How Telepresence is Making Surgery More Sustainable in the USA; A look at Climate, Costs and Patient Safety

Introduction

Why Sustainability in Healthcare Matters

A sustainable healthcare system is the backbone of a healthy, functioning society. Yet all around the world, healthcare sustainability is facing mounting pressures. Growing, aging populations are ramping up demand, stretching resources to their limits.

While the quality of medical and surgical care is constantly evolving thanks to the ongoing efforts of academic research and frequent advancements in medical technology, the stakes for improving efficiency, consistency and safety across all aspects of healthcare delivery have never been higher.

Looking to the future, we can say that the sustainability of healthcare depends on three key things:

- Cost efficiency, because despite increasing demand there is only so much funding to go around, especially with nations around the world facing so many other economic pressures;
- Patient safety, because a healthcare system that has high incidents of patient harm only contributes to its own burden;
- Better environmental practices, because contributing to a cleaner, greener future will help to improve public health and therefore reduce the burden on health services.

The challenge lies in striking the right balance across all three. For example, certain obvious cost-cutting measures, such as cutting back on staff or investing in training, have a demonstrably negative impact on patient safety, which undercuts efficiency. And while investing in greener technologies is desirable, it comes at a price.

Surgery and Telepresence

In this paper we will focus on how the challenge of achieving this kind of sustainable balance is playing out in the USA's surgical sector. We will also highlight a potential solution in the technology of telepresence, and demonstrate how remote, digital communication technologies are already helping surgical practitioners in the US cut costs, improve patient safety and implement greener practices all at once.

In doing so, we will present a case report on telepresence implementation in operating rooms (OR) across the US involving Proximie, a digital surgical platform that enables hospitals, surgeons, and medical device companies to capture OR data, share information from anywhere, and generate new insights that are contributing to improved outcomes and those all-important efficiency gains. There is a wide range of sustainability factors that we will not address in this paper, as the focus is on the factors that telepresence solutions like Proximie can address directly.

The Challenge

Cost and patient safety

America has the largest healthcare budget in the world, spending twice as much as the average Organization for Economic Co-operation and Development (OECD) Country, 17.8%, though this is not reflected in the country's standing in global rankings of healthcare outcomes (1). Within this context, surgery is often singled out for its contribution to what are perceived as systemic inefficiencies in care provision, on the basis that surgery consumes as much as six times as many resources as other hospital departments (2).

What is particularly worrying is that there are serious concerns over the long-term economic sustainability of the American healthcare model. According to industry analysts McKinsey, the US healthcare system faces a $370 billion risk to industry profit pools by 2027 (3). The knock-on effects of this threaten the affordability of healthcare.

The McKinsey analysis focuses on the impact staff shortages are having on cost efficiencies. Demand for qualified nurses, for example, is forecasted to grow in the US from 7 to 10% by 2025. Yet the COVID-influenced 'Great Resignation' has seen attrition rates in nursing in the US reach as high as 7% in recent years. The fact that demand and supply are pulling in opposite directions could lead to a 450,000 shortfall in registered nurses by the middle of the decade, or 20% of the workforce. That's on top of a forecast shortfall of 50,000 to 80,000 doctors (3), or according to the Association of American medical colleges (4) potentially a shortage as great as 124,000 physicians by 2034. In addition, due to these staff shortages, temporary staff is hired to fill the gaps, causing healthcare systems to shell out a substantial amount of funds. For example, Ochsner in New Orleans costs for non agency labor grew around 60% since 2019 and contract staff grew to nearly 900% (4).

Mensik (2023) states, many medical school and health system leaders are vocal in that addressing the education pipeline is one area legislators could focus on to improve nurse and physician shortages, and support the sustainability of the healthcare ecosystem (4).

Because of these shortages, McKinsey says clinical labor costs could grow by 6 to 10% over the next two years. But it also impacts directly on patient safety. Writing in Forbes, Dr. Sai Balasubramanian points out that the shortage of nurses is leading to patient-to-nurse ratios being stretched to suboptimal levels, leading to delays in care, bottlenecks in admissions and, ultimately, worse outcomes (1).

