

What Health Care is Learning From Transportation and Manufacturing

The Transformational Power of Minute-by-Minute
Coordination Systems



ORCONTROL - Minute-by-Minute Coordination

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Summary

Hospitals spend increasingly more time and money each year collecting and analyzing data. In turn, these efforts have led to incredible advances in planning systems and world-class operating practices. Unfortunately, most hospital executives remain frustrated by the meager improvements in the efficiency and productivity of their operations. Both the transportation and manufacturing industries faced the same shortcomings until each realized that great planning and processes are necessary but insufficient to perform optimally.



The missing piece of the puzzle in both industries was the disconnect between a great plan or process and the minute-by-minute coordination and guidance required by the dozens of departments and the hundreds of stakeholders across a large organization. Both industries implemented automated minute-by-minute coordination systems to provide the real-time guidance for their operations. The results were spectacular. Transparency, accountability, and productivity all skyrocketed, both in the U.S. and worldwide.

Hospitals are just now realizing the significance of minute-by-minute coordination systems and are now implementing them to enhance the efficiency of their surgical and procedural departments. These systems expertly handle the real-time coordination of patients, physicians, staff, and critical equipment movements, minute-by-minute.

As a result, these hospitals are performing many more procedures during prime time ([up to a 46% increase](#)), with less employee overtime ([up to a 50% reduction](#)) and seeing a dramatic improvement in the percentage of procedures starting on time ([up to 95%](#)).

What is most remarkable is that stakeholders adopt these systems immediately. They report lower levels of stress and improved patient and physician satisfaction.

Introduction

When the World Health Organization (WHO) launched a global effort to tackle surgical deaths caused by human error, it embraced a lesson from aviation: the checklist.^[1] The flight checklist transformed the aviation industry and has saved countless lives since its widespread adoption in the 1980s.^[2] In much the same way, WHO's Surgical Safety Checklist, introduced in 2008, has reduced patient deaths and complications around the world. In Scotland alone, the 19-point checklist cut patient mortality over a decade by 36%.^[3]

Healthcare is once again adopting an important [innovation](#) from transportation – which followed manufacturing's lead 20 years earlier. The innovation, called minute-by-minute coordination, has dramatically improved operations in manufacturing and transportation. Now, it's transforming healthcare.

Hospitals are deploying minute-by-minute coordination technology on top of their EMR systems (Cerner, Epic, and others) to solve a big stressor and money loser – the failure of disparate departments to coordinate minute-by-minute, both internally and with each other. Such coordination allows hospitals to act quickly so that surgical areas and other high-dollar resources get used efficiently every minute of every day. Poor coordination wastes staff time, idles operating rooms, and leads to patient errors. It also increases anxiety among families and patients forced to endure unnecessary delays and spotty communication with staff.^[4]

Financially, delayed and canceled surgeries are missed opportunities to capitalize on costly OR space and staff. Given the declining margins in spending^[5], using one's OR efficiently is crucial to staying in business.

A few decades ago, the U.S. manufacturing sector was experiencing drastic financial losses in the face of global competition. Manufacturers had to solve logistical difficulties to ensure that vendors could supply needed components just-in-time. Simply put, manufacturers had to become hyperefficient to survive. Automation was making it possible to manage workflows real-time, minute-by-minute, so the industry could immediately identify and prevent logjams, all while the production line was running at top speed. Minute-by-minute coordination systems became an industry best practice in the late 1970s and the standard in the 1980s. By the early 1990s, plants either had adopted an effective coordination system or they were out of business.

INTRODUCTION

Railroad, trucking, and steamship companies faced a similar threat to their profit margins in the 1990s. In response, they deployed minute-by-minute coordination technology that made them hyperefficient and globally competitive. The improvements were not marginal.



In the case of intermodal yards in North America, minute-by-minute coordination systems increased throughput of shipping containers by **240%**, all while reducing labor costs by **20%** and total crashes and damage by **30%**.

