DATA & ANALYTICS CASE STUDY SERIES

When Health Care Gets a Healthy Dose of Data

How Intermountain Healthcare is using data and analytics to transform patient care

By Michael Fitzgerald

Made possible by exclusive
Global Insights case study sponsor:

EY Building a better working world

AUTHOR

MICHAEL FITZGERALD is a contributing editor at
MIT Sloan Management Review.

CONTENTS

When Health Care Gets a Healthy Dose of Data

Introduction

The views of Utah's Wasatch Mountains are spectacular from the east side of Intermountain Medical Center, but as 40-year-old Lee Pierce walked down a hallway on the fifth floor of the hospital's administrative building, he hardly noticed them. Pierce, Intermountain's chief data officer (CDO), was more focused on the giant countdown clock the implementation team had put up in the corridor. The clock was approaching zero, which marked the moment in February 2015 when Intermountain Healthcare would switch on its new electronic health records (EHR) system in two of its 22 hospitals and 24 of its 185 clinics.

Pierce was hardly the only health care executive concerned about a major EHR installation. Indeed, a year earlier, a key provision of the American Recovery and Reinvestment Act of 2009[1] went into effect, mandating that all health care providers adopt and demonstrate "meaningful use" of EHR systems to maintain their Medicaid and Medicare reimbursement levels.[2] But while others scrambled to meet the deadline, Intermountain executives were thinking past it — because Intermountain was *replacing* an EHR system, not installing its first one.

In fact, Intermountain had created its own EHR system in the 1970s, helping the not-for-profit hospital develop a reputation as an innovator in evidence-based medicine. But that system had aged: It

had become incompatible with new forms of input, like speech and data from wearable devices, and it was cumbersome and challenging for the nurses and physicians using it to navigate the antiquated interface to document and retrieve patient information.

Over the years, clinicians had learned to work with the system. It was part of a concerted effort to bring data-based insights to clinicians and managers across the Intermountain Healthcare organization. All clinical programs had embedded analytics support teams; procurement decisions were heavily influenced by data and analytics; and patient interactions were continuously enhanced by data, from the application of population health analytics to analyses of patient self-reports. A culture of data use was widespread among Intermountain's clinicians and managers.

Even so, the switch to a new EHR system was expected to challenge Intermountain on two fronts: one technological, the other organizational. This was Intermountain's second effort to update the technology behind its EHR system. An earlier attempt had been abandoned in 2012. Executives pulled the plug on a six-year overhaul involving tens of millions of dollars after deciding the technology was not going to work. This time, Intermountain leaders, including Pierce, were confident they had the right technology and the right systems in place to move the data and information where it needed to go.

There were concerns, however, about whether physicians were ready and willing to make a speedy transition to the new system. They had had only occasional interaction with the old system used in the hospitals, which meant, on the one hand, that physicians were unfamiliar with its interface, and on the other, that they would have to integrate technology into their approach to patient care in new ways.

Two months later, Pierce was at the Las Vegas airport returning from a data and analytics conference, standing with one of the Intermountain physicians working on the rollout. "You know, they said we would be up and running and as efficient as before in just a couple of weeks," the physician commented. "Here we are, a couple of months in, and some people are still not there. We should have set the expectation that it will take a few weeks to months, depending on the physician's comfort using technology, the complexity of individual workflows, and frequency of use."

Pioneering Health Care Analytics

Computers barely existed when Intermountain began its quest to incorporate data analytics into its health care practices. In the 1950s, a cardiologist named Homer Warner joined one of the hospitals that eventually became part of the Intermountain Healthcare organization. Shortly thereafter, he began gathering data to understand why some heart patients had better outcomes than others. Warner would become known as the father of medical informatics — the use of computer programs to analyze patient data to determine treatment protocols — after he and some colleagues built a decision-support tool in 1968 called HELP (Health Evaluation through Logical Processing).[3] HELP was one of the first EHR systems in the United States, and it provided doctors with diagnostic advice and treatment guidance. It was also effective in helping doctors identify the causes of adverse drug reactions.

Years later, Warner recalled that using computers to model diagnoses was not — at first — well received; some cardiologists were even insulted by claims that

---

ABOUT INTERMOUNTAIN HEALTHCARE

Intermountain Healthcare runs 22 hospitals and 185 clinics in Utah and Idaho. It employs more than 800 physicians. In 2014, it performed 150,000 surgeries and had 488,000 emergency room visits. It grew out of a system of 15 hospitals operated by the Church of Jesus Christ of Latter-day Saints, which donated the hospitals to their communities in 1975. Intermountain was formed as a secular operating company to oversee those hospitals. It also operates an insurer, SelectHealth, which had 750,000 members and $1.83 billion in revenues in 2014. Overall, in 2014 Intermountain Healthcare had $5.57 billion in revenues and an operating surplus of $301 million.

a computer could make a diagnosis. Despite the resistance, the system's benefits began showing up in improved patient outcomes, and HELP became a key component in Intermountain's approach to patient care. The innovation attracted attention from all over the world.[4] In 1985, Intermountain began using the HELP system in all of its hospitals. Administrators saw an opportunity to put data-driven decision making at the forefront of the organization.