And in a vicious feedback loop, the worse outcomes are in our healthcare settings, the higher the cost and resource burden is pushed up, ultimately impacting patients.

According to the LeapFrog Group, "many hospitals in this country have safety records that wouldn't be tolerated in any other industry, the statistics are alarming," (5).

According to the World Health Organization (6), "there is a 1 in a million chance of a person being harmed while traveling by plane. In comparison, there is a 1 in 300 chance of a patient being harmed during health care. Industries with a perceived higher risk such as the aviation and nuclear industries have a much better safety record than health care." Some of the staggering statistics in more detail include numbers like 200,000+ people die every year from hospital errors, injuries, accidents, and infections with 1 out of every 25 patients developing an infection in the hospital, and if you are a medicare patient, there is data showing that you have a 1 in 4 chance of experiencing injury, harm or death when admitted to a hospital (5).

Climate Change

Not only is more and more money being spent on healthcare in the US with no improvement in patient safety standards, but it is also coming at a significant cost to the environment.

Globally, healthcare is believed to contribute around 4% of total net emissions from fossil fuel combustion, equivalent to 514 coal-fired power plants (7). Studies show that the healthcare sector in the US is a significant contributor, responsible for approximately a quarter of greenhouse gas emissions (GHG) of all healthcare systems and as much as 10% of the country's total GHG emissions overall (8). A 2020 assessment revealed that emissions from US healthcare rose by 6% between 2010 to 2018, the highest rate among industrialized nations (9).

The public health consequences directly resulting from healthcare-associated emissions are estimated to be equal to preventable medical errors (10). So just as medical errors undermine attempts to make healthcare provision more sustainable, by increasing the cost and resource burden, so too do emissions. A high carbon footprint healthcare system is not just non-sustainable in an environmental sense, but in terms of protecting the efficacy of healthcare provision itself in the long term, too.

Emissions from healthcare can be categorized as direct and indirect. Direct emissions are those that result directly from medical interventions and practices. For example, leading anesthesia experts have acknowledged the considerable environmental impact the use of nitrous oxide and other volatile anesthetics has (11). As these gasses have a 'greenhouse effect' many times stronger than carbon dioxide, studies have suggested that anesthetic gasses could account for 50% of the GHG footprint of the entire operating room (OR).

More indirect sources of emissions include patient transport - both the fact that patients travel to clinics and hospitals at massive scale in order to receive care, and transportation of patients between settings for them to receive the appropriate care. The movement of healthcare professionals for purposes of training and consultation, plus medical logistics and device representatives across the supply chain could be added to this.

Solution

How Telepresence Boosts Efficiency and Sustainability

Telepresence refers to technologies that allow a person to appear to be present in a physical space, feel like they are present or have some effect in that location, all when they are in fact physically absent from that space (12). It is sometimes referred to as remote presence.

Telepresence technology has evolved out of telecommunications, which allows people to influence events and actions over distance through remote communication. Reports of telephones being used by medical professionals to facilitate consultation and guidance over distance date back to at least the early 1950s (13), and many surgeons to this day are still heavily reliant on using this method.

With the arrival of the internet, mobile, cloud and various other digital technologies, telepresence has evolved rapidly. A key breakthrough has been the emergence of livestream video and video conferencing, which recreate the visual 'presence' of people on screens. Following on from that, technologies such as Augmented Reality (AR) and Artificial Intelligence (AI), haptic feedback and remote robotic control have progressively made remote contact more immersive and 'realistic', as well as increasing the extent to which individuals can directly influence events (or even act themselves) from afar.

As surgical telepresence technologies have evolved, their uses across the health ecosystem and in many different patient care pathways have increased. The COVID-19 pandemic was a tipping point, with deployments of 'telehealth' technologies such as remote patient consultations multiplying by factors of ten in a matter of months as US healthcare providers scrambled to maintain services without risking face-to-face transmission of the virus (14).

