DASH TECHNOLOGIES

EMPOWERING OPERATING ROOMS WITH AI TECHNOLOGY

"In just a few months' time, the COVID-19 crisis has brought about **years** of change in the way companies in all sectors and regions do business"

-McKinsey Global Survey 2020

Dash AI Technology Series: No. 1 of 2

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The COVID-19 pandemic forced nearly every industry to adopt new skills and new technologies in order to not only survive in a global marketplace, but quite literally, survive a pandemic. Staff meetings have become Zoom calls, cubicles have become home offices, and dozens of everyday tasks have now migrated to online platforms, including grocery shopping, food delivery, and even doctors' visits.

The acceleration of technology is fast-tracking change everywhere. Applied machine learning, artificial intelligence (AI), and data science are moving and evolving quickly to keep up with the increasing pace of change.

According to an October 2020 McKinsey Global Survey of executives, companies have accelerated the digitization of their customer and supply-chain interactions, as well as their internal operations by three to four years, with digital or digitally-enabled products accelerating by seven years.

Hospital OR's: A Major Opportunity

One place where technological changes are most needed, and where they provide the greatest opportunity for cost savings and efficiency, is in hospital operating rooms (ORs).

ORs are the largest contributors to a hospital's financial success, bringing in approximately half of a hospital's total revenue.

However, OR's suffer from a number of inefficiencies, including:

- Lack of communication between team members and devices
- Ad hoc surgical teams
- Poor team dynamics
- Needless duplication of information and resources
- Overlapping processes and responsibilities
- Forgotten procedural steps
- Wasteful practices
- Barriers to in-the-moment expert advice

These inefficiencies can lead to dissatisfaction for all involved—from surgeons, to support staff, to patients—which can create poorer clinical outcomes and higher hospital costs. With so many hospital dollars being spent in the OR, it's clear why hospital boards target this division as a high priority for efficiency efforts.

While current systems help alleviate some problems, they are limited by their lack of all-in-one connectivity between OR devices, their reliance on human interaction for planning and record-keeping, and their inability to provide live, in-surgery virtual services. The best solution to these limitations would be bringing technology and healthcare companies together to pilot digitized and interoperable (AI) software systems for the OR.

AI systems can create virtual checklists that allow surgical teams to account for each step of a surgical procedure. These systems offer seamless views of the tools and equipment needed at each stage of a procedure. Additionally, they account for virtual, real-time consultations with medical device representatives during surgery, and more.

The implementation of AI software in the OR can enhance resource allocation, optimize surgical precision and outcomes, and create positive team dynamics. All of this promotes cost savings for the hospital and other healthcare partners, and results in shorter surgical appointments and a better overall patient experience.

The “OR of Yesterday”: Technology Challenges Impede Efficiency

There are very few places where the pressure to perform to perfection is as high as it is in a hospital OR, since decisions can mean the difference between life and death.

At the same time, the number of professionals trained at the highest level of OR healthcare is falling behind an ever-increasing patient demand. The World Health Organization estimates that by 2030, there will be a personnel shortage of up to 9.9 million physicians, nurses, and midwives.

The future of the OR depends on having much greater procedural efficiency than currently exists in many of today’s hospitals.

Challenge #1: Technology Lacks Connectivity

OR technology has fallen behind that of consumer technology. Even technological novices are syncing data between phones and laptops and sharing large files between family members. Millions of people have easily integrated “smart” technologies into their homes, using apps to control thermostats, doorbells, and more. So why is OR technology less accommodating?

Although medical devices have grown more complex over the years, devices and OR technologies are often disjointed in that they cannot communicate with each other. While it is hard to fathom a world in which our cell phones do not automatically connect to our car stereos, this is the reality that OR staff are facing each day, except with pacemakers and infusion pumps instead of iPhones.

Technical connectivity issues can negatively impact surgical outcomes. In fact, survey results from surgical teams show that a growing number of media disruptions, interfaces, isolated digital solutions, and a higher rate of user errors currently impede the seamless surgical flow.

This issue extends beyond the procedure itself. Before and after surgery, the lack of connectivity can trigger poorly coordinated processes, missing data integration, and duplication of work for hospital employees, especially in double analog and digital data logging. They can lead to surgical postponements and overtime, which reflect poorly on the OR teams.