But it wasn't easy.

Delivering an Analytics Culture

Over the next dozen years, Intermountain expanded its use of data-driven decision-support tools. In 1986, Intermountain hired Brent James, a physician with a master's degree in statistics, to champion quality-improvement principles and initiatives across the organization. One early challenge was that expensive information technologies, such as data storage, were still improving, making the premise that large investments in data technology would improve care and lower costs somewhat risky. "It was really a decision made on faith at first, that if we invested in the systems, we would see results," says Brent Wallace, chief medical officer (CMO) for the organization.

James focused on improving data quality and data-gathering techniques. As Mark Ott, chief of surgery at Intermountain, says, "I never want to give data to doctors that I can't defend. Because once you've got bad data, it takes months to recover that level of trust. The single most important thing is the integrity of the data." James adds that there needs to be a constant focus on data gathering, painstakingly mundane work that almost no one takes to naturally. "You have to have a data zealot who goes around and grabs teams and pulls them into line," James says.

Helping physicians become comfortable with data became an important part of Intermountain's approach to developing a data-oriented culture. A key facet of this approach was being as transparent as possible about data quality, CMO Wallace recalls:

When we first started presenting data to physicians about their own performance and how they were doing, most physicians, especially if they were not performing as well as they feel like they ought to be, have two comments. One is, "Well, the data really aren't accurate. There are problems with the data." And the second is, "I have sicker patients than my colleagues." And you hear those two things over and over again.

We allow and actually encourage physicians to question the integrity of the data. If it's a dataset around their own performance, we show them the names of the patients from whom the data was derived, and they can look at it and say, "Well, this isn't my patient. This one really sees my partner." And then we'll take it out of their dataset. Or if they look at it and say, "You know, I just really don't believe that this case costs this much money. I want to get in and see what were the contributing factors and challenge that. Have we really collected that accurately?"

And over time, many of our physicians who have been involved in this process iteratively have become pretty comfortable that the data we provide are accurate and okay. But they still know they have the capability to challenge it, if that is needed.

Intermountain's team-driven culture applies gentle peer pressure, extolling doctors or teams that have excellent results and encouraging others to take the same steps. Administrators in the surgical unit, for instance, show physicians how they are performing relative to their peers because they believe surgeons are competitive and want their names at the top of the board. This collegial approach comes in part because only a third of the company's doctors work directly for Intermountain. Another third work for affiliated medical practices, and the rest are independent and only occasionally interact with Intermountain. The system needs them all to contribute data that is as complete as possible, so that data quality doesn't degrade.

In 1999, at the height of the Internet boom, Intermountain experienced something of an organizational

epiphany when it discovered the power of data analytics to affect population health. That year, the American College of Obstetricians and Gynecologists recommended that doctors stop choosing to induce labor before the 39th week of pregnancy, because medical research showed that early induction carried significant risks for babies and mothers.

The hospital's labor-and-delivery committee suggested that doctors should investigate the hospital's elective induction rate. "We don't have that problem here," came the response from a majority of the obstetricians. The data said otherwise. In fact, 28% of Intermountain's deliveries were elective preterm inductions, on par with the national average. Intermountain urged its doctors to think twice about performing them, but moving away from elective inductions was a bumpy process. With most deliveries' timing now left to Mother Nature, many obstetricians had to get used to being on call again or working at odd hours. But eventually they accepted the changes in procedure, and by 2001, elective preterm inductions had fallen to less than 2% of all cases.

Hard work followed this organizational epiphany, as the organization spent years creating a common language for data across departments and hospitals. Colleen Roberts, who switched from being a nurse to a data manager in 2002 after earning a master's degree in medical informatics, began building out data dictionaries. "Everybody knew that Emergent meant this, and Urgent meant this, but there weren't clear definitions for every data element," says Roberts. It took regular meetings with practicing clinicians to hammer out definitions that ultimately enabled Intermountain, for the first time, to directly compare hospitals and departments on a wide range of metrics. Over the last decade, the use of data has become completely ingrained in the culture, she says.

Today, "we never do a project or care initiative that we don't first run baseline data to see where we were. And post implementation, we run data to see if we've shown improvement," says Roberts, now director of operations for Intermountain's cardiovascular clinical care unit.

As data analytics spread among Intermountain's clinical care settings during the 2000s, the cost of gathering and storing data decreased rapidly, enabling more access to analytics. But the main reason analytics spread was not the cost of the technology but the results, how good the analytics were at helping patients.

An Appointment With Clinical Programs

Intermountain has set up multiple touch points for clinicians to access the data they need, or the data they want. Most of its 10 clinical programs, whether big ones like women's and newborn and cardiovascular, or small specialty services like ear, nose, and throat, have their own data team, as does the clinical services group (pharmacy, imaging and radiology, nursing, physical therapy). Each data team consists of three people: a data manager who makes sure data is being collected correctly, a data analyst to flag important trends, and a data architect who pulls together data from various sources inside and outside Intermountain. The data manager and data analyst are embedded in the clinical team's staff and report to the clinical program's operations manager. The data architects are based in a centralized IT department and report to managers who report to CDO Pierce. In addition, Intermountain has 240 data analysts spread throughout its facilities, as well as 70 researchers in the Homer Warner Center for Informatics Research, formed in 2011. A few of those report into Pierce's group; the rest are involved in research projects.

