Whitepaper

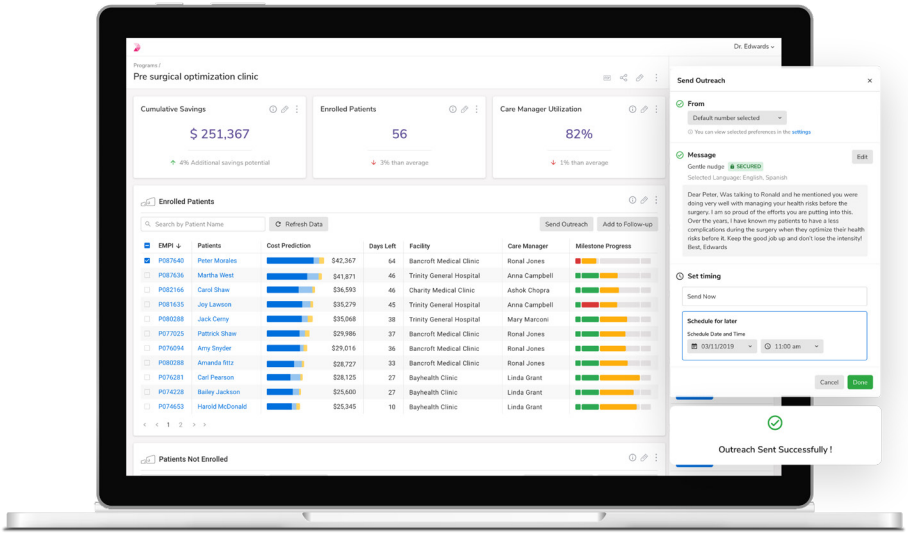
How can Health Systems Improve Post-surgical Outcomes with FHIR®-enabled Data Activation Platform

innovaccer

Executive Summary

A study[1] estimates that the aggregate surgical expenditures are expected to grow from $572 billion in 2005 (4.6% of US GDP) to $912 billion (2005 dollars) in the year 2025 (7.3% of US GDP). This implies that the surgical expenditure is expected to expand by almost 60% during the period 2005-2025. As a result, surgical health care expenditures by 2025 are likely to be 1/14 of the US economy. Studies[2] conducted previously found that hospital stays in the US, including surgeries, were 2.5 times costlier than the stays for treatment of medical conditions without surgery.

Based on the costs involved, critical surgeries like spinal fusion bring in most hospital revenue due to the high cost per hospital frequency and stay. This trend is followed by other crucial surgeries such as knee arthroplasty, and percutaneous coronary angioplasty. Surgeries are generally elective instead of emergent, involving high costs and patients with severe illnesses or pre-existing conditions.



At the same time, under the Hospital Readmissions Reduction Program[3] (HRRP) of Affordable Care Act (ACA) , hospitals receive reduced payments due to excess readmissions. Under this program, hospitals are financially penalized if they have higher than expected risk-standardized 30-day readmission rates or unplanned readmissions within 30 days of hospital discharge. Reducing readmissions saves money for hospitals by avoiding penalties worth millions of dollars. In this scenario, careful surgical planning becomes pivotal for hospitals and health systems to drive greater value in their operations by delivering quality care and avoiding penalties.

In this paper, we discuss how robust care management and seamless coordination can redefine post-discharge surgery planning and help hospitals increase incentives with better outcomes. We also discuss the key pillars of the ROI framework designed to optimize end-to-end surgical planning for enhanced patient health outcomes.

The Key Steps to Surgical Planning with the FHIR®-enabled Data Activation Platform

Broadly, there are four major steps to it:

1. Data integration and activation by analyzing clinical and social factors,
2. Execution of machine-learning algorithms to proactively identify high-risk surgical patients,
3. Virtual pre-operative interventions and comprehensive engagement for prioritized patients ready to undergo surgery, and
4. Patient follow up with pre-built care protocols that significantly reduce the post-surgery readmission rate

Data integration and activation by analyzing clinical and social factors

Patient data is scattered across hospital EMRs, labs, physician offices, pharmacies, claims, HIE, and other data sources. The first step is to ingest data from these different sources and aggregate them on the FHIR®-enabled Data Activation Platform. Once the data from multiple sources is streamlined and unified to create a patient-360 profile, it is refined to give it meaning and make it truly interoperable for providers, payers, and employers across the healthcare continuum. These unified patient records are then activated by including clinical and social risk factors on a smart, secure, and transparent data platform.

