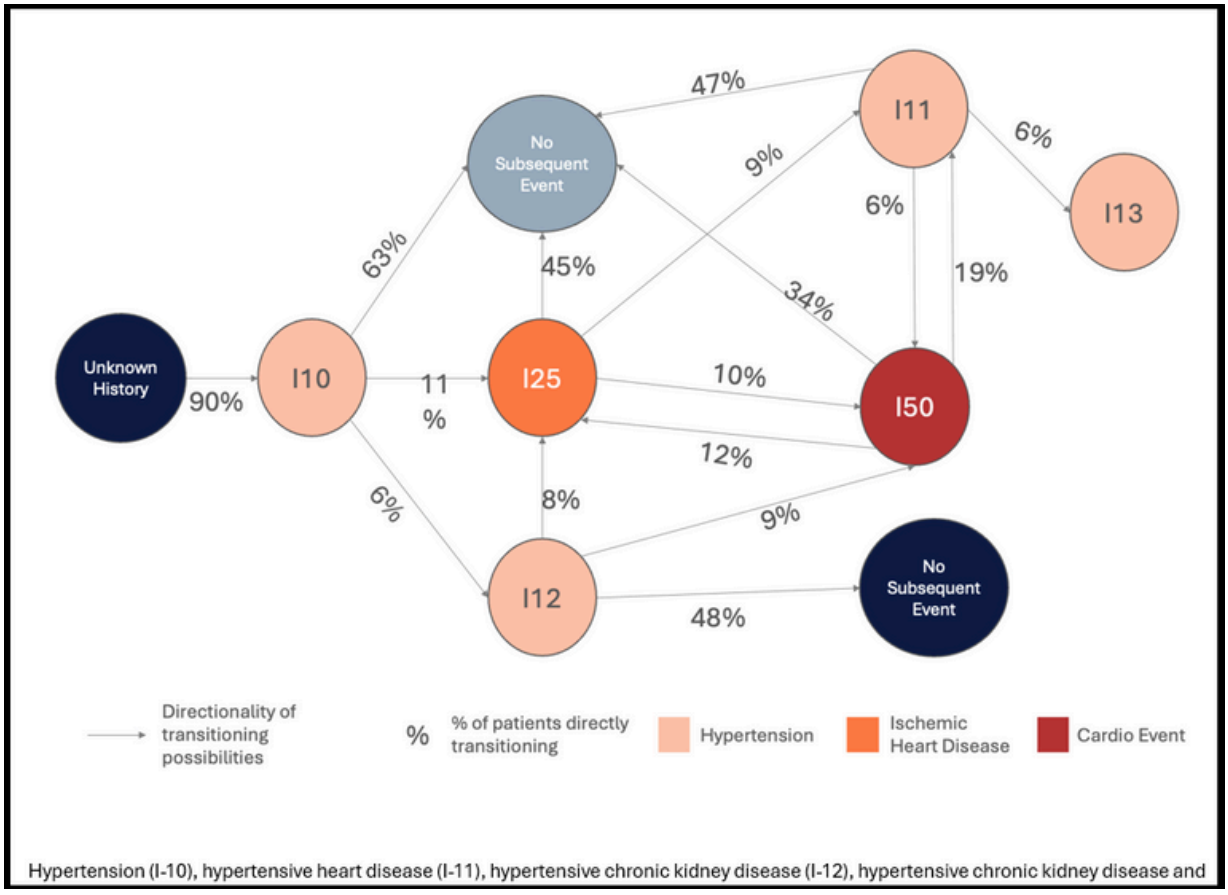

Figure 1. Cardiac Disease Mapping: *The diagram demonstrates the directionality of transitioning possibilities at various points of the pathophysiologic progression of cardiac disease.*

