How Artificial Intelligence Increases Engagement in a Surgery Decision Program – A Case Study

Earlier Identification of Potential Surgery Candidates Results in Higher Engagement, Lower Costs

Executive Summary

Most people, at some time in their lives, will have a medical problem that requires them to navigate the complexities of the U.S. healthcare system. According to Accenture, low healthcare system literacy creates an estimated $4.8 billion annual administrative cost burden for payers.[1] These costs are the result of few patients being equipped to navigate this journey, even with the advice of a physician.

Many healthcare conditions are complex and difficult to manage. The challenge is greatest for those conditions for which there is no clear path of treatment. In the absence of specific clinical guidelines, patients and their care team must make healthcare decisions that can be costly, can lead to further complications, and may even result in medical errors. In fact, some experts state that unnecessary medical tests and treatments cost an estimated $200 billion annually[2] and that some overly aggressive treatments result in medical mistakes that cause an estimated 250,000 deaths each year.[3]

Health plans and employers are simply not equipped to provide the range of medical guidance needed for this broad range of situations. Participants with complex conditions often need coordinated service: a team of multi-disciplinary experts and clinicians who work with the patient and their local healthcare team to consider all options and map out the optimal course of care. These professional advocates have access to the latest clinical research on the patient's diagnosis and recommended treatment options, clinical trials, and the nation's best specialists and hospitals for that condition. With this information, patients are armed with the facts they need to make the best decisions.

These programs do exist at some large employer groups; however, despite the clear benefits, getting engagement in these programs is challenging. For example, an individual may have a certain medical test or be starting a treatment for a condition like cancer, but by the time claims data is available showing this information, often the decisions are already made, and the care plan activated without the guidance of critical expert information. Either the patient doesn't find out about or contact the service, or the outreach is too late, and by then key medical decisions are already in motion, too late for clinical intervention when it could matter most.

What if it were possible to identify people BEFORE they were at the point of considering surgery and other major healthcare interventions, and to engage them in the decision process BEFORE they reach a crisis state? Would outcomes be better? Would risks be avoided? Would costs be less? These are the questions asked, and answered, by ConsumerMedical.

ConsumerMedical is an employee benefit service that helps people make informed medical choices, through clinical advocacy, decision support, and expert second opinions. ConsumerMedical bridges critical information gaps, providing high-touch services for employees and members along with guaranteed savings for payers. Using its 5 Drivers of Quality Care℠ for the right diagnosis, doctor, hospital, clinical information, and coping support, ConsumerMedical's Medical Allies ensure that patients are empowered to make the best decisions for their situation. Combining sophisticated data science with compassionate, personalized education, ConsumerMedical delivers an average 4:1 return on investment and satisfaction ratings of 99%.

This paper details engagement results of ConsumerMedical's Surgery Decision Support® program using an artificial intelligence-based predictive modeling technique with a multi-modal outreach strategy that can identify and reach patients who are likely to be considering surgery or heading down that path.

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The new AI-powered model focuses on five elective surgeries undertaken by patients making a decision on what they think is the best choice for them: hip and knee replacement, hysterectomy, bariatric (weight loss) surgery, and low back surgery.

The results demonstrated that the hypothesis was correct: for the five surgeries listed above, **identifying people earlier in the process of considering their treatment options succeeded in doubling the average program engagement rate and in generating significant cost savings while achieving and maintaining high satisfaction rates**. In fact, a Honeywell study found that 37% of members chose to avoid surgery after going through the ConsumerMedical program. For another employer, ConsumerMedical observed that 27% of the Surgery Decision Support candidates who participated in the program avoided surgery for a savings of $2.3 million and a total ROI of 4.4:1. ConsumerMedical's industry leadership in developing and activating this AI-powered model is a major step forward in harnessing the power of predictive analytics to improve healthcare decision-making and to reduce unnecessary costs and risks.

Facing Healthcare Decisions When the Guidelines Aren't Clear

For many years, Justin struggled to maintain a healthy weight. On several occasions, he'd lose weight only to gain it back. Exercise was no longer an option as it was often painful and difficult due to a previous injury. His primary care physician diagnosed Justin as obese and recommended that he undergo bariatric surgery. The prospect of this drastic measure left Justin anxious and concerned about his health, the risks of surgery, and the anticipated out-of-pocket costs.