Execution of machine-learning algorithms to proactively identify high-risk surgical patients.

The next step involves the execution of machine-learning (ML) algorithms to proactively identify high-risk surgical patients. These ML algorithms estimate the cost of care for patients from past EMR and claim data on customizable dashboards. With multiple modeling inputs, such as the predicted cost of care, social vulnerability, the presence of multiple chronic conditions, and other factors, advanced program-driven analytics helps develop patient stratification strategy based on predefined risk thresholds. This is a crucial step in the pre-surgical planning process.

With accurate patient stratification in place, surgeons conduct surgeries on high-risk patients at a stage where chances of complications are low. Patient triaging also helps hospitals perform surgeries before the patient's condition worsens and the cost of care increases.

Virtual pre-operative interventions and comprehensive engagement for prioritized patients ready to undergo surgery

Once the patients are stratified into high, medium, or low-risk categories, care managers engage the patient remotely on virtual pre-surgical interventions. These include comprehensive patient engagement, assessment, triage, education, and care navigation.

Care managers follow pre-built care protocols within workflows to engage the patients. They recommend virtual PCP follow-up to address critical pre-surgical health conditions or symptoms in the patient. These care protocols help care managers optimize patients before the surgery. Healthcare teams also conduct outreach to disseminate relevant wellness and self-care patient guides before the surgery.

Patient follow up with pre-built care protocols that significantly reduce the post-surgery readmission rate

After the surgery is successfully completed, a robust care management solution facilitates workflows and communication to help physicians and care managers care as one. This reduces the readmission rates for hospitals and helps them improve their patient throughput.

How Can Machine-learning Algorithms Help Identify and Prioritize High-cost Patients?

While there is a vast amount of information on how hospitals should plan surgeries, there is no defined or standard industry strategy that guides patient prioritization in pre-surgical optimization. So, how should hospitals prioritize their programs and patients in a large network?