DeLorean AI's predictive modeling and risk stratification have an average sensitivity of 87% for all cardiac diagnoses analyzed, which is similar to or superior to those validated in peer-reviewed studies using similar machine learning approaches. Efficient Data-Driven Machine Learning Models for Cardiovascular Diseases Risk Prediction by Dritsas and Trigka reports a machine learning stacking ensemble model for cardiovascular disease risk prediction that achieved an average sensitivity (recall) of 88.3% across cardiac diagnoses analyzed, with a corresponding accuracy (measures the overall correctness of the model's predictions, including both positive and negative predictions) of 87.8%, recall (measures the proportion of actual positives that are correctly identified by the model also known as the true positive rate (TPR)) of 88.3%, precision (measures how close repeated measurements are to each other) of 88% and AUC of 98.2% using a data set of 6311 subjects,.[6] This study utilized multiple machine learning algorithms with performance metrics specifically reported for sensitivity. Other studies in the medical literature, including large meta-analyses and systematic reviews, report high discriminatory performance (AUCs near or above 0.88) for machine learning-based cardiac risk prediction models, but do not consistently report average sensitivity values at or above 88% for all cardiac diagnoses analyzed[7,8,9]

In comparison to the Dritsas and Trigka study that considered 6311 subjects, DeLorean AI analyzed over 12 million members and appears to be one of the largest cohorts focusing on hypertension (I-10), n= 8,836,983 and chronic ischemic heart disease (I-25), n= 1,629,949. DeLorean AI stratified each chronic cardiac condition state into three predictive pathways with calculated predictive probabilities: (1) the condition will progressively deteriorate, (2) the condition will not deteriorate nor improve, and (3) the condition will improve based on the data at that moment in time. These probabilities fluctuate as new data are entered over time, revealing changes due to meaningful interventions or the lack thereof. DeLorean AI's prediction accuracy for hypertension (I-10) was 85%, and for chronic ischemic heart disease (I-25) our prediction was 87% accurate for the directionality of a patient's condition progression. This hyperpersonalized information allows practices to be aware of significant changes in a patient's risk factor in real time and thus prioritize outreach and institute immediate interventions in order to prevent an adverse event.

DeLorean AI also provides an event prediction horizon. For example, we analyzed the probability of being diagnosed and hospitalized with acute heart failure (I-50) within 90 days of running the model for the following cardiac conditions: hypertension (I-10), hypertensive heart disease (I-11), hypertensive chronic kidney disease (I-12), hypertensive chronic kidney disease and heart disease (I-13), chronic ischemic heart disease (1-25), and heart failure (I-50). The accuracy of the predictive probabilities is stratified by disease state in Figure 2. The accuracy for a specific patient tends to improve as more longitudinal data is provided to the model over time, and our event horizon, depending on the condition, can also be decreased.

Disease State	Total Members in Disease State	Total with Heart Failure	Members Correctly Identified Before Heart Failure	% Correctly Identified	Members with Heart Failure Missed
I10[2]	7,972,448	241,016	186,928	78%	54,088
I11	272,466	59,440	56,321	95%	3,119
I12	353,902	23,978	18,418	77%	5,560
I13	101,468	33,564	29,762	89%	3,802
I15	60,854	3,294	2,744	83%	550
I25[3]	2,930,358	367,132	322,808	88%	44,324

Figure 2: Accuracy of predicting a future event. Data from 2021 cardiovascular disease patients was run through Cardio AI to predict patients who would have acute heart failure with hospitalization in the first 90 days of 2022.

Takeaways

1. The Burden of Cardiovascular Disease

Based on the latest published data from the National Health and Nutrition Examination Survey, during August 2021–August 2023, 36.4% of U.S. adults had no cardiovascular disease (CVD) risk factors, 34.9% had one, and 28.7% had two or more, with men having a higher percentage than women of two or more CVD risk factors. Increasing age correlated with increasing risk factors. [10,11] The driving risk factors of CVD are uncontrolled high blood pressure (a systolic blood pressure of 130 mm Hg or more or a diastolic blood pressure of 80 mm Hg or more), uncontrolled high blood lipids (non-high-density lipoprotein cholesterol greater than or equal to 190 mg/dL), uncontrolled high mean blood glucose (hemoglobin A1c greater than or equal to 6.5%), and high BMI (defined as BMI of 30.0 or more, corresponding with the definition of obesity).[10,11] The more CVD risk factors one has, the greater the increased risk of CVD and all-cause mortality. [12,13] DeLorean AI's Cardio AI product mines the EMR in real time and identifies patients at risk for developing these abnormal parameters or who have them, analyzes their co-morbidities, and assigns them a risk score for progression, providing next best action (NBA), allowing the provider to optimize the patient's care with guideline best practices. DeLorean AI's Cardio AI module allows for proactive and timely intervention to prevent further progression of the condition (s) and prevent an acute event.
From our data analysis, hypertension (ICD-10 diagnosis code I-10) and hyperlipidemia (ICD diagnosis code E78) dominate in the cardio population, representing over 50% of patients. Heart failure (I50), while less prevalent, incurs the highest per-member-per-year (PMPY) costs exceeding $350,000 in the year of diagnosis across all claim types. This natural condition progression from hypertension to ischemic heart disease (I25) and ultimately to heart failure is well-documented in the literature and represents a predictable, preventable trajectory.[14,15]