According to **DR. THOMAS FEO**, PhD, PE, CEO, Healthcare Control Systems, Inc.,
Endowed Professor, College of Engineering, *University of Texas at Austin*

Hospitals are now following in the footsteps of the manufacturing and transportation industries by deploying these unique systems. The arguments for doing so are compelling. Lack of effective coordination within and across departments limits hospitals from adding between 4 and 80 surgical cases during prime time, 7 a.m. to 3 p.m., each weekday. With average contribution margins per surgical case across the U.S. running over \$5,000, hospital CFOs have documented that the efficiency delivered by coordination systems has increased their bottom lines by \$1 million to \$20 million per year. This benefit is on top of verified savings achieved from reduced overtime, improved nurse retention, lower consumable costs, higher reimbursements, and, most importantly, increases in patient safety and satisfaction.

The hospital's return on investment is striking. The all-in cost to deploy and sustain a minute-by-minute coordination system at a major medical center typically is less than \$300,000 per year.

What Does a Minute-by-Minute Coordination System Do?

An automated coordination system uses minute-by-minute information to monitor processes so that tasks can be executed as efficiently as possible. These systems provide instant accountability by continuously answering, “Who is doing what and where at this very moment?” They focus workers on executing tasks in the here and now, rather than on waiting for after-the-fact reports and analyses. Coordination systems are proactive, not reactive. All stakeholders have simultaneous, digital access to the same timely information, and they receive alerts enabling them to immediately address problems and prevent delays.

“ It made me [proactive to the tenth power](#) rather than reactive to things I couldn't control. ... Now we're looking out of the front windshield rather than reacting to things that already happened. ”

DANIEL ERNST, CRNA, Chief Nurse Anesthetist,
Dell Children's Medical Center of Central Texas, *Ascension Healthcare*

Again, aviation demonstrates the power of these systems. An airport can have a world-class scheduling system with incredible analytics and reporting capabilities, but it cannot operate effectively or safely without an air traffic control system used minute-by-minute in real-time by 100% of its pilots, groundcrews, and other stakeholders. Imagine the chaos – not to mention the crashes and deaths – if pilots did not have access to such minute-by-minute coordination systems.

Hospitals are no different. They send large numbers of patients on a journey each day where the expectation is for an efficient and safe experience. In an environment with disparate workers and objectives, minute-by-minute coordination systems put everyone on the same page.

WHAT DOES A MINUTE-BY-MINUTE COORDINATION SYSTEM DO?

These systems, minute-by-minute, schedule and track patients, staff, rooms, and equipment. They are completely different from the data entry and retrieval reporting systems that are used to fulfill clinical, accounting, and regulatory requirements. In fact, they are a truly different breed of information technology. Automated coordination systems must be easy-to-use and require little, if any, end-user training or manual data entry. Furthermore, these systems must be highly adaptable and customizable so that they can be tweaked on the fly as a facility's operational needs evolve month after month. They empower all stakeholders to take ownership of their responsibilities and to intervene in real-time to prevent snafus.

“ I like to describe it as the **control tower** of the OR. ”

DR. J. SEAN FUNSTON, MD, Professor
of Anesthesiology,
Medical Director Perioperative Services,
University of Texas Medical Branch at Galveston

Even communicating with a coordination system is more transparent and seamless than the tedious transactions required by data entry and retrieval systems. Much of the communication is via users' cell phones and large, easy-to-read electronic touchscreens. The touchscreens are hung throughout patient care and work areas in surgical departments, cath labs, endo suites, sterile processing, blood banks, and many other departments. Each is constantly updated automatically via data feeds from the hospital's other IT systems. In addition, real-time tracking devices placed on charts that travel from room-to-room with patients and worn by physicians and staff are detected by wall-mounted sensors. This real-time location technology provides additional automatic updates to the minute-by-minute coordination system.