In addition, the clinical programs' operations directors spend part of their time ensuring that data is being gathered properly on the clinical side. There are even data abstracters — nurses assigned to gather data in the operating rooms and other locations — in part because Intermountain participates in a variety

of national programs where hospitals contribute information on various procedures, which can require collecting more than a thousand points of data for some procedures.

Any Intermountain employee can make formal or informal requests for analytics support. Pierce notes that with 240 data analysts spread throughout the organization, many requests are made informally. They're water-cooler conversations or brief email exchanges along the lines of, "What does the data say about this kind of treatment?" Intermountain encourages this informal activity, though its analysts must make formally approved queries a priority.

Formal requests for analytics are processed through the internal Web portal. These requests include estimates of the likely time needed from data analysts, managers, and architects. If the combined time for the request is projected to exceed 40 hours, it must be approved and given a priority assessment at the monthly meeting of an information management council, chaired by Pierce, which handles analytics and data governance.

Cardiovascular

The cardiovascular practice, where Warner started the use of analytics, has expanded its use of analytics to support patient care not only through decision making but also at the policy level. Intermountain used data to decide that it should, for instance, have only four of its hospitals perform cardiovascular operations (surgeries and catheterizations), because concentrating procedure volumes and maintaining implicit controls over conditions was the best way to improve care and reduce costs. By concentrating expertise at each of the four hospitals, Intermountain increased response times for certain emergency procedures, for which speedy interventions are closely connected to better health outcomes.

For example, on average about 15% of people who suffer ST-elevation myocardial infarctions (STEMI) — heart attacks that occur when coronary arteries

suddenly become completely blocked — die within 30 days. Better outcomes are achieved when patients receive rapid intervention to unblock the artery. The national standard is 90 minutes for what's called "door-to-balloon time," which represents the amount of time from the moment the patient enters the hospital to relief of the blockage via a balloon inflated within the blocked artery. Beating that national average of door-to-balloon time would mean more lives saved.

To work toward that goal, in 2011 Intermountain's cardiology leadership began working with STEMI teams to set internal time standards and measure results. Every time a heart attack patient was treated, the data on the operation was circulated to the whole team within a few days, a process known as rapid process improvement. This feedback loop helped Intermountain reduce the median door-to-balloon time to 57 minutes. In the last three years, *all* STEMI patients at Intermountain have gone door-to-balloon in less than 90 minutes. Intermountain's rate of STEMI patient survival beyond 30 days is now at 96%. "That was purely data-driven — and without the data, we'd have no clue what was going on," says Don Lappé, the chief of cardiology at Intermountain.

Another example: The cardiovascular surgical team evaluated published research findings that suggested that blood sugar management helped heart patients after operations. Since surgery and anesthesia increase stress levels, which can cause spikes in blood sugar levels, the team asked their data analyst to build a query to examine average blood sugar levels before, during, and after surgery.[5]

The analysis showed that patient blood sugar levels reached between 300 and 400 mg/dL on average, which was well above the average values of around 90 to 160 mg/dL. A related query showed that Intermountain patients who went home without having their blood sugar managed had more health issues, including needing to be readmitted to a hospital, than those who received blood sugar management.

The cardiovascular surgical team evaluated research on the question with representatives from Inter-

mountain's four open-heart surgery programs and asked them to think about how to manage blood sugar levels. One hospital started testing blood sugar levels when patients were admitted, and put patients with high baseline blood glucose levels — even those who weren't diabetic — on insulin. An anesthesiologist at one hospital devised a procedure where he would infuse patients with glucose and then adjust their insulin levels; he found that this caused patient blood sugar levels to fall below 200. He shared the results with his colleagues, who adopted the same techniques. The result from these efforts was a 50% drop in deaths after heart surgery as well as a reduction in time in intensive care units and shorter overall stays.

Endocrinology

In 2014, Intermountain published its analysis of diabetics and angiograms in *The Journal of the American Medical Association* (*JAMA*).[6] JAMA also published a commentary from a doctor at the Mayo Clinic arguing that what was really happening is that Intermountain does such a good job caring for diabetics that they face no higher risk of heart disease than the general population.[7]

In fact, information sharing has played an important role in how Intermountain providers manage blood sugar levels within their population of diabetic patients. The endocrinology data team analyzed which diabetic patients from across the entire Intermountain group had the lowest average blood sugar levels based on scores from a routine lab test. The practice team took this data and asked the doctors whose patients had the best scores what they had done to help their patients maintain their low levels. Answers varied from using motivational tools to having their assistants call the patient every three months. The analysis gave all of the doctors with diabetes patients a way to connect their patients with the data by showing patients their scores and correlating scores with lifestyles. By doing so, the doctors were taking patient care, and analytics, outside the hospital.