These inefficiencies, along with the bureaucratic obstacles to correct them, often take place in the context of high administrative demands, leading to frustration among staff members.

Challenge #2: Surgical Teams Lack Effective Communication and Tracking Systems

As with the lack of technical connectivity, the lack of connectivity on the part of the surgical team is costly. Human relationships and communications play a major role in high-stakes, high-acuity settings such as the OR. When teams communicate effectively, it can lead to significant improvements in throughput and turnover time (the interval between patient departure and arrival of the subsequent patient).

The ad hoc system of forming OR teams impedes effective, efficient communication. In fact, both team device problems and communication factors are the most common reasons for the current high stress that surgeons feel.

- **Poor Communication Leads to Conflict, Misunderstandings and Potential Failures**

ORs bring together surgical teams based on which procedures are being done on a given day. Each team member arrives with a different skill set, from a different background. This means that the full surgical team has sometimes never worked together prior to that day.

During surgery, team members are continually navigating unfamiliar team dynamics, while also doing their specific jobs. This constant switching of focus increases the likelihood of miscommunication and interruption during surgical procedures and creates unlimited opportunities for conflict, misunderstandings, or unintentional failures.

Everything in the OR is complex and intertwined. There are waiting periods for the administration of anesthesia and surgical delays while specialists are summoned. These intricate systems require a software accessible by everyone in the OR in real time. Such a technology could standardize tasks, collect and use actionable data, and help maintain effective team and third-party communication.

- **Poor Communication Leads to Duplication of Tasks and Wasteful Systems**

Ineffective communication also leads to duplication of essential tasks, which is not only costly but can threaten patients' lives. Recent studies suggest that up to one fifth of healthcare costs are due to these types of duplications and uncoordinated care. Every healthcare worker and patient is frustratingly aware of this hurdle to a more advanced system of care.

- **Poor Communication Leads to Poor Patient Care**

A disconnected surgical team with poor communication does not go unnoticed by the patient who, as a result, is proven to experience:

- Higher postoperative pain
- Lower postoperative functionality
- Longer length of stay
- Higher occurrence of hospital-related infections
- More complaints and medical errors

Challenge #3: Medical Representatives Lack Virtual Capabilities

The presence of medical representatives (reps) in the OR provides a great benefit to teams using their advanced medical product devices during surgery. The reps' insights can be life-saving and are often critical to a successful surgery.

However, because they must travel long distances to manage hospital accounts across the country, medical reps are often unavailable. Regardless of travel restraints, in the midst of a pandemic, limiting outsiders to any part of a hospital makes sense, especially in an OR.

ORs would benefit greatly from "Zoom-like" software that would allow medical reps to be virtually present in the OR for consultations, as needed, without the expense and unreliability of travel, scheduling, and health issues impacting a surgery.

Past Solutions Fall Short

The "OR of Yesterday" is full of harmful and costly challenges that affect a hospital's bottom line and, most importantly, patient safety and consumer trust.

Although previous process improvement methods have been effective on some level, the insights gained from them have been limited to the speed at which humans can process hand-written data, or through non-interoperable interfaces.

Outdated, disconnected systems that impede efficient communication create stress, negatively impact throughput times, and ultimately cost hospitals time, money and goodwill with their patients and staff. Additionally, these systems do not meet the primary challenges that OR's face today—the interconnectivity of devices and teams.

Approaching current OR challenges by providing piecemeal solutions can further complicate the issue by adding one more piece of disjointed technology to an already disconnected mix of technology.

The New Operating Room: Powered by AI

The Ideal Patient Journey

In a recent study, clinical staff described the ideal patient journey:

1. Needed data is gathered automatically pre-surgery.
2. With needed information, procedures start "just-in-time."
3. Relevant data is displayed in real time, allowing the entire OR team to anticipate and react quickly to any complications.
4. Comprehensive data is collected so efficiency can continue to improve.

Note that data is at the center of each of these ideals. Clinical staff understand that accessibility to information is the key component in a successful patient journey.

OR's are in need of a large-scale, visionary solution that will address a myriad of inefficiencies. Given the acceleration of technology, the transformation of hospital ORs through AI is achievable and warranted.