Code	Disease State	Type	Total Patients from 2018-2022	Percent of Population (82M)
I13	Hypertensive CKD & Heart Disease	Condition	1,190,239	1.46%
I50	Heart Failure	Event	3,396,601	4.16%
I46	Cardiac Arrest	Event	346,996	0.43%
I25	Chronic Ischemic Heart Disease	Condition	5,987,476	7.43%
I21	Acute Myocardial Infarction	Event	1,015,733	1.24%
I61	Hemorrhagic Stroke	Event	180,611	0.22%
I12	Hypertensive CKD	Condition	2,576,042	3.16%
I11	Hypertensive Heart Disease	Condition	2,895,910	3.55%
I16	Hypertensive Crisis	Event	671,543	0.82%
I24	Other Acute Ischemic Heart Disease	Condition	374,358	0.46%
I10	Hypertension	Condition	22,719,301	27.83%
I63	Ischemic Stroke	Event	1,496,682	1.83%
E78	Other Acute Ischemic Heart Disease	Condition	23,689,314	29.02%
I23	Hyperlipidemia	Event	21,209	0.03%
I15	Current Complications Following MI	Condition	426,428	0.52%
I22	Subsequent Myocardial Infarction	Event	29,415	0.04%
I20	Angina Pectoris	Event	1,114,164	1.36%

Figure 3: *Most common diagnoses by total patients. Hypertension (ICD-10 diagnosis code I-10) and hyperlipidemia (ICD diagnosis code - E78) are the most common diagnoses in the studied population, representing over 50% of patients.*

2. Predictive Modeling and Risk Stratification

DeLorean AI's Cardio AI product was trained on over 12 million patient records from several regional and national managed care companies to model disease progression and predict cardiac events. The platform identifies patients transitioning from I10 to I50 with a sensitivity or the true positive rate (recall rate) exceeding 87% in DeLorean AI designated high-risk cohorts. These predictive capabilities mirror those validated in peer-reviewed studies using similar machine learning approaches.[16,17,6,7,8,9]