Orthopedics

If there has been a data holdout at Intermountain, it is orthopedics. It is effectively a self-contained department, in that orthopedic surgeries are usually one-time events, handled within an orthopedics group without a lot of patient follow-up except for physical therapy visits. The orthopedics practice does track short-term complications from procedures, such as infection rates, patient time out of work, and how many patients need to return to the operating room. There is a system used to collect physical therapy outcomes. The data from that system suggests that some orthopedists' patients seem to recover more quickly, but data does not measure patients' progress over time. Data doesn't show, for instance, if full knee replacements create better long-term results than partial knee replacements.

Intermountain is evaluating different tools it can use to start to collect that data and use information to better analyze the impact of orthopedics on patient lives. "What I'd love to see is when the patient hits our system, wherever it is, a flag goes up and says 'it's been a year since this person had a knee replacement; fill out the survey and give us some follow-up,'" says CMO Wallace. "That will trigger other care-related questions in the EHR. When you can put that kind of information in front of doctors, they'll start saying, 'Huh? I've always been able to be the Lone Ranger, maybe it does make sense to talk to folks riding the range.'"

Surgery

Intermountain's chief of surgery, Mark Ott, gets reports on surgical infection rates every six months and is using that data to reduce infection rates in operating rooms. When the data showed that surgical infection rates at the flagship hospital, Intermountain Medical Center, were in line with national norms, he presented the findings to the surgeons there. He said, "You think you're great, but compared to other hospitals in the country, you're not above average."

Intermountain uses a collaborative process to encourage behavioral change. Regarding infections, a committee of clinicians spent a year developing a list of 30 possible causes, then whittled it down to five and made recommendations of changes that would address them. Ott sent out a note announcing the five recommendations, and got, he says, "a bunch of people complaining — the usual thing." In particular, they hated having to give up bringing personal items into the operating room, including fleece jackets they would wear to keep warm. "They literally hated that," Ott says. "I would get calls all the time about how stupid that is." Ott himself had to quit wearing his Boston Red Sox cap and instead cover his hair with disposable surgical caps. The doctors argued that there was no hard evidence that the recommendations would actually help. Ott agreed, but told them that in six to nine months he would have data — and if it didn't show results, they could go back to the old ways.

In fact, infection rates fell to half the national standard. When the doctors got the data, they were delighted. But they also asked to relax the rules against personal items in the OR. Ott held firm, saying that since it was not clear how much each of the five factors worked, they needed to keep doing them all.

Ott also explained how data is being used to change the way Intermountain surgeons approach postoperative care following gall bladder removals. Each year, Intermountain performs thousands of gall bladder removals. In 90% of cases patients receive postoperative antibiotics whether or not they have an infection. Ott believed that this standard practice of administering antibiotics was unnecessary. He asked for a data analysis on the use of antibiotics after gall bladder removal. While antibiotics aren't expensive, they still cost something. And if a patient has an allergic reaction to the antibiotic, or develops a drug-resistant *C. difficile* infection leading to colitis, treatment gets pricey. Ott found that the use rate varied across the system; most hospitals used antibiotics at a near 100% rate, while ambulatory care facilities, usually staffed by the same doctors, did not prescribe them at all for the same gall bladder removal surgery. Same doctors, same operation, just a different build-

ing. "Why is that?" Ott asks. He says the data from the different venues show no difference in patient results, so he's encouraging surgeons to rethink prescribing antibiotics.

EAR, NOSE, AND THROAT

In 2014, Intermountain began applying data analytics to ear, nose, and throat surgeries, a subspecialty service within the surgical services program. Wallace had observed that surgeons used four different methods to cauterize, or seal off, bleeding during tonsillectomies. Each method differs significantly in price. Wallace says the question became: Was one method better than the others in limiting bleeding and improving how patients fared? The data showed that there were essentially no differences in complications, length of stay, or hospital readmissions, says Wallace.

In fact, the oldest (and cheapest) method, electrocauterization, held a slight, though insignificant, statistical edge. When the data was presented to the surgeons, they did not exactly embrace the findings. "They said, 'that's all well and good, but — ' especially for those that use the more expensive new stuff, ' — I think my patients do better, they feel better after surgery,'" Wallace says. So a follow-up survey is underway, to collect more data on patient recovery issues. In most cases, there are no dictators in the Intermountain process, says Ott. "We don't tell the surgeons what to use. We say, 'Here's the data. You can use what you want.'"

Care Process Models

Intermountain's doctors and nurses use dozens of different data-based decision-support tools (also known as care process models) to help them care for patients. In the cardiovascular unit, for instance, a tool runs every morning at 9:15 in all 22 of Intermountain's hospitals, pulling readings from patients' vital signs. It sends an email alert telling clinicians which patients are at risk of heart failure, including assessments of their likelihood of being readmitted

to the hospital once released, or of dying. That helps Intermountain adapt its care pathways and the way it handles patient care, accelerating the education process for these patients. It might mean assigning patients to palliative care or a hospice.

These tools help track things humans might miss, says Kim Henrichsen, Intermountain's chief nursing officer. She says that over time, a patient's vital signs can shift subtly, and tools built into the system analyze that data and will automatically send alerts to nurses to monitor patients or check specific vital signs. The algorithms also flag patients who appear to be at high risk for readmission based on previous data patterns, and may lead to Intermountain assigning home care to help reduce the likelihood of readmission. Over time, the hospital has also developed monitoring tools for patients who have a single episode, like hip surgery, versus those with a chronic condition, like chronic heart failure.

