

How robotic colon surgery helped lower surgical site infections

Surgical site infections pose a challenge across healthcare systems. But an Oregon medical center shows how robotic-assisted colon surgery can help.



Hospital

Legacy Mount Hood Medical Center

Location

Gresham, Oregon
(a city on Portland's eastern edge)

Number of beds

115

Medicare and Medicaid population

70 to 75% of patients

Integrated delivery network

Legacy Health

Case summary

Community hospital turned to robotic-assisted surgery to address surgical site infections and lower volume

A high rate of colon surgical site infections (SSI) triggered financial penalties for Legacy Mount Hood Medical Center, a community hospital, in 2015. Based on a standard 1% annual penalty, the Centers for Medicare & Medicaid Services (CMS) ultimately reduced the medical center's reimbursements by an estimated total of \$585,000.

Challenges: Lack of robotic colon surgery, falling caseloads, and gap in health equity

Legacy Mount Hood's SSI challenges largely arose from the medical center's inability to consistently provide minimally invasive surgery (MIS) for general surgery and colon cases. That shortcoming caused the medical center to send many colon cases to hospitals farther away. Not only did the referrals represent a revenue loss, but they also placed a travel burden on the hospital's lower-income and rural patient populations.

Solutions: Robotic surgery with da Vinci® systems

Legacy Mount Hood's initial solutions achieved only modest success. Ultimately, expanding the use of robotic-assisted surgery (RAS) helped drive down SSI rates, avoid CMS penalties, and regrow case volume. Those surgeries were performed with Intuitive's da Vinci robotic-assisted surgical systems.

Outcomes: Care improves, patients return, hospital finances strengthen

Legacy Mount Hood achieved shorter hospitalizations and faster recoveries by transitioning to RAS. The general surgery team felt comfortable providing colon patients the chance to stay closer to home. Legacy Mount Hood was able to upgrade and expand its pool of da Vinci systems, solidify its finances, and free beds for other needs.



SSI can increase the cost of colon surgery for a hospital by more than \$20,000 per admission.

Reducing hospital-acquired infections poses challenge for hospitals nationwide

Legacy Mount Hood is not alone in the struggle with hospital-acquired infections (HAI)—especially SSI.

Each year, 160,000 to 300,000 U.S. patients develop a surgical site infection in the days or weeks following their operations. These complications:¹

- Represent 20% of all HAI
- Increase hospital length of stay (LOS) by 9.7 days, on average
- Drive the most readmissions
- Place a significant burden on healthcare consumers, providers, and payers, costing the system \$3.5 – \$10 billion annually

Many SSIs are considered to be preventable, so their impact has drawn CMS' attention. CMS now requires hospitals to report their rates publicly to promote transparency. As part of its larger pay-for-performance push, CMS has factored SSI rates into a key value-based program—the Hospital Acquired Conditions (HAC) Reduction Program. HAC scores include two SSI categories—abdominal hysterectomies and colon surgeries—among other risk-adjusted measurements.

CMS began penalizing lower performers under HAC starting in fiscal 2015. Hospitals in the bottom quartile receive 1% less for inpatient reimbursements after accounting for bonuses and other penalties.

Legacy Mount Hood worked to lower SSI rates even before these measures, updating facilities, changing cultures, and improving practices. Preventive guidelines, including from the Centers for Disease Control and Prevention and the Agency for Healthcare Research and Quality (AHRQ), aid these efforts. Indicating the global nature of the challenge, the World Health Organization issued guidelines as well.

These responses have worked to an extent: AHRQ reported a 16% decline in U.S. SSIs between 2010 and 2015. But such complications remain far too common, with a continued impact on morbidity and mortality. Based on Medicare's publicly available CMS data, nearly 2,000 hospitals, in addition to Legacy Mount Hood, have received a HAC penalty, with 764 on the list for 2022. Given the continued impact on patient care and resources, a multifaceted response is required.

“There is no clear evidence that checklists alone can prevent SSIs.”

Agency for Healthcare Research and Quality, in a report for its Patient Safety Network

A case matched comparative analysis of nationwide data showed minimally invasive colon surgery reduced complications and improved recovery

Cleveland Clinic specialists also demonstrated this advantage in a pivotal 2016 paper in *The International Journal of Medical Robotics and Computer Assisted Surgery*.²

Team members started with an analysis of the National Surgical Quality Improvement Program database, overseen by the American College of Surgeons.² They looked at results for traditional laparoscopic techniques, RAS, and open operations when treating conditions that included colon cancer, diverticular disease, Crohn’s disease, and ulcerative colitis.