However, the potential benefits of telepresence technologies in healthcare reach far beyond controlling the transmission of pathogens. From empowering patients to take greater control of their own care to improving access to and utilization of medical expertise, to establishing frameworks for integrated data and knowledge sharing across disciplinary and setting boundaries, to a secure and more private avenue of communication, telepresence is now recognized as a key asset in driving operational efficiencies and achieving better outcomes with less input (15).

Applications of Telepresence in Surgery

Within the last few years, telepresence has become a routine part of surgical practice. There is already a wealth of scientific literature highlighting the effectiveness of telepresence as an educational tool in surgery (16), a facilitator of collaboration between surgical staff, and a useful channel for pre- and post-operative patient consultations (17).

Surgical telepresence platforms are already being widely used for training and education purposes in the operating room. For example, telementoring (i.e. mentoring over distance using remote communication technologies) can replace the need for a surgeon to be physically present to guide the technical aspects of a procedure. Surgical video libraries also provide a rich knowledge resource for training and continued professional development, giving practitioners the opportunity to access demonstrations and observe procedures any time, any place. Similarly, they can have videos of their own practice reviewed in depth by specialists based in other parts of the country and world, driving improvements in technical skill acquisition and helping to reduce procedural variations. Sharable surgical content can be collected through equipment integrated in the ORs already providing real time insights and turned into data for better training, impactful education and more effective case reviews.

By improving opportunities to upskill surgical practitioners, telepresence technologies also help to address inequalities in the availability of surgical expertise, and therefore improve access to care for patients. In the US, for example, it is recognized that there are sharp discrepancies in access to surgical care between remote rural and large urban communities. Studies have shown a high level of interest in telementoring among rural surgeons, primarily for learning new surgical techniques, but also for getting the benefit of intra-operative assistance and guidance during complex cases to help make more procedures available to their local communities (18).

Benefits of Telepresence in Surgery

Though the initial costs of acquiring some surgical telementoring systems range all over the spectrum from low to high, any additional costs may be discouraging to healthcare institutions, initial investments will realize returns through the upskilling of surgical staff, better access to care, improved accuracy and patient outcomes, reduced variation, fewer incidents of patient harm, plus incremental cost efficiencies in the form reduced travel costs etc. By their very nature, because most platforms are built on the back of readily available technologies like digital cameras, cellular networks, WiFi and cloud computing, telepresence solutions are also fast and easy to deploy, as well as highly scalable.

All of that adds up to telepresence solutions being well placed to make surgical services significantly more sustainable in terms of cost, patient safety and the environment.

On patient safety, a growing body of literature is highlighting the positive correlation between telementoring and improved patient outcomes. For example, in one two-year multicenter study, the use of telepresence as a collaborative tool for sharing surgical expertise was shown to have resulted in profound educational benefits. Moreover, post-utilization questionnaires indicated that consultations conducted via telepresence led to clinically significant increases in diagnostic accuracy (19).

Similarly, a study by Latifi et al. investigating the impact of telehealth solutions on trauma and emergency care in rural US hospitals concluded that, as an innovative method of local practitioners acquiring and developing their expertise, telementoring was likely to lead to improvements in the initial evaluation, treatment and care of trauma patients, as well as reduced costs. It found that 'live' telementoring in the form of guided management through cases by specialists based at distant hospitals could have a life-saving impact for patients. The study also found significant financial benefits, such as the fact that, in 29% of the cases analyzed where telementoring took place, the need for air transfer to another hospital was avoided, with average savings of over $20,000 per case on transport alone (20).

We will highlight further examples of telepresence delivering cost savings in a rural surgical institution in the case study on Proximie detailed later in this paper.

A recent article review in the Journal of the American College of Surgeons (JACS) highlighted how cost benefits also go hand in hand with environmental benefits. For example, the article references one education initiative that saved almost $700,000 annually by educating staff on proper disposals in the OR, which also resulted in a 30% reduction in medical waste from a single hospital (21).