Patients who have suffered heart failure are put on up to 14 different drugs, from aspirin to beta-blockers, after their release. Because of the number of medications, Intermountain developed a tool to automatically create the list of medications heart failure patients need. CMO Wallace says this lets clinicians spend their mental energy focusing on what is unique about the patient.

Supply Chain

Industry analysts predict that supply costs will exceed hospitals' top expense — labor — by 2020. The challenge, they say, is that a lack of price transparency and no system for sharing cost information leaves doctors unaware of their supply costs or how to reduce them by requesting equally effective but less expensive alternatives.[8]

At Intermountain, applying analytics to this challenge started in earnest in 2005, when the company started a supply chain organization. With 12,000 vendors, $1.3 billion in non-labor expenses, and a culture that ceded much purchasing authority to doctors, the supply chain managers had their work cut out for them. Perhaps the most significant challenge was finding a way to reduce expenses for physician preference items (PPIs). These are the devices or supplies that doctors request because they prefer them to comparable products. PPI suppliers worked hard to develop relationships with doctors to create physician loyalty to their products. But PPIs could consume as much as 40% of a hospital's supply budget — and one study found nearly $5 billion in annual losses in the health care industry due to PPI-driven waste in the supply chains.

In 2014, Intermountain launched Intermountain ProComp, a system designed to reduce costs by tracking its 50 highest-volume procedures and presenting information to surgeons on their supply options in real time.

Launching ProComp has led to significant cost reductions. Ott's data team dug through about a dozen different systems to figure out what various supplies cost. One thing they found was that some coronary surgeons used sutures that cost $750, while others used sutures that cost $250. The analytics revealed no appreciable difference in patient outcomes. Ott presented the data to the surgeons. "They were fascinated by that," Ott says. "They had no idea that the things they were using cost so much." Most of them stopped using the more expensive sutures.

Sometimes, though, Ott had to attack the problem from the supplier side. In bowel surgeries, Intermountain surgeons use two kinds of end-to-end anastomotic staplers. One type of stapler cost $270, the other, $870. Doctors prefer the more expensive one; two-thirds of the surgeons use it, in fact. Ott says, "I've used them both. I don't really think there's a difference. But when I talk to my surgeons, they are adamant that the more expensive product is clearly better."

They felt that way even after Ott showed them data that found the two staplers were equivalent. Surgeons said patients' bowels leaked more after they used the cheaper stapler, which meant patients would get sick

and need another operation. Or they said that it led to more bleeding after the operation.

Ott turned to his data analytics team, who pulled 170 cases from one of Intermountain's hospitals and combined it with data from the American College of Surgeons' National Surgical Quality Improvement Program. The data showed that leak rates for the two staplers were the same, at about 5%, and the only major bleeding event involved the more expensive stapler.

Ott went back to the surgeons, who acknowledged the data but still wanted to use the expensive stapler. Ott didn't force them to quit using it. Instead, he showed his data to the supplier. "I said, 'either you lower your price to the competitor price, or we're taking you off the shelf.' And they immediately lowered their price." That one minor change saved Intermountain $235,000 a year. In its first year, Pro-Comp cut $25 million from operating costs in its Surgical Services Clinical Program alone. It aims to cut costs by $400 million by 2018.

A New Record System

According to the Organisation for Economic Co-operation and Development, the United States spends, on a per capita basis, more than twice the average spent by 34 industrialized nations on health care ($8,745 in 2012 compared to an average of $3,484), but gets health results towards the bottom of the pack.[9] Critics have fastened on the U.S. fee structure as a big part of the problem, arguing that the system is built around paying for visits, tests, and procedures, many of which are unnecessary, some even harmful. This provides an incentive for providers to focus on quantity of services over quality of care. Intermountain has seen this in action for more than 20 years. It believes its use of data has improved quality and therefore saved lives — more than 1,000 to date.

But for all the benefits the data-centered care brings, it has been a struggle sometimes to pay for it. That change in elective inductions? It was a huge success for patients, but actually meant a revenue loss. In a value-based model, Intermountain would have been rewarded for the better health outcomes.

That is a reason why Intermountain is eager to move to a value-based business model where it gets paid for effectively caring for patients. In a value-based model, insurers will reward health care providers that lower costs by sharing the cost savings. The importance of value-based care to the future of U.S. health care is reflected in the U.S. Department of Health and Human Services' recent announcement that it will tie half of all Medicare provider payments to value-based models by the end of 2018. CDO Pierce knows the effective use of data will be central to making the shift to a new way of doing business.

Intermountain's new EHR is expected to play a pivotal role in helping the organization make this shift.

iCentra

When selecting its new EHR, Intermountain placed its interest in value-based health care at the forefront of its decision making. It selected Cerner, a large EHR vendor based in Kansas City, Missouri. The executive team thought Cerner had the careful attention to the secondary use of data for back-end analytics in addition to an excellent clinical transaction system that could help clinicians make better patient-care decisions. Intermountain's configuration of Cerner products is called iCentra.