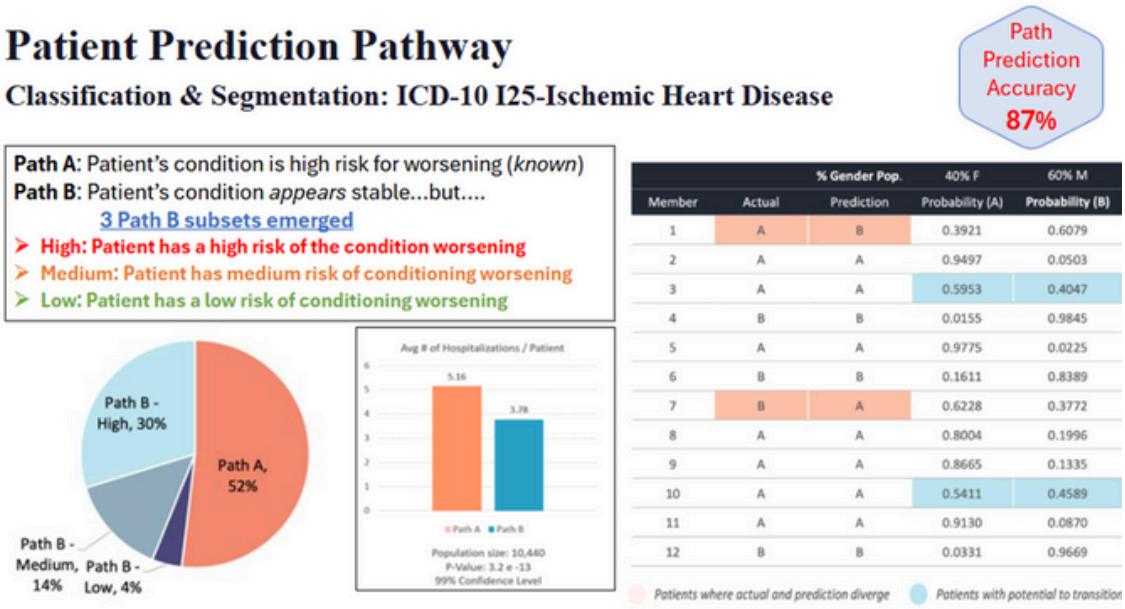

Figure 4: *Identification of transitions to I50 (Heart Failure) for high-risk cohort with 87% accuracy.*

DeLorean AI provides valuable insights to bend the quality-of-care outcome curve and the cost curve. We profile each patient and determine the current active clinical conditions, even those that the provider may not have yet diagnosed as having a clinical condition (identifying unknowns). Then we stratify the members into 3 groups: those who we predict will negatively progress with their health condition(s), those who will neither progress nor improve with their health condition(s), and those who will improve with their health condition(s) based on the data available at the time the model is run. These probabilities fluctuate over time based on interventions or lack thereof. These changes are presented to the providers with each run of the model as new data is entered into the EHR. We next provide a risk prediction for certain events to occur within defined time frames. These identifications, stratifications, and predictions allow for the practice to prioritize its resources on those patients where meaningful cost-effective interventions can be instituted to avert negative, costly health care events. DeLorean AI empowers providers not only with identification and predictive tools, but also with patient-specific hyperpersonalized recommendations (our decision support next best actions (NBAs)), to consider based on the patient's profile, EHR structured and unstructured information, and current evidence-based medical literature. DeLorean AI's Cardio AI Solution always keeps the provider at the center of the decision-making process, providing the information a licensed professional might need to provide evidence-based, high-quality care. The provider always retains the ultimate responsibility to care for the patient and use sound clinical judgment while deciding on care interventions. DeLorean AI serves as a tool to augment the provider's overall analysis of the patient.

3. Clinical Impact and Quality of Care

DeLorean AI enables earlier identification of patients at risk for heart failure and other cardiovascular events, allowing for timely interventions such as:

- Medication optimization (e.g., ACE inhibitors, beta-blockers)
- Lifestyle modification support
- Diagnostic testing
- Specialist referral

These interventions are consistent with the American College of Cardiology and the American Heart Association guidelines and have been shown to reduce hospitalizations and mortality. [18,19]

4. Return on Investment

Health technology return on investment is about more than measurable monetary gains. Technology that health systems and practices invest in should improve patient and provider experiences and improve clinical and financial outcomes. DeLorean AI addresses these pain points and more.

DeLorean AI's predictive modeling should yield substantial cost savings. With over 3 million patients at risk, even modest reductions in event rates can translate to billions of dollars in savings annually. These estimates are consistent with published cost-effectiveness analyses of early intervention strategies. [20,21]

5. EHR Integration, Analytics & Decision Support

DeLorean AI integrates with any EHR systems and supports scalable deployment across diverse care settings. DeLorean AI can seamlessly integrate with any EHR systems, allowing for scalable deployment across diverse care settings. DeLorean AI can run daily updated predictive and stratification analytics as well as identify if patients' prescribed care is compliant with evidence-based medical guidelines, such as those provided by the American College of Cardiology and the American Heart Association, as new data is entered into the EHR. DeLorean AI's solution will identify care deviation, flag those patients on a dashboard, and recommend steps for the patients to become compliant with guidelines. These next best actions (NBAs) offer decision support to assist the provider with patient-specific recommendations to consider based on the patient's profile, EHR structured and unstructured information, and current and emerging evidence-based medical literature. DeLorean AI is built with the provider in the loop.

Conclusion

What you do not know can hurt you. You in this context, are the patient, the provider, the practice, and the healthcare ecosystem. DeLorean AI leverages machine learning, neural networks, and deep learning to improve patient outcomes by providing transparent stratification, predictions, and evidence-based next best actions to actively bend the condition and cost curves.