An estimated 228,000 bariatric procedures were performed in the U.S. in 2017 at an average cost of $23,000.[4] Surgical risks range from developing gall stones, to malnutrition, to a variety of gastrointestinal problems — and a failure rate, according to reports at the Obesity Society 2017 meeting, ranging from 25% to 70%. Often patients don't understand the implications of gastric bypass and other weight-loss surgeries or the permanent changes to their diet and lifestyle that are necessary to ensure long-term success.

Justin knew that being obese posed other health risks, including Type 2 diabetes, heart disease, and high blood pressure. He needed to lose weight and make a decision on how to proceed. However, deciding on what course of treatment to follow is especially complicated when there is no "best-practice" recommended therapy. These conditions are known as "preference-sensitive," meaning that the preference of the patient is usually the deciding factor.

Examples of these preference-sensitive conditions and the number of procedures that are performed each year include hip and knee replacements with 1,000,000 performed annually,[5] hysterectomies with approximately 600,000 being performed annually,[6] bariatric surgery with 228,000 performed each year, and low back surgery with approximately 500,000 performed annually[7].

The figures mean that more than 2.3 million people each year undergo these five surgeries for which patient choice, not clear clinical recommendations, are the deciding factor. After hearing about the risks of the surgery, weighing the pros and cons, and maybe (or maybe not) hearing about some alternatives, the patient makes a decision. Because there are no definitive guidelines regarding the optimal path to clinical decision-making, people with such conditions often make these choices based on the recommendations of the medical professional managing them.

In these situations, surgery candidates can benefit from objective, in-depth counseling and information provided by clinical experts like ConsumerMedical. ConsumerMedical educates participants about their options, criteria for choosing a healthcare provider for their condition, and evaluating quality and research data, so these individuals can select the highest-value treatment that is right for them. As noted earlier, timing is very important in gaining patient engagement. In Justin's case, he is thinking about surgery but has not made a decision. This is the point at which outreach needs to occur. But how is it possible to find out when surgery is under consideration, or when a person might have symptoms or health problems that could precipitate a consideration of surgery?

ConsumerMedical's predictive analytics experts stepped in to solve the problem. By creating a powerful predictive analytics engine for early identification of Surgery Decision Support program candidates, ConsumerMedical developed the ability to spot these "symptoms" for immediate outreach. The hypothesis that earlier intervention would increase engagement and improve outcomes, turned out to be true.

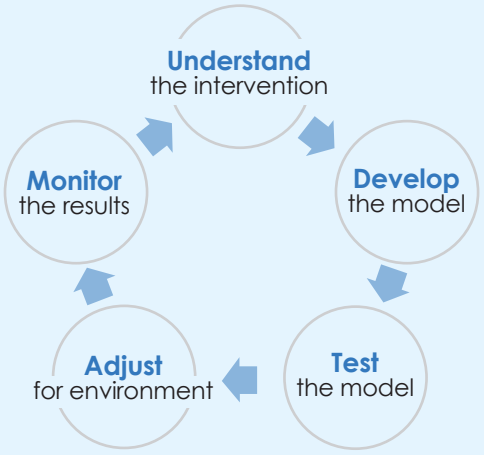
In 2018, employers that had predictive outreach in place for this program saw an engagement rate (number of people enrolling relative to number of actual eligible surgeries) that was more than twice as high as employers that did not have predictive outreach in place — 31.3% versus 14.3%. Additionally, claims savings for these individuals was more than double the savings from employees who were not identified so quickly — $7.33 per employee per month, versus $3.05 per employee per month.

The Science Behind AI-powered Predictive Analytics for Proactive Outreach

As a result of the big data revolution that has been sweeping across industries in recent years, artificial intelligence and machine learning are taking hold in many sectors, including healthcare. Predictive modeling in one form or another has been used for at least two decades for the purpose of targeted outreach and engagement for various types of businesses. Models have significantly improved over the years as a result of improved data collection and the introduction of machine learning. In addition to selecting a valid model, operational efficiency and implementation success should be supported by five factors:

- Accurate definition around problems to be solved.
- Understanding of the data and the models being used.
- Understanding of the economics involved.
- Setting appropriate key performance indicators.
- Timely implementation in workflow.