The beauty of minute-by-minute coordination systems is they make it possible for every stakeholder to [see the current status of all cases at all times](#) – before, during, and after a procedure.

This is no different from the systems that “show” all stakeholders at an airport which aircrafts are landing, which are taking off, and which are taxiing. Like at an airport, no one in the hospital is left to wonder whether a patient has checked in, if the surgeon has arrived, whether a case was just canceled, or any other critical piece of temporal information.

WHAT DOES A MINUTE-BY-MINUTE COORDINATION SYSTEM DO?



Effective coordination systems use a minimal amount of text, along with icons and color-coding, to provide at-a-glance updates that are highly digestible by busy clinicians and administrators. Authorized personnel can adjust schedules or move a case or staff member to a different room by a simple touch of their finger on a screen. This change is then instantly visible and produces proactive alerts to all stakeholders in the OR, anesthesia, blood

bank, radiology, housekeeping, pharmacy, pathology, and beyond. Furthermore, when a patient is moved from say, surgery to recovery, housekeeping is automatically alerted that the room is now ready to be cleaned so the next case can proceed on time. Even in waiting rooms, families track their loved one's status in real time from registration to recovery.

Hospitals also use minute-by-minute coordination systems to coordinate and balance staffing across multiple facilities. These systems have become critical in plugging holes during hectic days by reassigning available staff across hospitals in the same network. If a surgery at one hospital is suddenly canceled, anesthesiologists and nurses can be immediately sent to a sister hospital grappling with emergencies. Minute-by-minute coordination systems allow hospitals to unlock and use more of their human and physical resources productively.

Stakeholders are enthusiastic adopters because minute-by-minute coordination systems truly help them do their [jobs better and with less stress](#).

These systems seamlessly integrate with existing IT systems and require no changes to existing clinical, accounting, and regulatory practices. That is, they require little if any training to use. They fully complement the many planning and data entry and retrieval systems like Cerner, Epic, and other EMRs that hospitals have so heavily invested in over the last decade.

No Longer 'Flying Blind'

As an OR director at an Ascension Seton hospital, Mara Rosalsky had doubted a coordination system would improve the way her hospital scheduled and managed surgical cases. She had seen other efficiency and reporting “solutions” come and go. At University Medical Center Brackenridge, which closed when its replacement, Dell Seton Medical Center, opened in 2017, OR staff used a digital board to report status updates. But the information had to be input manually, and it was neither timely nor complete. Even though that system was designed to be a step up from the white board and magnets that many hospitals use to display such information, hardly anyone ever looked at the digital board, Rosalsky notes. They knew that “if the nurse doesn’t do her documentation, it’s not there,” she said.

“ Staff spent their days physically running around looking for people, peeking into rooms, calling on the phone. No one knew where everyone was. You truly were flying blind. You were just hoping this surgeon would be done by this time, but (now) [you can see it in real time.](#) ”

DANIEL ERNST, CRNA, Chief Nurse Anesthetist,

Dell Children’s Medical Center of Central Texas, *Ascension Healthcare*

Consequently, physicians and staff did what most of their American peers do when they need to find out where someone is or the status of a case: they called, called again, and then walked down the hall until they found an answer. At Dell Children’s Medical Center, another Ascension facility, staff knew there had to be a better way.

NO LONGER 'FLYING BLIND'

At Dell Seton, the percentage of first cases starting on time improved from 36% to 82%, when comparing pre-deployment numbers to the last six months of 2019. In addition, the system, with its stakeholder alerts and at-a-glance status updates, has shortened the time it takes for operating rooms to be cleaned and readied for the next case. These turnover times fell from an average of 34 minutes to 26 minutes by the end of 2019, a 24% improvement.