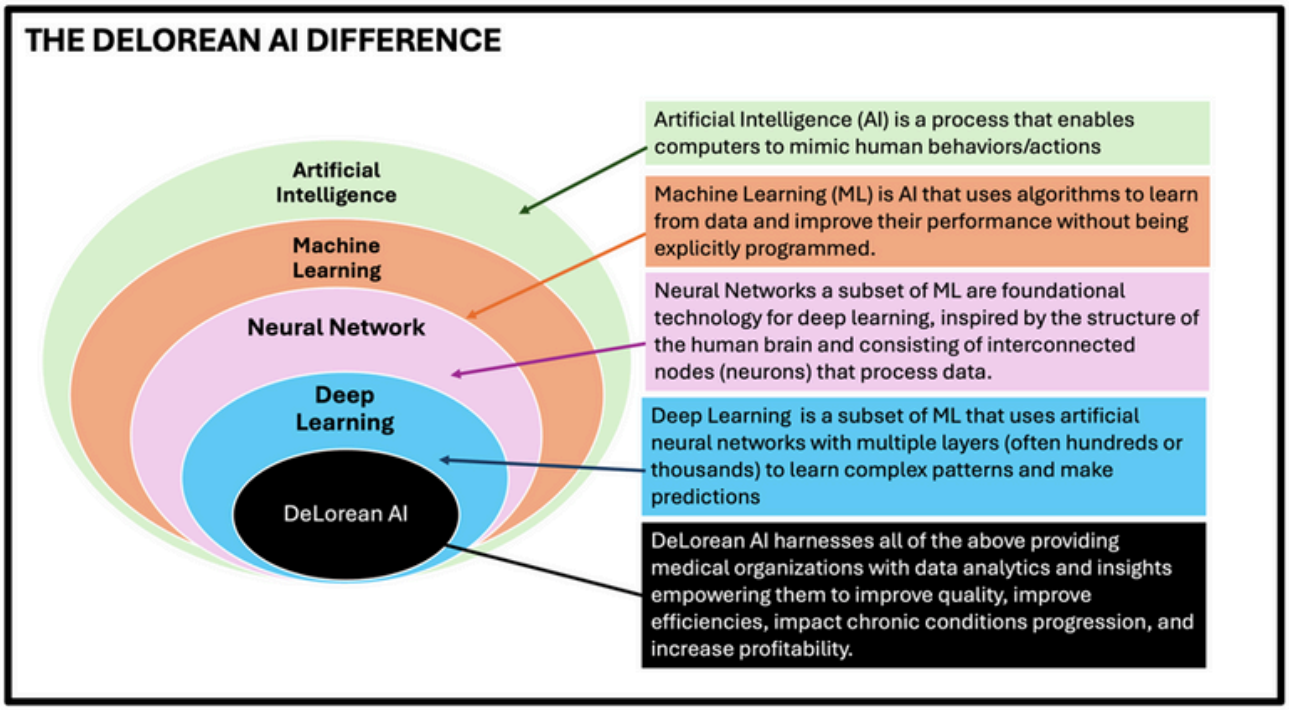

Figure 5: *The DeLorean AI Difference. DeLorean AI uses machine learning, Neural networks and deep learning to achieve superior predictive analytics and decision support.*

References

1. Couch CA, Mascarenhas R, Stierman B, Fryar CD. Prevalence of cardiovascular disease risk factors in adults: United States, August 2021–August 2023. NCHS Data Brief. 2025 Sep;(540):1–9. DOI: https://dx.doi.org/10.15620/cdc/1746231
2. American Heart Association. 2025 Heart Disease and Stroke Statistics Update Fact Sheet. Published 2025. Accessed September 11, 2025. https://www.heart.org/en/-/media/PHD-Files-2/Science-News/2/2025-Heart-and-Stroke-Stat-Update/2025-Statistics-At-A-Glance.pdf
3. Centers for Disease Control and Prevention. Heart Disease Facts. Updated October 24, 2024. Accessed September 11, 2025. https://www.cdc.gov/heart-disease/data-research/facts-stats/index.html
4. Moriya AS, Berdahl T. Healthcare Expenditures for Heart Disease among Adults Aged 18 and Older in the U.S. Civilian Noninstitutionalized Population, 2022. Statistical Brief #562. Medical Expenditure Panel Survey. Published July 2025. Accessed September 11, 2025. https://meps.ahrq.gov/data_files/publications/st562/stat562.shtml
5. HF STATS 2025: Heart Failure Epidemiology and Outcomes Statistics An Updated 2025 Report from the Heart Failure Society of America. Fonarow, Gregg C. et al. Journal of Cardiac Failure, Volume 0, Issue 0 (in press).
6. Dritsas E, Trigka M. Efficient Data-Driven Machine Learning Models for Cardiovascular Diseases Risk Prediction. Sensors (Basel). 2023 Jan 19;23(3):1161. doi: 10.3390/s23031161. PMID: 36772201; PMCID: PMC9921621.
7. Krittanawong C, Virk HUH, Bangalore S, Wang Z, Johnson KW, Pinotti R, Zhang H, Kaplin S, Narasimhan B, Kitai T, Baber U, Halperin JL, Tang WHW. Machine learning prediction in cardiovascular diseases: a meta-analysis. Sci Rep. 2020 Sep 29;10(1):16057. doi: 10.1038/s41598-020-72685-1. PMID: 32994452; PMCID: PMC7525515.