The success of ConsumerMedical's Surgery Decision Support (SDS) Predictive Outreach model is the result of implementing predictive modeling for the five elective surgeries within a broader engagement strategy, targeting members who can best benefit from the particular intervention economically and in a timely fashion.



The following areas were addressed in the development of the predictive model.

- Understand the intervention and its economics.
- Develop a model specifically for the intervention keeping in mind the following key components:
    - Necessary balance between model accuracy and operational efficiency.
    - Operational framework.
    - Member experience.
    - Overall costs and benefits.
- Validate the model using core machine learning and statistical outcome methods to avoid overfitting the model.
- Consider the operating environment and process and develop it further where necessary.
- Monitor the results against reasonably-defined key performance indicators and iteratively improve the process.

Step 1: Understand the Intervention and Its Economics

The purpose of the Surgery Decision Support Predictive Outreach model is to identify those members at risk of surgery before the member has the surgery. There is usually a small window of opportunity between the surgery recommendation and actual surgery in which to intervene with the participant via the Surgery Decision Support program. The difference between the SDS Predictive Outreach model and a traditional identification model for a condition like cancer or diabetes or high cost claimants is that the SDS Predictive Outreach model predicts a future event with the goal of avoiding that event through intervention. In contrast, a standard disease management model simply identifies a population with a particular diagnosis or prior expenditures. While it can be reasonably certain that everyone identified via such a traditional outreach model has the condition of interest and is thus a true candidate for a particular program, the Surgery Decision Support Predictive Outreach model identifies those at risk of surgery, who may or may not yet have a physician recommendation for surgery.

Step 2: Develop a Model Specifically for the Intervention

ConsumerMedical partners with Santa Barbara Actuaries, a data science and actuarial firm that specializes in healthcare financial outcomes evaluation, predictive modeling, and risk assessment to develop predictive models and enhance its existing engagement in its programs.

Step 3: Test the Model

The first generation Surgery Decision Support Predictive Outreach model could predict about 50% of surgeries before they occurred by reaching out to approximately 1% of the highest risk members in each surgery category. Combining these findings with other key assumptions around outreach success led to the projection that employing predictive outreach should bring an increase to overall Surgery Decision Support enrollment of about 25%. This estimate was contingent on several operational variables that are independent of the model such as outreach success, reaction of members, and the current state of engagement in the program without predictive outreach in place. A/B testing results in 2018 actually show a much greater impact to overall engagement rates [see Table 1 below].

Step 4: Consider the Operating Environment and Process and Develop it Further Where Necessary

Successful operational execution is just as important, if not more so, than model development. Often targeted outreach and predictive modeling applications fail in practice because they do not execute appropriately. One failure in the multi-faceted operational framework will result in overall program failure. This cannot be emphasized enough for aspiring predictive outreach programs.

Step 5: Monitor the Results Against Reasonably-defined Key Performance Indicators and Iteratively Improve the Process

Prior to implementing the SDS Predictive Outreach model, key performance indicators (KPIs) were established to monitor performance of the program. The objectives of this particular predictive outreach program are to 1) increase engagement in the SDS program, 2) identify surgeries before they occur, and 3) to reduce claims cost more than the cost of the additional resources deployed to run the program (in other words, to generate a positive, marginal ROI).

Results are continuously reviewed against KPIs and a concentrated effort is underway to optimize the operational environment for the Surgery Decision Support Predictive Outreach program. In addition, a second-generation AI model was released in early 2019 that should significantly improve the model's ability to predict surgeries.

Results

Companies that implemented this model for the five Surgery Decision Support elective surgeries saw an engagement rate and cost savings more than double the rate experienced by companies not using this model.