For the two minimally invasive categories, the group found:²

- Shorter hospital stays
- Fewer readmissions
- Lower overall morbidity, including lower SSI rates

Overall morbidity, superficial SSIs, and LOS were lowest for RAS. (Benlice found that the longer the stay, the greater the risk for additional HAI.²) Also, compared to laparoscopic techniques, RAS needs to be converted to open surgery less often.

While the authors didn’t address the intensive care unit (ICU) utilization, Legacy Mount Hood found that rates are lowest for colon RAS.

Despite these advantages, a significant portion of colon surgeries nationally is still performed with open operations. (A 2022 study in *Surgery*, places the open rate at 33.2% for left colectomy and 32.7% for right colectomy.³) That was the approach Legacy Mount Hood previously took.





Turning to robotic colon surgery at Legacy Mount Hood

When Dr. Greg Starley joined general surgery at Legacy Mount Hood in 2014, the medical center had one system for RAS—a third-generation da Vinci Si®. It was used mainly for urology and gynecology.

The medical center had already begun referring out nonemergent colon surgery cases—even before its first HAC penalty. Those patients went to sister hospitals in Portland that could consistently provide minimally invasive options with superior outcomes. Back at Legacy Mount Hood, surgeons performed most remaining colon cases with open approaches.

Against that backdrop, Starley developed an interest in RAS, learning to use the da Vinci Si for inguinal hernia repair and gallbladder removal. In Dr. Starley's experience, he was impressed with patients' improved outcomes, so he began adding more complicated procedures as he gained experience.

That path ultimately led to reinvigorated colon care at Legacy Mount Hood and a leading role for RAS. Arriving there depended on several considerations, though:

Reducing patient burden: Despite receiving care from the same system, patients often had to wait weeks or months to have colon surgeries in Portland—even for cancer. The journey also burdened patients and their loved ones because Portland is a 30- to 45-minute drive from Legacy Mount Hood. In response, Dr. Harald Schoeppner, a Legacy Mount Hood gastroenterologist, approached Starley about helping patients remain closer to home. He convinced Starley to overcome his hesitation about trying RAS for more complicated colon cases.

Securing reproducible results: Both RAS and traditional laparoscopic techniques help reduce SSIs for colon resection. But in Starley's experience, "data show that only the former can consistently keep LOS as low as safely possible."

In its paper, the Cleveland Clinic group suggested possible advantages of robotic assistance:²

- 3D visualization
- Instrumentation that mimics the human wrist
- Built-in tremor reduction
- Designs that account for ergonomics and physical comfort

Da Vinci Xi® systems such as those at Legacy Mount Hood include all these features, with a four-arm approach that maximizes multiquadrant robotic surgery.

Such attributes make minimally invasive colon procedures accessible to a wider range of surgeons, including for complex cases. Starley, for one, likes to say he's "just a general surgeon that trained in a very small community hospital in Ohio." He believes that good outcomes with colon RAS are "something that can be reproduced across the country."

"The data show us that across the country, robotic surgery for colon consistently sends patients home sooner than laparoscopic does and way sooner than open does."

Greg Starley, DO

General surgery



Hitting limits with SSI reduction: Legacy Mount Hood leadership asked Starley to head the SSI committee when he joined the hospital and focus on reducing the rates for colon surgery. The medical center's standard infection ratio (SIR) for such operations was 3.141—more than three times the expected number of infections. It was among the country's worst marks.

At the committee's urging, the hospital's surgical teams:

- Implemented strict temperature and blood sugar control for patients
- Began practicing clean closures
- Examined antibiotic use
- Initiated an enhanced recovery after surgery (ERAS) protocol

Most changes didn't make much of a difference, except for ERAS. Even there, improvements were modest.

Receiving support from Intuitive: As Starley worked to develop his RAS skills, Intuitive's representative for Legacy Mount Hood attended every case to provide support. Intuitive helped arrange for Starley to train with experienced surgeons and practice at the company's research facility when larger questions or needs arose. "To me, it's been critical," he says.