Picking up on the topic of transport, more widespread use of immersive remote surgical communication technologies to reduce the number of unnecessary patient, staff, and medical representatives journeys is not only an opportunity to reduce a major cost burden, but it will also have a significant impact on supply-chain carbon emissions (air transport for medical evacuations being a major contributor)(3).

One study which looked at patient transport greenhouse gas emissions from outpatient care at an integrated health care system in the Northwestern US found that a 50% increase in telehealth 'visits' at the onset of the COVID-19 pandemic corresponded with GHG emissions from transport nearly halving (22). A study in Sweden, meanwhile, found that replacing physical visits with telepresence could achieve a 40 to 70-times reduction in carbon emissions, concluding that remote digital communication was the greener option compared with 'local' journeys of just a few kilometers if transportation takes place by automobile (24).

Proximie Case Study

Telepresence in Practice

Proximie is a best-in-class telepresence platform that enables hospitals, surgeons and medical device companies to share expertise and use data from surgical procedures around the world to drive skills development, improve outcomes and productivity, and support the adoption of new technologies. Based on enhanced video and cloud-based data integration, it provides high-fidelity virtual access to any procedure, live or recorded, from anywhere in the world. It is fully HIPAA and GDPR-compliant.

"I founded Proximie based on the ethos that shared knowledge leads to accelerated learning and better patient care. Proximie strives to continuously push the boundaries of what is possible in operating rooms and cath labs, with a mission to provide better training and access to surgical care that ultimately saves and improves more lives."

– Dr. Nadine Haram FRCS (Plast), BEM, CEO and Founder of Proximie.

Initially developed as a remote collaboration tool for intraoperative collaboration and telementoring, applications of Proximie nowadays extend well beyond clinical care and surgical education, including its use as a solution for increasing healthcare sustainability. The case study detailed below describes the far-reaching financial benefits of a telepresence system like Proximie.

Supporting Surgical Provisions

On the request of a lead surgeon, Proximie was deployed at a remote ambulatory surgical center (ASC) in Fairbanks, Alaska. Before Proximie was put in place, the ASC faced numerous challenges in the wake of the COVID-19 pandemic due to its remote location, which made it necessary to reduce caseloads, halt medical device visits and make staff redundant, all affecting service quality. Proximie overcame these limitations, allowing the sole surgeon carrying out specific procedures at the center to increase caseloads again. It also facilitated remote visits by medical representatives and cut costs enough to keep hold of staff retention.

Following the initial implementation, it became clear that Proximie could deliver further benefits to the ASC, namely in allowing the lead surgeon to collaborate and share knowledge with medical practitioners in the remote surrounding areas, positively impacting on patient outcomes while reducing transportation costs and emissions. The same can be said about hospitals of both small and large sizes that adopted Proximie for one specific reason but have found it has become more benefical to the wider organization as a part of the every day.

Proximie's Impact

Reduction in Travel – Climate + Cost

Firstly, Proximie removes the need for consultants, mentors or medical device representatives to attend the OR. At the Fairbanks ASC, this led to an overall reduction in travel costs and travel emissions while also increasing patient safety by ensuring there was a second set of eyes and ears in the OR for complex cases. For example, in the Fall of 2021, the lead surgeon performed a shoulder replacement procedure, but one of the medical device representatives who usually supports this doctor had recently undergone elective surgery and had to stay home. The rep virtually attended using Proximie. At the end of the procedure, the doctor was having some difficulty getting one of the implants in due to an idiosyncrasy of the patient's anatomy. The medical device rep recovering on his sofa at home was able to help the surgeon go through all the options and possibilities, after which the patient went on to make a full recovery.

Another example is with a large hospital in Denver, Colorado. Even after the pandemic, when normal surgical procedures resumed, and widespread air travel for business and medical professionals were the norm again, one of their lead doctors continued using Proximie for its efficiency in the OR specifically in reduction of his own travel. Being able to meet the needs of numerous locations around the country and the world, and yet, being able to preserve his health by not having to travel; and preserving his coherency by not having to be subjected to the time delays and discomforts of jet lag; has all benefitted his patients, colleagues and administrative team in the long run.

