HOW AI & AUTOMATION **IMPACTS HEALTHCARE FACILITY DESIGN**

From Autonomous Pharmacies to AI Surgical Assistants

The healthcare industry has been notoriously slow to adopt new technologies due to regulatory uncertainty and security concerns. However, AI in healthcare is seeing extensive growth. AI in healthcare is expected to reach $173 billion by 2029. With this rapid expansion, architecture and design of healthcare facilities has already begun to change and will continue to evolve as these technologies expand. Ultimately, embracing AI-focused design today means setting the foundation for a more efficient, responsive, and patient-centric healthcare system tomorrow.

HOW HEALTHCARE FACILITIES HAVE ALREADY RESPONDED

As Business Unit Leader of the healthcare sector within the nationally recognized design firm HED, and someone who has worked in the healthcare sector for almost 35 years, I have seen how healthcare design has responded to changing environments. For example, following the pandemic, there was an increased focus on employee well-being. Healthcare facilities pivoted by adding design elements such as increased access to nature and decompression rooms. Today, healthcare systems are embracing AI and automation in their facilities in various ways. In areas demanding a high level of both precision and repetition over extended periods, AI and robotics outperform humans for consistency and accuracy.

In northern California, our team designed a mostly autonomous pharmacy that uses machines to pull medications for patients – robotic pharmacies often achieve accuracies well over 99%, providing safer dosing for patients.

Healthcare systems have also incorporated robot assistants that can be used to do simple tasks like make deliveries to patient rooms or mix IVs. To accommodate these robots, they've implemented "backstage" areas the robots can use to move freely without interrupting common area flow or designated paths in common spaces, so patients and robots share the same space without congestion. In the future, this may be taken a step further with AI-informed ordering that predicts exactly when to begin mixing IVs and how many, to reduce waste and optimize IV storage used.

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One of the most beneficial aspects of AI is data gathering and modeling to enhance operations. Using a digital building data monitoring system that AI can learn from and then extrapolate trends from can exponentially increase building system efficiency. With strict budgets and high operational demands, healthcare systems must always try to do more with less.

By using AI to discover building use trends, healthcare facilities management can be proactive and maximize resource and energy use, monitor system performance, evaluate equipment use and reliability, identify trends in occupant and user behavior, reduce energy costs, and create predictive maintenance and procurement plans. Additionally, AI can enable different teams to generate insights from the same data sets, enhancing multiple team's performance such as improving procedure planning for the caregiver team, understanding and evaluating service provider and vendor performance at the facilities and equipment level and gain clear ROI insight, as well as ensuring safety and regulation compliance in operations. Whether being audited or not, AI can monitor, track, predict and identify aberrations or inefficiencies in operations over long and short durations to keep employees and visitors safe. All of these efficiencies come down to AI's ability to ingest huge amounts of data, identify patterns and create predictions or identify outliers – the cost savings are probably only limited by our own creativity to leverage it.

HOW AI AND AUTOMATION WILL IMPACT FACILITY DESIGN

Building data collection and measurement, robotics, RFID, automation and some AI applications have already begun to radically transform healthcare design, but the real evolution is yet to come. Now is the critical moment to envision how this technology will shape the future and prepare our healthcare facilities accordingly. Below are 3 ways AI and automation will impact hospital and healthcare facility design:

AI Assistants | AI assistants aren't new; we've all called a business and had a robot answer to help or direct us to help. But we could see this concept expand greatly in the hospital settings. When going to an appointment, instead of being greeted by a person, patients could have a fully automated welcome experience. AI would go down a symptom list to help prep a nurse. The AI solution could then route the patient throughout the facility to get tests or wait for the doctor.

AI assistants can also help with surgeries both in assisting surgeons and helping to train future surgeons. A robotic assistant can assist in surgery rooms with repetitive, precise tasks such as suturing.

For education, virtual reality can create a safe, immersive place to practice procedures. AI machines can then pull data to provide real-time feedback and tips to surgeons or even throw curveballs. AI coaches can supply insights beyond surgery such as how the doctor communicated with patients or if there are any risks with treatment plans provided.

Enhanced Data and Flow Mapping | Enhanced data and flow mapping are revolutionizing the way healthcare facilities operate. While current AI applications already provide valuable insights into energy consumption and lighting, there is immense potential to expand this technology to track patient and staff movement within the facility.

There have been instances where patients have died because they're put in the wrong area or have walked out of rooms and staff can't locate them. AI would help ensure this doesn't occur by tracking patient occupancy and sending alerts if patients move outside of allotted boundaries such as their rooms, down the hall or near exits.

Flow mapping and tracking occupancy can also create predictability through data-driven insights. Are procedures running long? Is bed space reducing? Are average patient stays increasing? AI can answer each of these questions, use the data to provide predictions and give insights on how to fix any issues.

Remote Monitoring | In the ICU, you have to have a direct line of sight from the nurse's station or a remote desk. However, incorporating this into facility design, and ensuring adequate staffing, is a challenge. AI sensors can help solve this problem through expanded monitoring. The sensors can monitor patients for changes in vitals, respiratory rate or breathing and alert nurses if necessary. It can also monitor for events like a patient falling on their way to the bathroom. Remote monitoring allows for less physical visits and frees up nurses' time so they can focus on patients who need physical care. Response time can also be reduced by using real-time alerts, data and predictability.

The current implementations of AI and automation within healthcare settings are only the beginning. We'll certainly see additional use cases, and the architecture and design of facilities will need to keep up.

Staying on the cutting edge of technology is not just an option—it's a necessity to ensure patients receive the highest quality care. Integrating AI and automation into healthcare facilities is poised to enhance efficiency, accuracy, and patient outcomes dramatically. Imagine hospitals where AI systems predict patient influxes, optimizing staff allocation and reducing wait times. Envision smart rooms equipped with automated systems that adjust lighting and climate for individual patient comfort, or robotic assistants that enhance surgical precision. By working with a design firm attuned to these advancements, healthcare providers can transform their facilities into innovative spaces that offer unparalleled patient care and operational excellence.

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