Expanding RAS helps Legacy Mount Hood prevent surgical site infections

After completing his first RAS colon case—a man who needed palliative cancer surgery but feared a colostomy bag—Starley progressed to ever-more-complex cases. Legacy Mount Hood subsequently was able to slow referrals to sister hospitals and start rebuilding its caseload in a series of steps:

Care improves: As Starley gained experience, he realized his patients were recovering faster and leaving the hospital sooner. He then noticed a decrease in anastomotic leaks. Next, SSI for colon surgeries also began to decline. "We were reaching for things, anything we could find, to try to improve our outcomes," Starley says. "But nothing seemed to make an impact until we started to increase our robotic minimally invasive surgery."

Colleagues adapt: Many of Starley's colleagues decided to transition to RAS for colon cases. Intuitive arranged for experienced proctors to walk them through cases and for hands-on trainings and off-site case observations. New surgeons also adopted the robotic-assisted mantle, even if they had trained laparoscopically.

SSI continued to decrease as volumes increased and the team gained further experience. As the program grew, Intuitive applied its Custom Hospital Analytics to show the team how it was doing and how it compared to national leaders. This evaluation led to improved SSI scores, outcomes, and total costs.

“We were able to develop a culture within the hospital and to share techniques and skills. It evolved into everybody having similarly desirable outcomes and quality.”

Greg Starley, DO

General surgery

Number of da Vinci systems grows, with upgraded units: With demand rising on his medical center’s existing system, Starley worked with system leadership to acquire a second Si, available when a sister hospital upgraded.

Later, as medical director of Legacy Health’s robotic steering committee, Starley pointed to his hospital’s reductions in SSIs and LOS. He advocated for leadership to pursue a system-wide upgrade. His hospital secured a pair of fourth-generation units, covering two of its four operating rooms (ORs).

The fourth-generation system, the da Vinci Xi, offers particular benefits for colon surgery:

- Longer instruments, for improved access
- Enhanced energy devices, for more effective stapling
- 3D cameras with higher magnification and greater clarity for better depth perception and visualization
- Rotating, four-quadrant access, forgoing the need to move the patient cart or undock the system—even for total colectomy

Partnerships blossom: The rise of colon RAS at Legacy Mount Hood dovetailed with Schoeppner and his team opening a new gastroenterology facility focused on advanced endoscopy. The new facility, paired with the hospital’s colon surgery to form a gastroenterological center of excellence, helped expand referrals. Starley and his surgical colleagues also contacted local primary care physicians to explain the benefits of colon RAS.



Colon Resections by Approach at Legacy Mount Hood

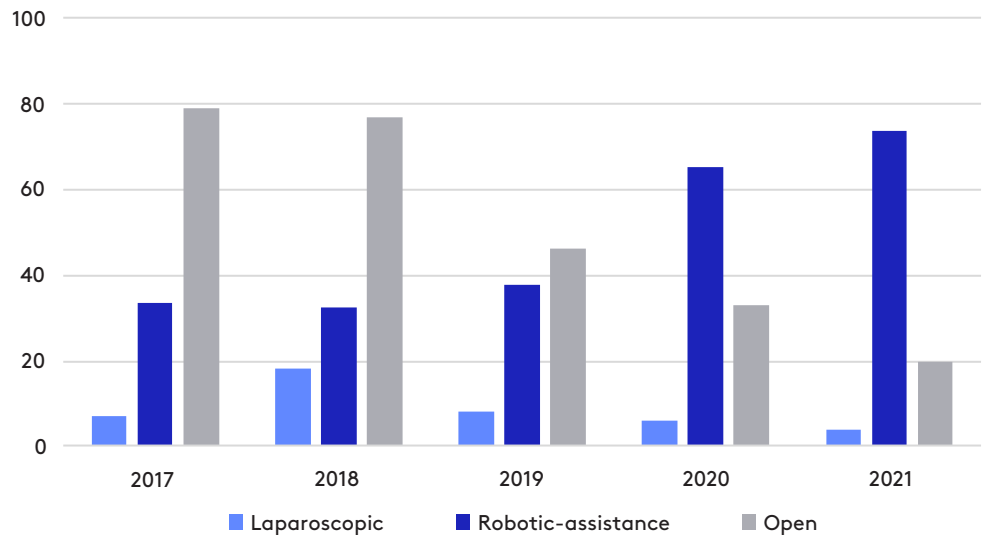


Figure 1: Since 2017, Legacy Mount Hood has increased its colon resection volume, with 95% of cases now performed with RAS. (Some hospital surgeons still take a traditional laparoscopic approach because of their training, while some patients benefit the most from open surgery.)

Legacy Mount Hood shows robotic colon surgery can benefit community hospitals

Legacy Mount Hood hasn't received CMS HAC penalties since 2020, allowing it to collect its full reimbursements because of its significantly lower colon SSI rates.