Moreover, post-pandemic shortages in pilots and aircrew are not only pushing up air travel costs, but also making flight cancellations and delays much more common (25). Proximie is more reliable than travel, you can guarantee the right people are 'present' when they are needed, as well as reducing emissions and costs. With one Medical Device company at another location using Proximie at least 1 rep from the company did not have to come onsite for 173 different cases and attended virtually through Proximie. According to Business Insider (23) in the last 10 years, 20% of medical sales roles are dedicated to overnight travel. With 260 working days and 3 weeks of vacation, that leaves an average of 48 days of travel per rep. When you multiply the cost of 173 less trips a year for 1 company, the cost savings and reduction in emissions speaks for itself in the impact if implemented across all medical device companies.

"For our reps, things are so much easier now. It used to be the case that they would take a four-hour flight from Seattle to Fairbanks, which is not financially feasible on a regular basis. Without Proximie, several days would be wasted with all the traveling required to attend a case that lasts just a few hours. With Proximie they can now attend to multiple cases in that same timeframe. It's now possible for us to interact more frequently and receive more guidance from our reps than ever before."

– ASC Clinical Director

Onsite Workflow – Patient Safety

Secondly, by using Proximie to broadcast the surgery, space is freed up in the OR for essential staff who are crucial to the workflow. For example in Alaska; a different doctor was carrying out an ACL reconstruction on a pediatric patient, but it wasn't a procedure he had performed frequently. Another surgeon flew up from Spokane to assist in the operating room, but the location also had a couple of different reps and medical professionals that were planning to come and support. The OR was starting to get clogged up with people. The Center therefore used Proximie to streamline who was physically present in the OR, thus decreasing distractions, limiting outside germs, and reducing emissions.

Education and Training – Cost + Patient Safety

Thirdly, improved education and training for current and prospective staff was also a benefit of Proximie witnessed at multiple locations, with the added benefit of overall improvement in internal communication. For example, a clinical team in Rhode Island have used Proximie during onboarding for new staff, and also to store recordings of cases for post-operative review and training purposes. Since the recordings were made by the staff, using their equipment in their ORs, the recordings were touted as a better guide for new staff members than anything made anywhere else could be.

In these institutions, reliance shifted from online platforms such as YouTube as a source of training materials to their own personalized video materials stored on the secure Proximie platform.

In addition, Proximie was used in Alaska for the improvement of operational workflows and internal communication. It meant the clinical directors could monitor multiple ORs at once and communicate through Proximie, all from the comfort of their desk, saving time traveling from OR to OR and improving operational efficiencies by managing multiple rooms at once.

"At the same time as improving communication and operational efficiency, we're recording the procedure so that we can subsequently review cases, meaning we can review and hone our technique for the next procedure. This is a great help considering how hard it is to ensure the availability of training resources in such a remote location. Any new staff that join us can now be trained more quickly, and the recordings can also be used as a means of refining technique by our existing staff."

– Clinical Team Member

Conclusion

With population growth and rising resource consumption, surgical innovation is vital to improving sustainability in the US healthcare industry. The US healthcare system is among the leading contributors to climate change, necessitating prompt and reliable solutions.

Telepresence has become increasingly prevalent in healthcare settings in recent years, especially in the wake of the COVID-19 pandemic. But beyond assisting with infection control by reducing in-person contact, many more benefits have been recognized and documented, including its use as a training and collaboration adjunct in surgical practice, and its utility in ensuring patient standards are maintained at an optimal level irrespective of location and expertise present on site.

And as in the examples of Proximie's deployments, the benefits of telepresence extend beyond education and intra-operative support, producing system-level results including cost savings and improved hospital workflow.

The future of healthcare is digital and the foundation for a healthy and functioning society in the long term. The widespread adoption of surgical telepresence platforms such as Proximie can aid in creating a more carbon-neutral healthcare system in the US while still maintaining or improving standards of care and reducing costs. Implementing a surgical telepresence solution is a simple step in the right direction, aiding in the more complex challenge of creating a more sustainable US healthcare ecosystem.

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