“ I was the cynical OR director, but this **exceeds my expectations** every single day. ... I drank the Kool-Aid. ”

MARA ROSALSKY, BS, RN, MSN, Director of Surgical and Interventional Services Dell Seton Medical Center, *Ascension Healthcare*

In addition, the hospital was able to end a longstanding practice of pre-assigning blocks of OR time to each surgeon. Block times are a common practice among U.S. hospitals that results in diminished room and staff utilization and lower case volumes. Rooms go unused because surgeons have little motivation to maximize the productivity of the hospital. Instead, Dell Seton surgeons were asked to use a unique feature of the hospital's coordination system to reserve an open OR slot by submitting a request via their cell phone, much like a diner uses OpenTable to request a restaurant reservation. The coordination “application allowed me to build the confidence with the surgeons to eliminate block times,” Rosalsky said.

As a result, prime-time room utilization increased from **56% to over 80%**.

More importantly, it helped Dell Seton add 31.8% more surgical cases by the end of 2019.

Making Patients Safer

When he was executive vice chancellor for health affairs at the University of Texas, Dr. Ken Shine visited Dell Children's to see its minute-by-minute coordination system in action. Shine said he was so impressed he wanted hospitals throughout the University of Texas System to investigate using the tool.

“ I was frankly flabbergasted. The first thing that struck me was how quiet the pre-op area was. ”

DR. KENNETH SHINE, MD, Executive Vice Chancellor Health Affairs, *The University of Texas System*

Shine also noticed that the parents knew exactly where their child was at all times. “Not only was the recovery room alerted that the kid was coming, the mother was alerted, and so was the cleaning crew,” he said.

Shine, who was president of the Institute of Medicine when its famous report, “To Err Is Human,”^[6] was released in 1999, said automated minute-by-minute coordination systems enhance patient safety in various ways. Everyone knows what is happening, and patient care does not have to wait for a piece of equipment or a person to show up. “It shows what can be accomplished when industrial engineering is applied to healthcare,” he said.

“ You don't have people who need to do catch-up and that increases patient safety. There is a sense in medicine that only physicians and healthcare providers can figure out how to be more efficient. That is a false dichotomy. ”

DR. KENNETH SHINE, MD, Executive Vice Chancellor Health Affairs, *The University of Texas System*

MAKING PATIENTS SAFER

At the UT Medical Branch in Galveston, officials wanted to reduce room turnover times and took Shine's words to heart. After installing a minute-by-minute coordination system in 2013, room turnover times dropped drastically, from 48 minutes to 28 minutes, said Dr. J. Sean Funston, the anesthesiology professor and medical director of perioperative services. "We did it in about six months, and it has stayed that way," he said. "The program and the hardware paid for itself quickly."

“ With a third of our patients being inmates of Texas, the fact that we have been able to have this effect on OR efficiency is remarkable. We have turnover times comparable to large, private hospitals. [We all love it.](#) ”

DR. J. SEAN FUNSTON, MD, Professor of Anesthesiology

Medical Director Perioperative Services, *University of Texas Medical Branch at Galveston*

Dr. Mark Dentz, an anesthesiologist and perioperative operations director at Williamson Medical Center in Franklin, Tennessee, shared that his hospital implemented its coordination system just over a year ago. While it's too early to provide longitudinal data, the duration has been ample for him to deem it indispensable.

“ It allows you to [stay ahead of the curve](#) in terms of patient care. I can't imagine doing my job without it. ”

DR. MARK DENTZ, MD, Anesthesiologist, Perioperative Operations Director,

Williamson Medical Center

At too many hospitals, patients undergoing surgery enter a disorganized world. "When multiple silos exist without coordination, risks rise," said Dr. Sam Awad, Professor of Surgery and Vice Chair for Quality and Safety at Baylor College of Medicine. Like Shine, Awad said he sees patient safety benefits. Awad uses a minute-by-minute coordination system at the two hospitals where he works in Houston.

MAKING PATIENTS SAFER

“There are probably 50 different variables that must happen to a patient before they enter the operating room, and all of this leads to inefficiencies,” he said. “It also leads to, basically, the chance for error, it leads to cancellations, and it leads to bad morale because everyone else is finger-pointing.”