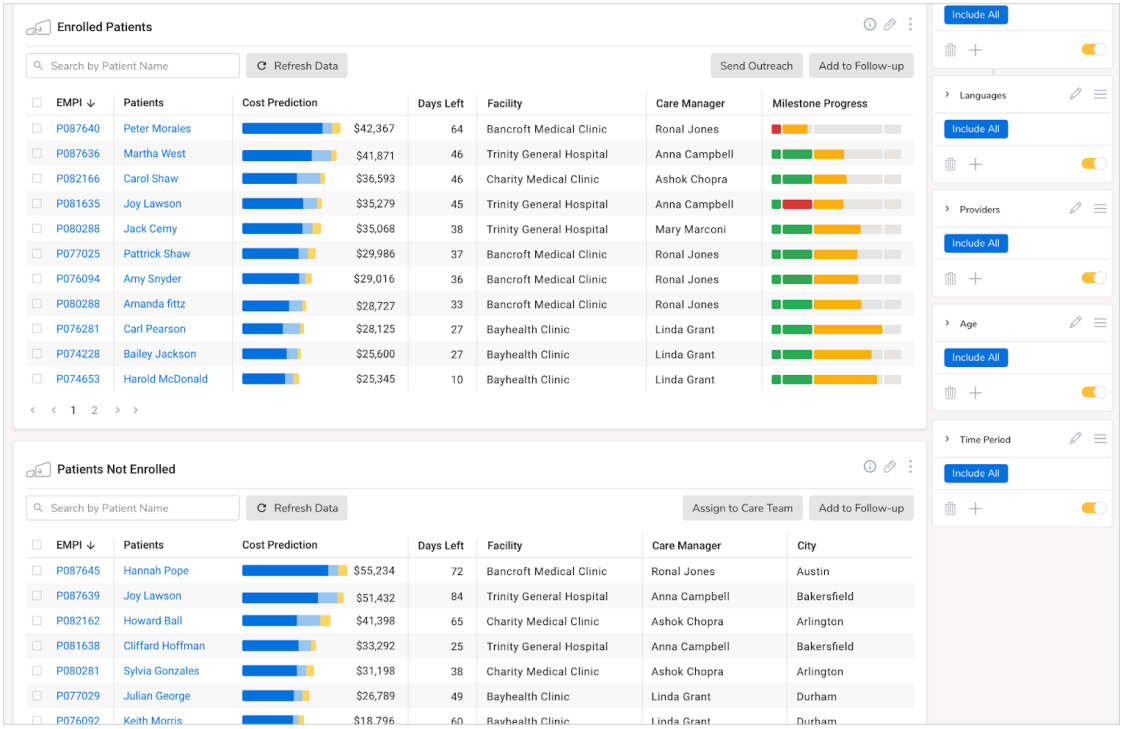


Figure: Risk-stratification for pre-surgical optimization

The solution to this is “Efficient Patient Stratification,” where a wide range of factors like medical history, patient demographics, allergies, chronic conditions, history, and social determinants of health are considered in the design of a stratification algorithm. Based on the previous data of these patients from EMR and claims and his/her risk factors, the algorithm estimates the future cost of care for the patient. Through such a risk stratification, hospitals can identify the high-risk patients and focus on the patients that will benefit most from pre-surgical interventions.

The algorithm also assigns patients to the right case managers using a smart rule engine that assesses a variety of factors, such as the number of appointments, and surgeon expertise to map the patients to the providers. This smart auto-assignment reduces the burden on care managers and optimizes the process.

High-cost patients are generally high-risk patients with health complications. Such patients need to be addressed first in the queue so that hospitals can be strategic in resource utilization and drive better patient health outcomes.

For instance, if a hospital has to conduct 1,000 surgeries and their care team has the capacity to manage 100 patients, how should the care managers select these 100 patients? In such a scenario, ML algorithms can stratify patients on the basis of risk-factor and predicted cost of care for the patient. This would reduce the burden on the care teams while optimizing surgeries to save the maximum expenditure for the hospital.

The Impact of Social Determinants of Health on Surgery Planning

The Social Determinants of Health (SDoH) factors are crucial in planning surgeries for the patients as many times they can impact patient health outcomes more than the procedure itself. For instance, a patient suffering from COPD undergoing a lung volume reduction surgery would need to participate in a pulmonary rehabilitation program before and after the surgery.

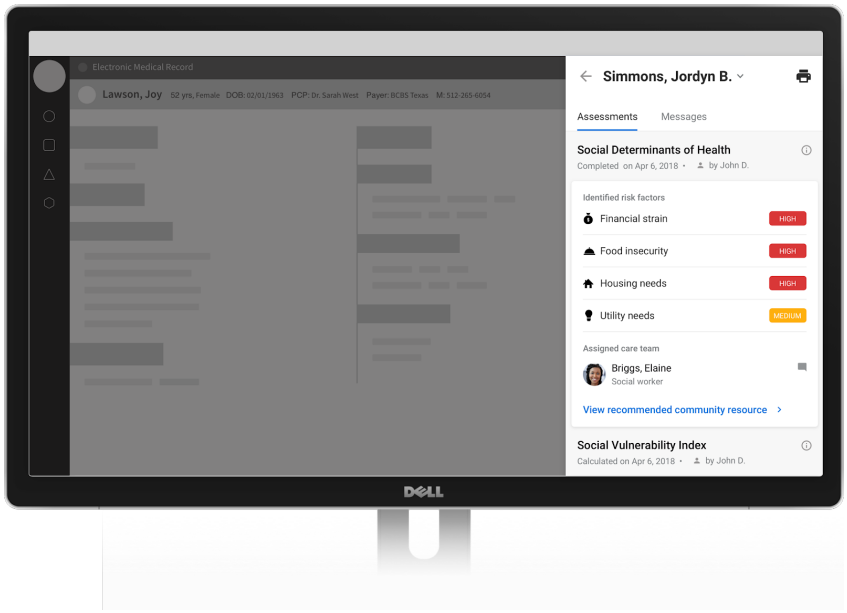


Figure: Social Vulnerability Index for pre-surgical optimization

With enough insights on the SDoH, healthcare organizations can track patients' vulnerability to various socioeconomic factors through a Social Vulnerability Index (SVI) and address their needs accordingly by redirecting these patients to the appropriate community resources.