The What and Why of Artificial Intelligence

AI is a computer system that learns to perform tasks that would normally require human intelligence. Today's AI has the capability to integrate and fully automate all processes relating to patients, personnel, documentation, and equipment.

When compared to hand-written or non-interoperable computers, AI has a superior ability to:

- Evaluate large data sets in real time
- Provide information in a never-before-seen, accessible way
- Improve treatment models and customize treatments to specific populations, individual patients, and more
- Significantly decrease resource waste
- Improve clinical team dynamics

Note a recent study by the research firm Frost & Sullivan, "The permeation of artificial intelligence (AI) and analytics in ORs will help hospitals achieve high potential. Their deployment addresses inefficiencies and challenges that conventional ORs are facing, such as optimal block utilizations, accurate case-by-case costing, and myriad clinical challenges for physicians performing surgery".

Saving $23 Billion With AI

Adopting AI has the potential to save the hospital industry up to $23 billion. Leveraging the healthcare data that already exists can lead to this considerable cost benefit.

In 2013, the world had 153 exabytes of health data, which was roughly equivalent to the storage capacity of 38.3 million DVDs—and this was nearly 10 years ago. AI technology can make this massive amount of data actionable. This can result in numerous new opportunities and a potential for the surgical field to grow immensely.

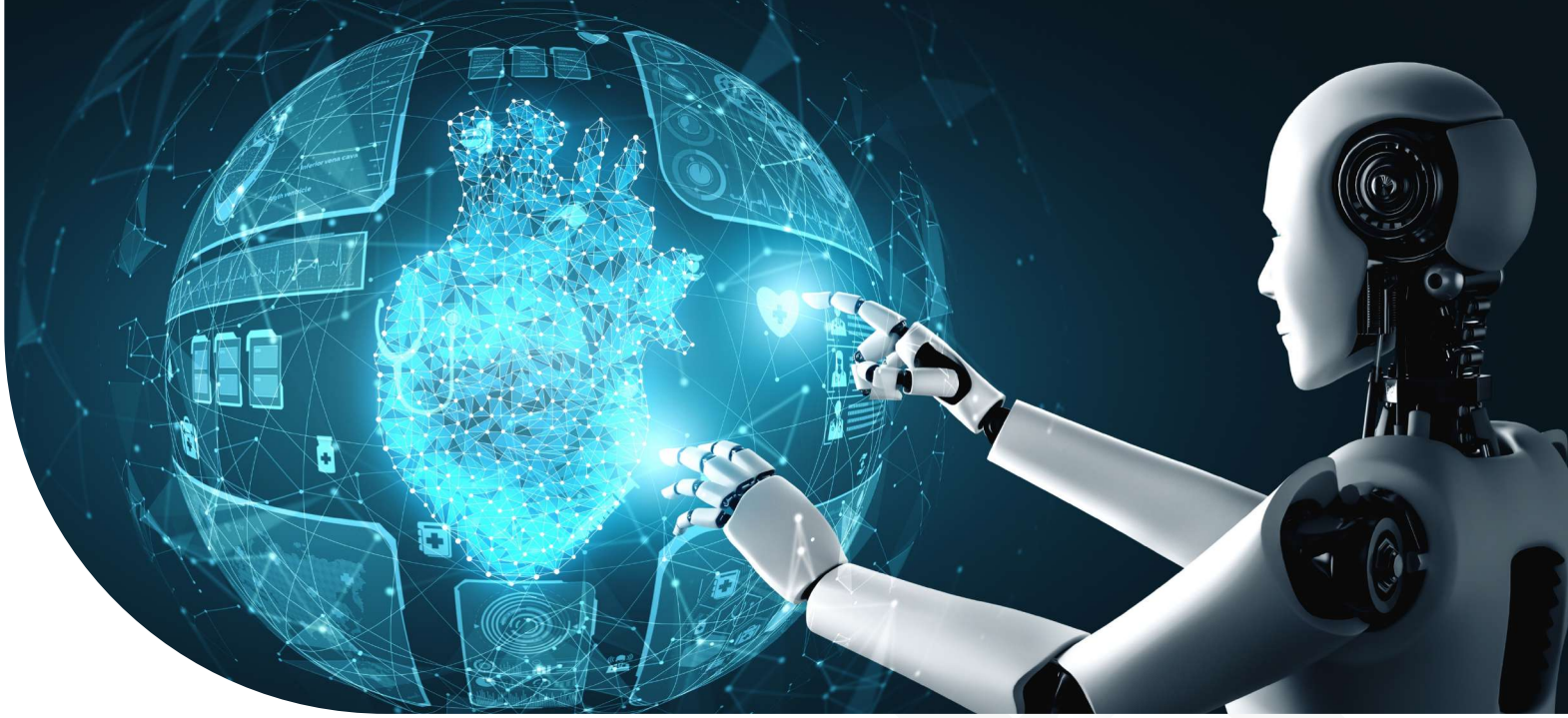
According to Frost & Sullivan, by 2024, the AI market for surgery will grow to $225.4 million, up from $69.1 million in 2019. This growth trajectory has already begun, with many hospitals integrating AI across all of their operations.