Once contracts were signed, Cerner set up shop in the offices next to the Intermountain Medical Center and relocated some of its top development talent to Utah. Pierce meets regularly with his counterparts at Cerner, which includes the occasional six-hour meeting to work through deployment strategies. He's moved his office from the headquarters building to Intermountain Medical Center to be closer to the action but also because there were twists to the deal:

Intermountain wanted to retain its own data management and analytic systems, resulting in the need for increased coordination between the organizations.

In the 18 months since they started working together, the two companies have formed a close relationship. Intermountain is consulting with Cerner on a massive Pentagon contract bid, and the two companies are discussing creating new products built on Intermountain's data management processes and its data warehouse framework.

The Rollout

Intermountain has a standard three-phase approach to all of its technology rollouts. Implementation is the first phase, and includes all of the design, build, training, and "go-live" activities. To prepare for the go-live phase, Intermountain combined a mix of supports that included classroom training, one-on-one coaching sessions, group simulations, super-user experts, physician coaches, and a telephone support help desk that now has the ability to remotely access the user's screen to solve problems and offer guidance.

Once the system is up and running and technically stable in a given hospital — usually after three weeks — the adoption phase begins. It is typical to have large variations in practice surface only after the go-live phase, so Intermountain has a process in place to identify and standardize these variations and adjust workflow designs. Some physicians may not be using the tools as they were designed to be used, or some may be using the tools in a laborious way. The quick-order page, for example, was redesigned as a result of analytics built on data regarding the first weeks of use.

The third stage — optimization — typically occurs over a longer time frame, from four months out to many years. This stage reflects ongoing efforts to improve the effectiveness and efficiency of the system. The time frame for this stage depends on the scope of changes that need to be made to the system.

Unwelcome Delays

No system implementation is without bumps, so Pierce's stomach didn't exactly sink while standing there in the Las Vegas airport, talking to the physician who said that expectations around the adaption of the tools were too aggressive. Once Pierce was back in Salt Lake City, he set up a conversation with Sameer Badlani, who joined Intermountain in October 2014 as its first chief health information officer (CHIO). The CHIO role was created to reflect that caring for patients was going to expand beyond hospitals and clinics into people's homes and communities.

"The common pushback is 'I'm doing too much data entry, spending less time with a patient,'" Badlani told Pierce. Some of this came because they knew the old system better than the new. Some of it was that in the new system, doctors really did need to spend more time inputting data, which they hadn't done a lot of before. And some of it was expectations. "They expect to be facile in a matter of two weeks, and it just doesn't work that way," Badlani said.

In the old system, doctors got a piece of paper with an order on it for prescription or follow-up, signed it, and sent it over to be input by a nurse or a unit clerk. But in the new system, IT was taking five or six minutes to put in an order. "The physician is appropriately saying, 'My day is getting longer,'" Badlani said.

Pierce grimaced. But as he talked to Badlani, he realized that the main problem was managing expectations and large-scale change management. While some doctors do adapt quickly, most have a longer, slower learning curve.

The iCentra system gives Intermountain the analytics to leverage and support change. They just needed to do a better job of explaining to doctors that yes, it might take six minutes to input data, but once it was in the system, patients were getting their next steps processed far more quickly. Errors in things like prescriptions were also dropping significantly. "When you say to a physician, 'Look at what this does for your patient,' that's really powerful," Badlani says.

After Pierce's discussion with Badlani, he and iCentra leadership from Intermountain and Cerner began looking at the iCentra analytics on how physicians were using the system, how much time they spent on documentation, and on order entry, looking for clues to areas where usability needed to be improved.

Pierce also found out that Intermountain had inadvertently run a test in the rollout. All the groups got the same basic training, but some groups went out and organized practice sessions on their own time. These groups as a rule handled the rollout much more effectively. So Badlani, along with the lead iCentra physician executive Mark Briesacher and the rest of the rollout team, started to develop a prescribed training methodology involving follow-up coaching sessions for the physicians after the initial classroom training and unit-based practice.

Badlani and Briesacher are focused on supporting the physicians and clinicians through this massive change. They are working with Pierce to use data in this process. "Our nurses and our doctors are believers," Pierce says. "They're seeking far more data, and they're seeking far more opportunities to have the analytics, to prove better ways of providing care and lowering costs."

Next Steps

Intermountain is not waiting for the industry to fully embrace value-based health care. In 2016, it will dive right in by launching a new insurance product that will make physicians and Intermountain jointly responsible for health care costs. Doctors who reduce costs will earn more income. Wallace thinks this will make them even more focused on data. "If there's a surgeon in a group who's not following that care process model, are going to look at that surgeon and say, 'You start to follow the care process model, or you're out.' That's a peer pressure model that can work well in some circumstances," says Wallace.

Wallace cautions that Intermountain will not force this on people, but that if they don't adopt the process models, doctors won't be able to participate in the shared-risk system that is coming to Intermountain. He thinks that by 2018 this will represent between 50–80% of how all Intermountain health care billing happens.

There will be cultural challenges that emerge from the use of the new system — beyond just getting doctors and nurses to adopt it. Primary care doctors who need to refer patients to specialists will be able to see rankings of these specialists based on internal data and make decisions accordingly. "I'm going to be able to look at what their clinical outcomes are, what their costs are, what their patient satisfaction is," Wallace says. "That's going to be totally transparent among the group. Our goal is to make that ultimately publically transparent."