8. Yu MY, Yoo HY, Han GI, Kim EJ, Son YJ. Comparing the Performance of Machine Learning Models and Conventional Risk Scores for Predicting Major Adverse Cardiovascular Cerebrovascular Events After Percutaneous Coronary Intervention in Patients With Acute Myocardial Infarction: Systematic Review and Meta-Analysis. J Med Internet Res. 2025 Jul 18;27:e76215. doi: 10.2196/76215. PMID: 40680235; PMCID: PMC12295455.
9. Kalmady SV, Salimi A, Sun W, Sepehrvand N, Nademi Y, Bainey K, Ezekowitz J, Hindle A, McAlister F, Greiner R, Sandhu R, Kaul P. Development and validation of machine learning algorithms based on electrocardiograms for cardiovascular diagnoses at the population level. NPJ Digit Med. 2024 May 18;7(1):133. doi: 10.1038/s41746-024-01130-8. PMID: 38762623; PMCID: PMC11102430.
10. Ahmad FB, Cisewski JA, Xu JQ, Anderson RN. Provisional mortality data—United States, 2022. MMWR Morb Mortal Wkly Rep. 2023 May 5;72(18):488–92.
11. Curtin SC, Tejada-Vera B, Bastian BA. Deaths: Leading causes for 2022. Natl Vital Stat Rep. 2024 Dec;73(10):1–117. DOI: https://dx.doi.org/10.15620/cdc/164020.
12. Lloyd-Jones DM, Ning H, Labarthe D, Brewer LP, Sharma G, Rosamond W, et al. Status of cardiovascular health in US adults and children using the American Heart Association's new "life's essential 8" metrics: Prevalence estimates from the National Health and Nutrition Examination Survey (NHANES), 2013 through 2018. Circulation. 2022 Sep 13;146(11):822–35.
13. Arnett DK, Blumenthal RS, Albert MA, Buroker AB, Goldberger ZD, Hahn EJ, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2019 Sep 10;140(11):e596–e646.

14. Benjamin EJ, et al. Heart Disease and Stroke Statistics—2023 Update: A Report from the American Heart Association. Circulation. 2023;147:e93–e621.
15. Virani SS, et al. Heart Failure: Epidemiology and Prevention. J Am Coll Cardiol. 2020;76(20):2348–2362.
16. Kwon JM, et al. Deep Learning-Based Algorithm for Detecting Atrial Fibrillation Using Electrocardiography. JAMA Cardiol. 2020;5(9):948–956.
17. Rajkomar A, et al. Scalable and accurate deep learning with electronic health records. NPJ Digit Med. 2018;1:18.
18. Yancy CW, et al. 2017 ACC/AHA/HFSA Heart Failure Guidelines. J Am Coll Cardiol. 2017;70(6):776–803.
19. Heidenreich PA, et al. Forecasting the Impact of Heart Failure in the United States. Circ Heart Fail. 2013;6(3):606–619.
20. Bress AP, et al. Cost-Effectiveness of Intensive vs Standard Blood Pressure Control. JAMA Cardiol. 2017;2(8):890–898.
21. Pandya A, et al. Cost-effectiveness of guideline-directed medical therapy for heart failure. Ann Intern Med. 2021;174(5):658–667.