Humber River Hospital in Toronto is the world's first all-digital hospital. By adding AI to their operating room, the hospital was able to serve 4,000 additional patients per year, the equivalent of adding 45 new beds.

Additionally, the USFDA is actively facilitating the introduction of AI-enabled medical devices into the market today. Investors are taking notice of AI's increasing role in the healthcare system and investing accordingly.

Healthcare AI, a key investor, has seen about $1 billion in investment dollars. The AI health market is forecast to hit $6.6 billion by 2021. This is 11 times the size of the market in 2014, according to Accenture.

This private infusion of capital will significantly boost both technology companies and the public sector as they integrate AI systems throughout their facilities.



Finding the Right AI Solution: Comprehensive, Integrated Software

AI-powered OR systems pave the way for a new era of proficiency and novel opportunities. AI technology, coupled with the appropriate software, provides interoperable connectivity and addresses current hospital OR inefficiencies in a comprehensive way, from scheduling to post-surgery data handling.

For instance, through integrated scheduling, AI can create efficient and agile room management systems. This also addresses the high degree of uncertainty in daily surgical programs to maximize the OR for the ever-increasing demand for services.

Once inside the OR, an AI-aided surgical procedure would look significantly different. Here are a few examples of how AI could change a typical surgery :

- Linking machine learning algorithms to medical procedure checklists
- Displaying instant imaging data on surgical imaging cockpits which operate through touchscreen control, enabling situation specific and intelligent support with better ergonomics for surgery
- Routing video for the surgical field to be displayed on multiple platforms in the OR to allow the entire team to stay on track and react quickly when needed, without crowding the surgeon

- Allowing surgeons to connect virtually with on-demand medical reps to help surgical teams retrieve accurate and context-relevant information without taking their hands and eyes off the patient

- Allowing clinical team members to ask questions verbally to a medical rep virtually joining the surgery

- Allowing medical representatives to respond virtually, both verbally and visually, to surgical teams on a large screen in the OR, using tools such as a laser pointer to indicate which tools need to be used for a procedure

- Collecting AI data to analyze, detect and respond to audio-visual clues during surgery in real time to help create, maintain, and monitor aseptic surgical techniques and anticipate the instruments and supplies needed for procedures (This ensures the efficiency of the procedure)

- Incorporating actual surgical experiences to inform new, improved techniques and insights

- Empowering junior physicians to perform more complex surgeries based on precise pre-planned imaging data prepared by a senior physician in advance

The ability of AI to work on several levels ultimately reduces patient throughput and turnover times. In fact, studies indicate cutting-suture time can be reduced by an AI-powered OR, which can reduce the time and effort it takes to manually position a patient, set up devices, and synchronize systems.

One study found that AI significantly decreased turnover time from a median of 41 minutes during the baseline period, to 32 minutes in the interval period. Additionally, in the same study, turn-around time significantly decreased from a median of 81.5 minutes to 71 minutes.

AI efficiencies continue beyond the actual surgical procedure, as AI simplifies supporting processes with standardized data handling through automated central storing and a fast data transfer. This allows caregivers to spend more time providing excellent care rather than sifting through large amounts of paperwork.