Pierce knows that transparency will put even more pressure on data quality. The specialist ranking project is set to launch in mid-2015, right around when Pierce will be evaluating how the most recent phase of rollouts of iCentra has gone. Looking at the iCentra launch should provide more data for analyzing ways to improve, so that each rollout in the future will go even more smoothly.

REFERENCES

1. The complete provisions of the American Recovery and Reinvestment Act of 2009 can be obtained here: http://www.recovery.gov/arra/About/Pages/The_Act.aspx

2. The Centers for Medicare and Medicaid Services (CMS) Webpage http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html details incentives for adopting EHRs. A related page at the Indian Health Service website, http://www.ihs.gov/meaningfuluse/incentivesoverview/incentivesreduction/, outlines some of the penalties faced by organizations that don't effectively use EHRs.

3. K. Stewart, "Father of Medical Informatics, Utah's Homer Warner Dies," Salt Lake Tribune, Dec. 3, 2012, http://www.sltrib.com/sltrib/news/55391911-78/warner-medical-homer-utah.html.csp; P. Owens-Liston, "Homer Warner, Founder of Biomedical Informatics," University of Utah Healthcare HealthFeed, Nov. 30, 2012, http://healthcare.utah.edu/healthfeed/postings/2012/11/113012homeobit.php.

4. Intermountain Healthcare: About Us — Medical Informatics: Our History. http://intermountainhealthcare.org/qualityandresearch/informatics/about/Pages/history.aspx (from video), accessed April 4, 2015.

5. K.W. Jones, A.S. Cain, J.H. Mitchell, R.C. Millar, H.L. Rimmasch, T.K. French et al., "Hyperglycemia Predicts Mortality After CABG: Postoperative Hyperglycemia Predicts Dramatic Increases in Mortality After Coronary Artery Bypass Graft Surgery," Journal of Diabetes and its Complications 22, no. 6 (November–December 2008): 365–370. http://www.sciencedirect.com/science/article/pii/S105687270700061X

6. J.B. Muhlestein, D.L. Lappé, J.A.C. Lima, B.D. Rosen, H.T. May, S. Knight, et al., "Effect of Screening for Coronary Artery Disease Using CT Angiography on Mortality and Cardiac Events in High-Risk Patients With Diabetes: The FACTOR-64 Randomized Clinical Trial," JAMA 312, no. 21 (December 3, 2014): 2234–2243. http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.2014.15825

7. R.J. Gibbons, "Optimal Medical Therapy vs CT Angiography Screening for Patients With Diabetes," JAMA 312, no. 21 (December 3, 2014), 2219–2220. http://jama.jamanetwork.com/article.aspx?doi=10.1001/jama.2014.15958

8. According to research published by Material Handling & Logstics: http://mhlnews.com/global-supply-chain/health-care-companies-using-supply-chain-stay-competitive

9. Organisation for Economic Co-operation and Development. "OECD Health Statistics 2014: How does the United States compare?" http://www.oecd.org/unitedstates/Briefing-Note-UNITED-STATES-2014.pdf.

'NO PAIN, NO GAIN' IN THE TRANSITION TO DATA-DRIVEN HEALTH CARE

Commentary by Sam Ransbotham

The heart of the latest analytics initiative at Intermountain Healthcare is the implementation of a new electronic health records (EHR) system. As the case study on the implementation shows, despite Intermountain's history of success with analytics, even the best system implementations can be difficult pills to swallow. They produce a lot of extra work for everyone, and they carry considerable risk and unexpected difficulties. For those learning new systems, the suffering as they're in the early stages of implementation is concrete and visceral; the promised benefits can be abstract and far less certain.

Yet despite the considerable effort and potential for difficulties, many aspects of Intermountain's new EHR implementation are notable and laudable.

As it rolled out the new EHR system, Intermountain limited the number of hospitals and clinics involved in the initial deployment — to 2 of its 22 hospitals and 24 of its 185 clinics. These numbers are small enough to keep the project scope manageable, but at the same time, large enough to create opportunities to benefit from information exchange.

Furthermore, Intermountain has positioned the new EHR system as part of an inclusive analytics initiative with everyone working together on something that, while difficult, has benefits for both patients and the organization itself. Too often, new initiatives come across with users feeling forced to use a new system by management or IT. The prior cardiovascular, endocrinology, and surgery examples each show that Intermountain uses collaborative approaches to benefiting patients rather than fiat-based mandates.

Intermountain is building on a strong foundation: Its history of prior analytics innovation helps on both the technological and organiztional fronts. Technologically, it has a solid infrastructure and technical experience that help reduce project uncertainty. Even an abandoned 2012 overhaul provides a basis for Intermountain technical staff to learn from and perhaps build on. Organizationally, executives and staff have had an analytics culture for many years, with many success stories that illustrate how analytics can transform patient care.

Intermountain's approach to the role and limitations of technology is savvy. It positions tools as helping "track things that humans might miss" and allowing clinicians to "spend their mental energy focusing on what is unique about the patient." This mindset helps with setting realistic expectations about what technology can and cannot do, and it reduces resentment of new technology. The key with analytics is to blend the strengths of technology with the strengths of people. Neither alone is sufficient.