A coordination system is transparent. If consent hasn't been obtained from the patient or the patient's family, everyone can see it still needs to be done. “The feedback from the families is uniformly positive,” Awad said, adding that staff morale has improved and the work environment has become more collegial. “It's a sin that people are not fully aware of these systems and their capabilities.”

He saw other benefits beyond patient safety, including efficiencies that [exceeded his expectations](#).

He also saw room turnover times fall dramatically, from 55 minutes to 28 minutes, and surgical volumes rise over five years from 6,500 cases to 9,500, a 46% increase.

“ If you're at 90% on time for your first case of the day, you're supposed to be awesome. We are up to [95%](#) on-time starts at one of our hospitals. It was 60% when we started in 2012. ”

DR. SAMIR AWAD, MD, MPH, FACS, Professor of Surgery, Vice Chair for Quality and Safety, *Baylor College of Medicine*

The Veterans Health Administration, using a minute-by-minute coordination system at a hospital in Texas, reported in 2013 that the system reduced surgical delays overall by 56%.^[7] At the same time, the VA said, the number of surgical cases increased by 12%; the first case of the day on-time starts rose from 50% to better than 80%; and overall OR utilization jumped from 52% to 80%. Room turnover times fell by 9 minutes, while the time it took from patient check-in to surgery declined by 30 minutes. Overtime was reduced by 50%. The VA's hard-dollar return on its initial \$200,000 investment to deploy its coordination system was \$4.6 million in just the first year.

A Paradigm Shift

So, why isn't every hospital adopting minute-by-minute coordination technology?

Paradigm shifts aren't easy to achieve. They require new approaches to problem-solving. Healthcare is known for traditional thinking, new technology discomfort, and overworked IT staff resistance. Healthcare professionals want reports and are wed to a traditional approach to process improvement.

They collect data, evaluate it, gather to reach a consensus on the findings, implement process changes, and then collect more data to repeat the cycle. Months, maybe even years pass, all while the hospital is not improving its productivity and possibly degrading patient outcomes. It doesn't seem to occur to most hospital executives that their planning and processes are already truly excellent, but they only lack an effective means of executing those plans and processes. That is, they are not aware of minute-by-minute coordination systems and the huge significant value achieved, especially when compared to buying into yet another efficiency study or set of reports.

The transportation and manufacturing industries faced the same barriers. They followed a classical approach to process improvement until they hit a financial ceiling that forced a paradigm shift. By expanding their focus to execution and not limiting it to just process improvement and reporting, they significantly increased productivity and enhanced quality.

“ There is an old saying in transportation – you can have a flawless plan, but if you can't execute, it's worthless! That is the paradigm shift: It's not about further improving your already excellent processes; it's about how you execute those processes in an effective and coordinated manner. ”

DR. THOMAS FEO, PhD, PE, CEO, Healthcare Control Systems, Inc.,
Endowed Professor, College of Engineering, *University of Texas at Austin*

A PARADIGM SHIFT

What is promising is that staff resistance to a minute-by-minute coordination system is usually mild and fleeting. For example, surgeons often balk at sharing their cell phone numbers to receive critical alerts. That was the biggest stumbling block at UT when it moved to their automated coordination system, but it quickly faded. Funston said, “Once we had it (the system), we were all very happy with it.”

In healthcare, there are additional barriers to any new ways of thinking and the deployment of a coordination system. They include executives who have no way of spending money that is not explicitly budgeted. Rarely are funds set aside for a novel technology that brings a new approach to problem-solving. And then there is always strong IT resistance to any project that adds to the existing workload. Paradoxically, hospital CIOs have documented that their minute-by-minute coordination system required very few IT resources to deploy and even fewer to maintain year over year.