The potential for AI in the OR is notable. The use of interconnected procedural and resource checklists, increased efficiency between surgical teams and hospital clinical and operations sectors, availability of pre-configurations and imaging data, and an addition of virtual connectivity that can bring in outside experts such as medical representatives at will are key examples.

AI-Powered Software Features

- Procedural Checklists Deliver Higher Throughput Times and Less Risk

One of the most important aspects of team communication in the OR is ensuring delegation of tasks. Given the ad hoc surgical team system and the pressure of the OR, bringing together different specialists to perform at their highest level for each day's procedures can be challenging.

This challenge can be met with AI software that formalizes procedural checklists that team members can mark off as they go through each step of surgery. This assures that steps are not duplicated or neglected, which at times can be life-threatening to the patient.

For example, if a nurse has already administered a medication to the patient, this will be accounted for automatically in the checklist. If through human error another healthcare provider tries to repeat the dosage of the medication, the technology will alert this healthcare provider and prevent the administration of the medicine.

There are numerous potential human errors that can be prevented in the OR with the use of AI. AI tools like procedural checklists and resource lists can prevent consequences of poor communication.

One study discovered that procedural errors are responsible for approximately 4 RSEs per surgery and can be reduced three-fold by using structured digital support for the team time-out before surgery.

- **Resource Checklists Offer Efficient Resource Allocation and Less Waste**

Resource waste can be a major cost issue in the OR. Due to time pressures and communication issues, resource use such as surgical instrument usage is not closely monitored.

Through a real-time AI resource checklist, information about resources and cost can be shared with the clinical team immediately post-surgery to enhance resource allocation and decrease expenditures. This approach is a scientifically proven approach to cutting costs.

One study found that educating surgeons about the price of disposable tools resulted in a 10% decrease in disposable costs for an average decrease of $500,000 in annual costs.

- **Virtual Connectivity for Medical Representatives**

Surgeons in the OR benefit from the expertise of medical reps. However, due to the need for these representatives to travel in person to the hospital, surgeries often lose the opportunity to incorporate their expertise.

AI solves this issue by allowing medical reps to be consulted on demand through virtual chat. Additionally, medical reps can instruct the surgical team on best practices through laser pointers located in the OR room, pointing to tools and specific sites for incision. In addition, AI could create substantial cost savings for both hospitals and medical device companies in this department.

Medical sales representatives typically spend 20% of their time traveling to different hospitals, but that travel time can go as high 50%. With the average business trip in the United States costing companies $1,293 in 2019, new AI technology would significantly reduce travel expenses while increasing opportunities for medical representatives to be present in ORs virtually.

This new system is also beneficial for medical device companies, which would also recognize savings, as they would need fewer representatives overall as each medical rep could cover a larger sales area. With an average annual per representative salary nearing $200,000, this technology could be a game changer for some medical device companies.

The New Operating Room: Software Capabilities Checklist

A comprehensive AI software program using interoperable connectivity would be able to :

- Provide all-in-one interoperable AI software connecting all OR devices
- Link machine learning algorithms to medical procedure checklists
- Virtually check-off staff for each step of surgical procedures
- Integrate procedural checklists with resource checklists
- Provide seamless viewing of the tools and equipment needed at each stage of the procedure

- Display instant imaging data, also operable through touchscreen control, in surgical imaging cockpits
- Provide data collection and analysis in real-time

- Enable situation specific and intelligent support with better ergonomics for surgery

- Allow on-demand virtual medical device reps to help surgical teams retrieve accurate and context-relevant information, responding both verbally and visually on a large screen in the OR, as well as with a laser pointer to indicate which tools need to be used for a procedure

Conclusions

The integration of procedural AI tools and checklists in the hospital OR can play a significant role in OR efficiency. These tools can standardize tasks, collect and use actionable data, and maintain effective team communication.

Additionally, the integration of resource tracking tools and checklists in the hospital OR can decrease duplication of services, lower costs, and provide better coordination of care.

Implementing virtual capabilities during surgery can potentially save lives by allowing medical representatives to offer needed expertise real time in the OR, and assisting surgical teams to maximize new medical device technology.

Altogether, ORs with AI capabilities can enhance team communications, increase patient throughput rates, minimize risk, systemize efficiency, decrease costs, and improve patient experiences.

Endnotes

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