The organization's embrace of transparency is particularly notable. By providing access to data and being forthcoming about its limitations, Intermountain encourages a culture that works to improve data quality. As errors or shortcomings are found, the feedback improves processes. While conceptually easy for many organizations to avow, embracing feedback is difficult to do in practice. Intermountain demonstrates the cumulative benefits that result from building what it calls "the integrity of the data" in a way that engenders a "level of trust from the doctors."

Intermountain shows signs of analytical maturity throughout the case study. We see senior-level leadership on analytics, a high value being placed on data in people's day-to-day work, and a widespread analytics culture — all of which are associated with analytical maturity.

An important feature of analytical maturity is that organizations embed analytics in processes rather than simply regard analytics as a set of beneficial, but ad hoc, projects. A process approach is clear in the feedback loops for data quality, common languages for data "across departments and hospitals," and structured processes for analytical decision making (e.g., operating room clothing). Analytics teams have defined roles (data analysts, data managers, and data architects); equally important, people have career paths and opportunities to progress along within the organization.

When all factors are taken together — an analytics history, savvy blending of technology and people, transparency about data sources and quality, incremental implementation, non-adversarial culture, analytical maturity, and a process focus — Intermountain has created an enviable set of achievements around data that bodes well for its future.

But of course, no analytics initiative will be completely smooth, particularly when it involves new computer systems.

Since Intermountain's new EHR system replaces another, there is a real danger of "second system effect." With the first system, people are often just happy to get it to work. But a replacement system must do more than the first (otherwise, why replace?), and those building it tend to try to accomplish everything that was left out of the first system and to correct all of the earlier shortcomings. As a result, second systems can be what Frederick P. Brooks, Jr. calls "the most dangerous system."

Hearing that doctors were expecting to be "facile in a matter of two weeks" must have been insanely frustrating to the project team. Despite what the case study calls a "standard three-phase approach" to training that included "classroom training, one-on-one coaching sessions, group simulations, super user experts, physician coaches, and a telephone support help desk," my guess is that Intermountain's chief data officer Lee Pierce was ready to yank his hair out in the Las Vegas airport meeting with a physician who had heard "we would be up and running and as efficient as before in just a couple of weeks." Where did expectations go astray?

Analytics initiatives bring challenges that differ depending on the organization's analytical maturity. Beginners struggle to get basic infrastructure and processes established and to get the first, crucial successes that are needed to showcase the system's value (and provide a foundation for continued building). Advanced organizations, on the other hand, may find they must undertake more complex systems or pervasive changes to continue to extract value from data. As a relatively advanced analytical organization, Intermountain's basic opportunities for value from analytics may have already been utilized.

With increasing complexity comes increased difficulty of showing value from data, and from the case study we see that that is clearly true of Intermountain's new EHR system. Drawing conclusions from data is rarely straightforward, particularly in contexts as complex as health care. For example, it is wonderful to use the opportunity to collect follow up data if an orthopedics patient later "hits our system, wherever it is." A holistic overview is a great benefit of an EHR. However, what about patients who *don't* hit the system again? It will be important to consider this source of potential bias in reaching conclusions about the strengths or shortcomings of the initial orthopedic treatment.

Or, in another example, consider the inadvertent test that took place during rollout. This is far from a true randomized test. There is something fundamentally different about a group of people who organize their own practice sessions than groups that do not; causal conclusions will require analysis of the subsequent follow-up coaching sessions, among other considerations. Difficult questions like these are complex to analyze, but simultaneously provide opportunity for analytically mature organizations to derive value from analytics. Data from the new EHR system will support this complex analysis analysis, but gathering the data is only the first of many steps.

Across the United States, both patients and physicians express legitimate concerns about EHR systems. Automation and the data that come with it are not free. Getting these platforms in place is costly; they impose a considerable "time tax" on people throughout the system. Physicians will spend more time using a system than writing a note by hand. Nurses will spend more time documenting.

This is true of most, if not all, changes. When organizations replaced typing pools with distributed

word processing, managers spent more time typing than they had before. Yet going back to typing pools seems absurd now. I expect many of the changes induced by EHR will seem similarly absurd to return to. And the first generations of these systems will be clunkier than later generations. Unfortunately, these clunkier steps are largely inevitable on the path toward benefits from EHR systems and analytics.

Intermountain provides a nice example of many successes from embracing analytics, both historically and with their current initiatives. But even with this rich history, it will continue to have to work through many issues when it comes to deriving value from data. From that perspective, Intermountain's story should be a cautionary tale for those looking to emulate it. Less analytically mature organizations will find it tough to have *only* the difficulties Intermountain has had and can realistically expect more.

Despite the effort required, organizations everywhere (in health care and beyond) need to improve their ability to build value through data.

Sam Ransbotham is an associate professor of information systems at the Carroll School of Management at Boston College and the MIT Sloan Management Review *guest editor for the Data and Analytics Big Idea Initiative.*

He can be reached at sam.ransbotham@bc.edu and on Twitter at @ransbotham.