Patients also benefited from adopting colon RAS—not only through the availability of local care but also from faster recoveries. With open surgery, patients “could barely stand up straight” at their two-week checkups, Starley says. With colon RAS, they’ve “already been back to work and the gym” at that milestone.

Legacy Mount Hood can now perform colon cancer surgery the day after a diagnostic confirmation with colonoscopy and CT. Patients often go home the next day, and those who need to can promptly pursue additional oncologic care on campus.

Other achievements fostered by the adoption of colon RAS include:

SSI rates stand among the nation's best: Previously in the 4th percentile for colon surgery, Legacy Mount Hood rose to the 81st percentile in 2021. That year's SIR of 0.374 meant the team encountered SSIs much less than expected, based on the hospital's patient profile and other CMS parameters.

"Compared to RAS, average LOS for a colon resection at Legacy Mount Hood is nearly three days longer with traditional laparoscopic techniques and more than twice as long with open surgery."

Greg Starley, DO
General surgery

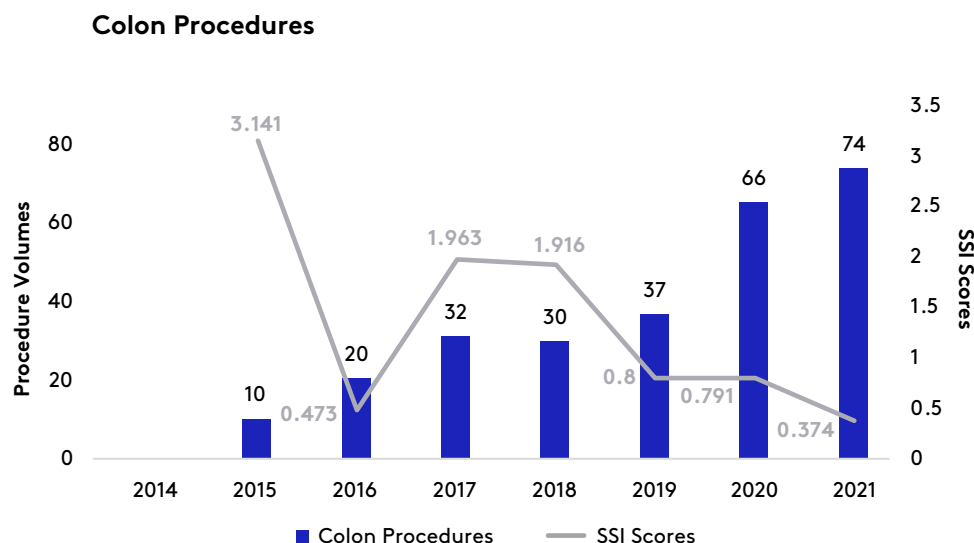


Figure 2: Not only have annual colon RAS volumes risen at Legacy Mount Hood, but the hospital's colon resection SIR is now among the nation's best.

Strong clinical outcomes continue: Legacy Mount Hood has demonstrated other advantages to colon RAS:

- Only 5.1% of patients have needed the ICU, compared to 5.9% for laparoscopic and 13.9% for open.
- Patients have stayed just 4.25 days on average, versus 7.12 for laparoscopic and 9.75 for open.

	ICU%	SSI%	Average LOS	OR Time	Conversions to Open	Readmission
Da Vinci	5.10%	0%	4.25	225.57	1.70%	7.20%
Laparoscopic	5.90%	0%	7.12	204.91	2.90%	2.90%
Open	13.90%	1.50%	9.75	171.46	N/A	10.20%

Figure 3: From 2017 to 2022, colon RAS at Legacy Mount Hood largely outperformed both open approaches and traditional laparoscopic techniques in clinical measures.

Volumes continue to rise: Colon RAS at Legacy Mount Hood rose from 10 cases in 2015 to 82 cases in 2021, a compound annual growth rate of 35%. The medical center saw growth among a range of case types.

Legacy Mount Hood has found that colon RAS is cheaper to perform than laparoscopic techniques or open surgeries.