Aggregate 2018 results comparing engagement for employers using the SDS Predictive Outreach model with a control group that did not have predictive outreach in place are presented in Table 1 below:

Metric	Employers without SDS Predictive Outreach but with an Incentive Model in Place	Employers with SDS Predictive Outreach and Incentive Model in Place
Number of Employers	37	7
Expected SDS Eligible Surgeries Based on Historic Surgery Rates	11,322	1,617
Number of Enrolled Members	1,618	506
Expected Engagement Rate	14.3%	**31.3%**
Expected Average Direct Claims Savings PEPM for the five elective surgeries	$3.05	**$7.33**

Conclusion

Targeted outreach models that leverage machine learning techniques and AI can benefit disease and demand management programs by increasing enrollment and optimizing outreach efforts and resources. As outlined in this case study, ConsumerMedical has seen tremendous success with AI-powered predictive analytics in its Surgery Decision Support Predictive Outreach program.

Appendix

Table 2 below demonstrates that ConsumerMedical's second-generation Surgery Decision Support AI-powered predictive analytics model is expected to perform better compared to the first-generation model as additional machine learning techniques and data improve the predictive power of the model.

Positive Predictive Value and Sensitivity are the key modeling metrics around accuracy and value.

Sensitivity = percent of future surgeries that are identified by the model (i.e., the number of actual future surgeries in the next 12 months correctly identified by the model divided by the total number of actual surgeries in the entire population in the next 12 months)

Positive Predictive Value = of those identified by the model, the percent that will have surgery in the next 12 months.

Surgery Category	Test Statistic	2nd Generation AI Model (started in 2019)	1st Generation AI Model (used in 2018)
Hip Surgery	Positive Predictive Value	45.4%	16.0%
	Sensitivity	80.5%	69.4%
Knee Surgery	Positive Predictive Value	42.9%	29.7%
	Sensitivity	76.0%	69.9%
Low Back Surgery	Positive Predictive Value	27.9%	13.1%
	Sensitivity	76.7%	69.1%
Bariatric Surgery	Positive Predictive Value	49.6%	9.4%
	Sensitivity	90.0%	92.3%
Hysterectomy	Positive Predictive Value	42.7%	7.4%
	Sensitivity	72.5%	62.2%

Notes:

- Specificity is above 99% for all models and the Area Under the Curve Statistics are also very significant.
- There is a natural trade-off between Sensitivity and Positive Predictive Value. Operationally, various levels of risk floors and outreach methods are defined in accordance to the member risk score produced by the model.

So what about Justin? He contacted ConsumerMedical to learn more about bariatric surgery and get an expert opinion to confirm if surgery was his best option. The ConsumerMedical team provided comprehensive information about Justin's diagnosis and the risks and benefits of surgery and nonsurgical treatment options. The Medical Ally team created a list of customized questions for him to ask his doctor as well as a list of top bariatric surgeons in his area. While following up with Justin, ConsumerMedical gave him a list of local psychologists who could help him address behavioral changes as well as a nurse Medical Ally who provided support and answered questions throughout the process.

For Justin, information was power. After learning more about his condition and treatment options, he opted to delay bariatric surgery. ConsumerMedical provided information and support that not only gave him peace of mind, but also improved his overall wellness and quality of life. He improved his diet, found an exercise program that worked for him, took medication to control his blood sugar, and sought emotional support from a counselor.

Even if Justin had chosen to continue on the path to surgery, the support from his Medical Ally team would have substantially improved the likelihood of a successful procedure. He would have information on inpatient versus outpatient options, objective clinical data on local and non-local healthcare providers and facilities, and research-based information on potential outcomes and complications.

For the millions of people facing a preference-sensitive surgery decision, ConsumerMedical's AI-powered predictive analytics results in a Medical Ally team being able to reach them with the information and counseling they need to make the right decision for them, before committing to a procedure they may regret. For the individuals who do proceed with surgery, they have the confidence that they have explored all options and have made the right choice. In the end, all participants have the security and confidence of a high-touch, knowledgeable and compassionate Medical Ally, ensuring that they have the expert information and research-based data they need.

For payers, ConsumerMedical offers a risk-free guarantee and an assessment of potential results before they sign on, so there are no surprises. The early identification of potential surgical candidates through predictive analytics and the educational process for members during one of the most critical times of their lives, improves their health outcomes and payers' bottom lines.

If you would like to learn more about ConsumerMedical please contact: mmenendez@consumermedical.com

If you would like to learn more about Santa Barbara Actuaries please contact: amackenzie@sbactuaries.com

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