Surgeons need to constantly assess the patient's risk of complications. Smoking, for example, is a risk factor for complications after surgery for musculoskeletal conditions. Similarly, drinking alcohol needs to be suspended after liver resection surgery. A patient of advanced age who stays alone and has limited mobility needs to be connected to a social service organization for emergent help. All such factors have a significant impact on the patient's recovery, medication adherence, and compliance.

With integrated SDoH planning in pre-surgical optimization, providers will be able to efficiently track the patient journey facilitating direct and seamless communication with social resources. Providers and social workers will be able to navigate across a nationwide social resource directory and plan post-operative care for the patients. Hospitals will also have detailed insights into temporary as well as long-term charitable and support services, which will link their patients to the correct resources for their individual needs.

Systematic Care Management for Pre-surgical Planning and Post-surgical Recovery

Hospitals need systematic care protocols in place to optimize care for high-risk patients undergoing surgery. It is important that care teams have streamlined worklists that organize care management activities in a single location. Embedded pre-built care protocols within these worklists help the care managers standardize the optimization process.

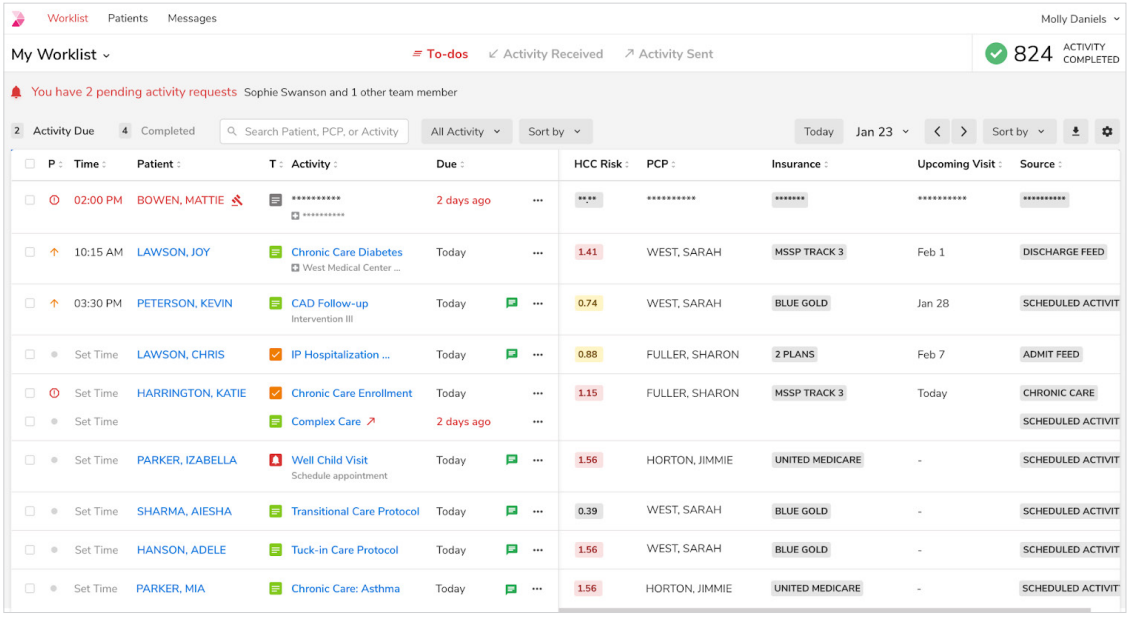


Figure: Care manager workflow for pre-surgical optimization

Care teams need to assess the patient's pre-existing health conditions, identify new medical issues, and assure that the patient is ready physically and psychologically for surgery. To ensure that these goals of pre-surgical planning are met, care managers must have access to clinical insights and organized clinical information about their patients across various data sources.

