BSG2021 NRC001

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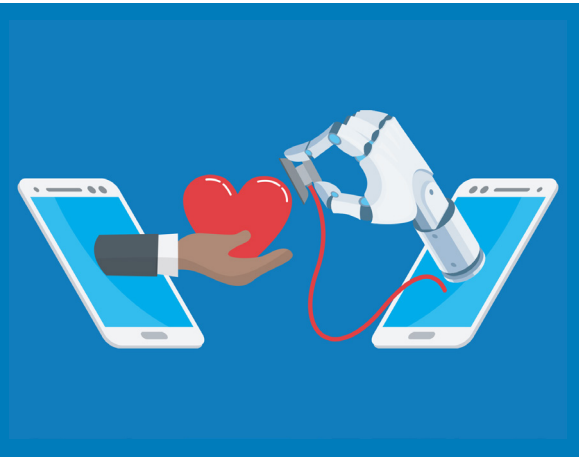
Case Study

Healthcare

Using **machine learning** to **triage patients** into risk categories

BSG helped a national renal care provider support their annual funder negotiations by generating a **novel reimbursement model** and a **machine learning algorithm** that **triaged patients into high-level risk categories**.



Overview of the client's needs

- Having lost market share to smaller providers, perceived to be cheaper, the Provider needed to justify its higher prices by demonstrating superior care
- Differentiate the provider by enabling prediction of the level and type of care a new patient would need, based on historical demographic and clinical data of similar patients

Objectives of the engagement

- Create a real-time dashboard, using hospital admission data, to track the frequency and duration of hospital admissions for the Provider's patient vs. patients treated by other providers to quantify costs
- Generate a scorecard to track and aggregate key performance indicators (KPIs) along the full patient journey
- Develop a machine learning model to predict the level, duration and cost of care for new patients

Benefits of the change

- Successfully demonstrated that, although more expensive in the short-term, the Provider's care cost less in the long-term and resulted in fewer emergency admissions for acute renal failure
- Enabled the Provider to quickly determine areas not meeting quality of care benchmarks and remediate
- Manage patient and Medial Aid Scheme expectations around cost and frequency and duration of dialysis sessions, and provided significant cost-savings through a tailored patient experience

BSG used data to **prove the Provider's superior care** and enable **successful funder reimbursement negotiations**

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Engagement Overview

A leading dialysis provider, operating in a number of major healthcare facilities across South Africa was losing renal care sector market share to smaller providers. Medial Aid Schemes were recommending these smaller providers based on a cheaper cost per dialysis session. The Provider believed the smaller providers were not providing the same level of care, resulting in longer term problems and more emergency hospital admissions for acute issues, ultimately leading to higher cost of care for the patients in the long run.

Believing they could use data analysis and machine learning to prove they offered superior care and to predict the level and type of care new patients would need, the Provider engaged BSG's data and analytics community for help. Given BSG's understanding of the healthcare industry and hospital data, the team was tasked with integrating data from the Provider with hospital data to create the model.

Solution

The data-led solution was driven by two major deliverables:

1. A management scorecard to demonstrate the superior quality of the Provider's care, ultimate cost of care, and KPIs along the patient journey to be used as part of a funder reimbursement model
2. A model to categorise patients into risk categories, which could be used to predict cost and duration of dialysis treatment

1. A management scorecard:

The Provider required a data-driven dashboard to demonstrate that their superior care resulted in reduced cost of care over the long-term, due in part to fewer emergency hospital admissions for acute renal failure.

The real-time dashboard, used to engage with funders as part of a reimbursement model, utilised hospital admission data to track the frequency and duration of hospital admissions for the Provider's patients and was compared to the same data for patients whose care was managed by other providers.

With this view successfully created, the Provider requested a full scorecard that tracked and aggregated KPIs along the full patient journey. Eighteen KPIs across the patient journey – from admissions, initial stages, hospital indicators and compliance, to dialysis and patient outcomes – were measured on daily. The KPIs where distilled to three major indicators:

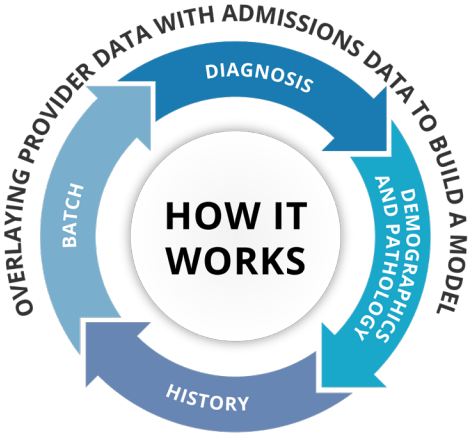
- patient journey
- patient management
- quality of care

These were then used to determine areas along the patient journey not meeting quality standards.

2. Machine Learning model:

A machine learning (ML) model was generated, incorporating the scorecard with the demographic, clinical, and physical and mental assessment data points to categories patients into risk categories. These categories enabled the Provider to manage the Medical Aid Schemes' and patient expectations regarding expected total cost of care, and duration of dialysis treatment. It further enabled the Provider to more effectively manage the clinical team with respect to the level of care expected for the patient.

How it works:



By overlaying the Provider's patient data with admissions data from the hospital, the model was able to filter data using a three-tiered approach:

1. Filtering by diagnosis: By first filtering patients and cases by diagnosis, using the ICD (International Classification of Diseases) codes, the size of the data source is reduced, providing focus to your ML model (i.e., what diagnosis are you solving for?)
2. Combine demographics and pathology: Patient demographics can have an influence on the model's function – some illnesses are more common in men than women, or across racial or geographic lines. By using demographic information, linked to pathology, you are able to further enrich the model
3. With history: This brings in other factors – such as financial records, medical aid claims and medical history.
4. Batch similar patients together: Based on the above filters and data combinations, the model batches similar patients together using an unsupervised machine learning algorithm, effectively creating patient personas for the diagnosis you are solving for.

Time was then spent evaluating the high-level persona(s) with specialist physicians, based on their experience and understanding of the diagnosis. This allowed the incorporation of things like risk rate, mortality and survival rates, comorbidity correlations, common CPT (current procedural terminology) codes, etc.

Labelled data was then used to train a supervised machine learning model to recognise and categorise new patients. Each new patient analysed by the model was assigned a probability of accuracy score, based on how closely they matched the patient persona. This probability score could then be used to predict various factors, such as the accuracy of the risk, mortality likelihood, and comorbidities.

The model was able to triage patients with 92% accuracy.

BSG making a difference

BSG successfully in delivered the project in three months with a team of four people. The triage model and scorecard were used as part of successful annual funder negotiations, and demonstrated the Provider's superior care and lower long-term cost of care, resulting in improved funder relations and more patient-centric care.

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