Hospital finances strengthen: In addition to helping the hospital end its HAC penalties (saving \$415,000 from 2020 to 2022, colon RAS has:

- **Proven cheaper to perform:** From 2017 to 2021, the average RAS cost \$19,304, compared to \$21,423 for laparoscopic and \$28,627 for open. The hospital saved a combined \$2.8 million in those years by doing the bulk of surgery robotically instead of open.
- **Increased hospital profit:** Even with pay-per-use financing for its da Vinci Xi systems— a model from Intuitive that provides flexibility but accounts for rising volume—Legacy Mount Hood profited from colon RAS. The hospital system expected a \$9 million to \$10 million increase in profits after upgrading its units. Instead, it recorded an \$18 million boost in 2020, even with the arrival of COVID-19. One factor is that its da Vinci systems support more complex cases, which bring in higher reimbursements.

Capacity concerns diminish: Legacy Mount Hood’s surgeons can typically send patients home sooner with da Vinci robotic surgery for colon resections. That turnaround frees up beds and helps the hospital avoid transferring patients. “The length of stay effort has been golden for us,” says Bahaa Wanly, president of Legacy Mount Hood. “Not only do we keep surgeries going, but it allows us to keep beds for capacity challenges.”

Given the success of its efforts, Legacy Mount Hood purchased a third da Vinci Xi in the third quarter of 2022. Legacy Mount Hood now has da Vinci Xis in 75% of their operating rooms.

“People assume that the big surgeries and the best technology are only at academic medical centers, but that’s a misconception,” Starley says. “By giving community hospitals the ability to have robotic surgery, you can improve surgical quality and outcomes across the country.”

"We're very much invested in this and we see it as the way of the future. If you don't do this, you're going to be left behind as a health system."

Bahaa Wanly, president

Legacy Mount Hood Medical Center

About the Legacy Mount Hood team

Greg Starley, DO, is board certified in general surgery. Before joining the staff at Legacy Mount Hood, he served four years as a U.S. Army surgeon, posted at a base in Louisiana and serving a tour in Afghanistan. He completed his residency in general surgery at Cuyahoga Falls General Hospital (now Western Reserve Hospital) in Ohio.

Bahaa Wanly is the president of Legacy Mount Hood Medical Center. He has more than 15 years of leadership experience with health systems and physician groups. Before coming to Legacy Mount Hood, he served as vice president and then chief operating officer for Salem Health, a system with several community hospitals.

References

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Additional Information

For background information, study information, congruency and typicality, and safety information, visit, go.intuitive.com/1112637-01

Financial disclosure

The independent institution and its represented physicians quoted in this study have not received compensation from Intuitive for consulting and/or educational services.

Physician/hospital disclosure

The material presented represents the views and opinions of independent institutions and physicians based on their practice and personal experience performing robotic surgery with the da Vinci surgical system. Their experience may or may not be reproducible and is not generalizable.

Economic disclosure

This single center's economic outcome data is not peer reviewed and not published, and may or may not be reproducible and is not generalizable. As such, the data reported should be considered informational only and not conclusive.

Surgical risks

Bowel resection and other colorectal procedures (colectomy, sigmoidectomy, low anterior resection, abdominopelvic resection (APR), intersphincteric resection, proctectomy, rectopexy): anastomotic leak, anastomotic stricture, colorectal or anorectal dysfunction.

Important safety information

Serious complications may occur in any surgery, including surgery with a da Vinci system, up to and including death. Examples of serious or life-threatening complications, which may require prolonged and/or unexpected hospitalization and/or reoperation, include, but are not limited to, one or more of the following: injury to tissues/organs, bleeding, infection, and internal scarring that can cause long-lasting dysfunction/pain.

Risks specific to minimally invasive surgery, including surgery with the da Vinci surgical system, include, but are not limited to, one or more of the following: temporary pain/nerve injury associated with positioning; a longer operative time, the need to convert to an open approach, or the need for additional or larger incision sites. Converting the procedure could result in a longer operative time, a longer time under anesthesia, and could lead to increased complications. Contraindications applicable to the use of conventional endoscopic instruments also apply to the use of all da Vinci instruments.

For important safety information, indications for use, risks, full cautions, and warnings, please also refer to intuitive.com/safety.

Individual outcomes may depend on a number of factors, including but not limited to patient characteristics, disease characteristics, and/or surgeon experience.

Da Vinci Xi/X system precaution statement

The demonstration of safety and effectiveness for the specific procedure(s) discussed in this material was based on evaluation of the device as a surgical tool and did not include evaluation of outcomes related to the treatment of cancer (overall survival, disease-free survival, local recurrence) or treatment of the patient's underlying disease/condition. Device usage in all surgical procedures should be guided by the clinical judgment of an adequately trained surgeon.

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