Robust care management also has a pivotal role in ensuring patient recovery post-surgery. With a better assessment of a patient's health status through dashboards, care teams can drive better patient engagement to increase adherence to care protocols and medication.

Care teams can successfully reduce unnecessary hospital stays and readmissions for their discharged patients by using these tools to increase adherence to evidence-based care. End-to-end care management will assist hospitals to avoid costly and debilitating complications and comorbidities, while improving patient health outcomes.

FHIR-enabled Healthcare Data Platform supports all healthcare stakeholders

The entire process of optimizing surgery planning helps healthcare become more patient-centered and leads to better patient health outcomes. However, the significant financial impact of the pre-surgical optimization process on hospitals' revenue generally goes unnoticed.

Component/lever	Component	Hip replacement	Knee replacement	Benign hysterectomy	Spine procedures	Comments
Reduce readmissions	Avg cost/readmission	$13,908	$11,528	$10,542	$14,740	2012 HCUP CCS data
	Readmission rate	7.3%	4.7%	5.3%	6.5%	2012 HCUP CCS data
	% decrease in readmissions	10%	10%	10%	10%	Assumption
	Avg savings/surgery	**$101**	**$54**	**$56**	**$96**	[Avg cost/readmission] * [Readmission rate] * [% decrease in readmissions]
Reduce LOS	Avg cost/day	$4,583	$5,218	$4,027	$7,711	Overestimates cost of incremental day because it includes day of surgery
	ALOS	3.85	3.17	2.43	3.66	2012 HCUP CCS data
	% decrease in LOS	5%	5%	5%	5%	Assumption
	Avg savings/surgery	**$882**	**$828**	**$490**	**$1,410**	[Avg cost/day] * [ALOS] * [% decrease in LOS]
Reduce unnecessary ED visits	Avg cost/ED visit	$1,000	$1,000	$1,000	$1,000	Assumption
	30-day ED visit rate	5.8%	5.8%	9.1%	12.8%	https://www.ncbi.nlm.nih.gov/pubmed/28632589; https://www.ncbi.nlm.nih.gov/pubme
	% decrease in ED visits	20%	20%	20%	20%	Assumption
	Avg savings/surgery	**$12**	**$12**	**$18**	**$26**	[Avg cost/ED visit] * [30-day ED visit rate] * [% decrease in ED visits]
	# of surgeries/year	2,000	2,000	1,000	1,000	Assumption
	Annual clinical savings	**$1,989,955**	**$1,786,673**	**$564,179**	**$1,530,946**	
Reduce admin/clinical FTE requirement	# of FTEs reallocated					Assumption
	Annual salary & benefits/FTE					Assumption
	Annual FTE savings	**$0**	**$0**	**$0**	**$0**	[# of FTEs reallocated] * [Annual salary & benefits/FTE]
	Total annual savings	**$1,989,955**	**$1,786,673**	**$564,179**	**$1,530,946**	
PSO program costs	**PSO cost/surgery**					Assumption
	Total annual costs	**$0**	**$0**	**$0**	**$0**	
	Total annual return	**$1,989,955**	**$1,786,673**	**$564,179**	**$1,530,946**	

Figure: Innovaccer ROI Framework for Pre-surgical optimization

Innovaccer leverages a refined ROI model that is designed to make the optimization process revenue positive for healthcare organizations. The three key pillars of the model are:

1. **Sensitivity Analysis Tool:**

   It is programmed to estimate and quantify the impact of hospitals' pre-surgical optimization initiatives. For example, a hospital that follows all preoperative interventions and follows up with pre-built care protocols can track its cost savings on a comprehensive and customizable dashboard.

   The dashboard charts all quantitative metrics such as reduced readmissions, reduced length of stay and ED visits with their associated costs. It helps healthcare organizations consistently track and meet their cost savings target, which might also be used to claim benefits at a later stage.

2. **Deep data insights:**

   These insights help hospitals in tracking their ROI near-real time with advanced analytics on reduced readmissions, length of stay and avoidable ED visits.

3. **Performance Analytics:**

   This feature helps healthcare organizations measure the impact of their pre-surgical optimization initiatives by tracking their value levers against comparable data cohorts.