“ When I first heard about our minute-by-minute coordination system project and how many stakeholders it involved across our entire medical center, I was convinced that it was going to expose us to significant risks, plus severely strain my IT resources. I am happy to report three years later that deployment costs were quite small, **ongoing IT costs are almost zero**, and to date, no risks have emerged. ”

DANNY SIERRA, Senior Director Information Technology Group, Methodist Hospital and Methodist Children’s Hospital, *HCA Healthcare*

One Size Doesn't Fit All – Flexibility Is Key

A successful coordination system must **adapt** to all types of physical plants, operations, and personnel.

It also must be responsive to the challenges hospitals face, whether they are unannounced visits from accreditors, a new electronic health record system, or a demanding surgeon. It cannot impose a standard method of operation on every facility using the system. In fact, a successful coordination system molds itself seamlessly to each hospital's local practices to improve work execution and productivity. This concept alone took years for senior management at manufacturing plants and transportation companies to accept.

Their knee-jerk approach was to standardize everything, forcing everyone, especially frontline staff, to do things the same way, and, surely, things would have to improve. Consequently, the initial coordination system developed for manufacturing and transportation failed. Designed as inflexible add-on modules to their existing IT systems, they couldn't be modified on the fly. Nor did they have a proper support model allowing for quick modifications from their vendors. Leaders in those industries eventually learned that the team making these modifications must be on-site regularly to identify problems and reconfigure the control system accordingly. They discovered that if changes weren't made within a day or two, stakeholders became disengaged and disgruntled.

Again, the experience of manufacturing and transportation holds true for healthcare. A one-size-fits-all approach will never work. Hospitals with pre-op areas adjacent to ORs must have a different second-by-second workflow configuration than a hospital with its pre-op on one floor and its ORs on another. Likewise, a major teaching hospital with dozens of residents and 80 operating rooms spread across a large campus must be run very differently than an ambulatory surgery center with just six ORs.

ONE SIZE DOESN'T FIT ALL – FLEXIBILITY IS KEY

Having a highly customizable coordination system that can easily be tweaked relies on maintaining a close relationship with the system's vendor. That proved to be a huge benefit at Dell Children's, Ernst said. He can get help reconfiguring the system the same day he discovers a new pressing need or a way to make everything run smoother. Here again, the contrast between coordination systems and data entry and retrieval systems is stark. It can take months to make a change in a system like Cerner or Epic.

“ That's one of the beautiful things about our minute-by-minute coordination system, [it's completely customizable](#). ”

DANIEL ERNST, CRNA, Chief Nurse Anesthetist,

Dell Children's Medical Center of Central Texas, *Ascension Healthcare*

Shine said he immediately noticed that doctors and nurses were “much happier” because the system removed many of their daily frustrations. “They didn't see it as some terrible encroachment on their autonomy,” he said.

Future of Minute-by-Minute Coordination Systems

Given the experience of manufacturing and transportation, minute-by-minute coordination technology is versatile and has staying power. Dell Children's has been using it for 10 years and improving it every month since to maximize its benefits. Hospitals that have seen the impact of coordination systems in the OR are now using it across multiple departments and compiling identical track records of success. These include managing procedures in their cath labs, endo suites, ICU, IR, and maternity wards.

“ I believe that these kinds of systems are inevitable, but I don't believe we have reached a tipping point yet. ”

DR. KENNETH SHINE, MD, Executive Vice Chancellor Health Affairs,

The University of Texas System

Traditional data entry and retrieval systems require specific personnel to manage and sustain them, with a heavy burden placed on IT personnel. Staff turnover can quickly reverse process improvements. But automated coordination solutions are easy to sustain because they do not rely on any individual or group of managers to oversee and maintain logistical practices. History has borne this out, not only in manufacturing and transportation, but now, for over a decade, in healthcare.

Shine said he believes automated minute-by-minute coordination systems in healthcare will be ubiquitous, but like in manufacturing and transportation, hospital leaders will not be forced to act until the current assault on their profit margins becomes intractable.

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Footnotes

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