The framework helps hospitals and healthcare organizations gain better control over health outcomes and cost savings. It also helps them track their progress to assist them to make the right decisions in the timeframe of maximum impact.

Why Innovaccer's Pre-surgical Optimization Solution?

Innovaccer's solution helps hospitals drive value and maximize ROI by not only managing care better but also avoiding penalties as much as possible. It helps in significantly improving the patient throughput figures by optimizing resource utilization and reducing the length of stay.

The entire optimization process requires a limited care team to expedite. Additionally, with patient prioritization based on his/her risk factor, the solution also leads to enhanced post-surgical outcomes and surgeon experience due to lesser complication rates.

The streamlined process decreases the chance of a same-day cancellation, which is a major source of resource wastage and increased costs for hospitals. The key impacts of the solution are as follows:

1. Reduced Readmissions and ED Visits

According to the Centers for Medicare & Medicaid Services [4], in the year 2015, approximately 2 million patients were readmitted, costing Medicare $27 billion, and $17 billion was spent on readmissions that were potentially avoidable.

Readmissions increase the cost of care for healthcare organizations. It is also easy to understand that generally, readmissions occur due to postoperative complications. Innovaccer's solution ensures seamless patient-provider communication for post-operative care guides and patient education. With pre-built care protocols, it helps hospitals ensure patient medication adherence. This approach helps healthcare organizations in significantly reducing readmissions and avoiding ED utilization.

2. Improving Patient Throughput:

The demand for healthcare services is never-ending. To cater to the care needs of a wider patient audience, healthcare organizations need to maintain the flow and discharge of their patients. Innovaccer's solution helps hospitals and care organizations to optimize their surgical planning for best resource utilization. With remote patient monitoring and virtual care management, it also helps in reducing the length of stay for patients. The comprehensive care management module assists providers in taking care of their patients and enabling necessary interventions by monitoring patient health in real-time.

3. Improving Holistic Healthcare Delivery with FHIR®-enabled Data Activation Platform

The FHIR®-enabled Data Activation Platform allows providers access to care insights and enable priority actions that they cannot take using their EHRs alone. It offers an in-workflow approach to enable cost-effective care delivery at the point of care without any EHR integration dependencies. With this platform, providers have the resources that enable them to improve clinical outcomes and boost the overall network performance.

The following solutions are built on Innovaccer's FHIR®-enabled Data Activation Platform:

inapi

Innovaccer's advanced healthcare data integration engine, providing one-click interfacing mechanisms to a wide breadth of healthcare data systems and a seamless bidirectional flow of data.

incare

Smart, AI-assisted care management solution, with patient-centered medical home (PCMH) level care delivery, hardcoded into the workflow. InCare streamlines the care management process enabling systems to scale care management programs at lower costs, and with higher quality.

ingraph

InGraph is the most intuitive healthcare analytics offering for population management health strategies in the industry with over 800+ measures to track network performance and outcomes, customizable measures and dashboards accessible across the network, and automated reporting on quality measures.

innote

A smart, lightweight physician's digital assistant that surfaces critical system and population health insights derived from multiple data sources, at the point of care. Using InNote, insights such as care gaps, dropped codes, process measures and referrals information can be shared with the clinician - without their having to leave the EHR experience.

inconnect

An automated analytics-driven patient engagement solution to scale patient outreach workflow and bring patients closer to the care team.

About Innovaccer

Innovaccer is a leading San Francisco-based healthcare technology company committed to making a powerful and enduring difference in the way care is delivered. The company leverages artificial intelligence and analytics to automate routine workflows and reduce manual overhead to facilitate more patient-centered care. Its KLAS-recognized products have been deployed all over the U.S. across more than 1,000 locations, enabling more than 25,000 providers to transform care delivery and work collaboratively. Innovaccer's FHIR®-enabled Data Activation Platform has been successfully implemented in healthcare institutions, government organizations, and corporate enterprises including Catholic Health Initiatives, MercyOne, Orlando Health, Hartford Healthcare, and Stratifi Health. By using the connected care framework, Innovaccer has unified 3.8 million patient records and generated more than $400M in savings.

For more information, please visit innovaccer.com.

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