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Building a Smart Hospital Cardiovascular Surgery Program: Lessons from the Ground Up

POINTS TO REMEMBER

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ABSTRACT

This Points to Remember column outlines the foundational strategies, technological integrations, and early outcomes that shaped our cardiovascular surgery program's initial success when opening a smart hospital in March 2025. Houston Methodist Cypress leveraged advanced artificial intelligence-driven systems to improve surgical outcomes and optimize patient care through real-time data integration with electronic health records. These tools were foundational to the hospital's design, resulting in optimization of patient-centered care through sustainable practices and efficiencies.

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INTRODUCTION

Houston Methodist opened its first entirely smart hospital in March 2025 in Cypress, Texas. Included in the launch of Houston Methodist Cypress (HMCY), the cardiovascular (CV) surgery program had a clear strategic vision: to create an integrated, high-performance ecosystem leveraging advanced technology, patient-centric design, and interdisciplinary collaboration. This article outlines the foundational strategies, technological integrations, and early outcomes that shaped the program's initial success.

HMCY leveraged advanced artificial intelligence-driven systems, combining ambient intelligence, in-room computer vision, and voice-enabled bedside technologies to improve surgical outcomes and optimize patient care through real-time data integration with electronic health records. These tools were not supplementary; rather, they were foundational to the hospital's design and resulted in early clinical wins through optimization of patient-centered care, achieved through sustainable practices and efficiencies such as real-time hemodynamic monitoring, hands-free command functionality across patient care areas, and streamlined intraoperative communication.[1]

DISCUSSION

Before the first patient arrived, HMCY engaged in deliberate infrastructure planning, system-wide collaboration, and stakeholder alignment. Leadership emphasized embedding innovation into the physical and digital fabric of the hospital to ensure readiness on day one. The approach was grounded in "day-in-the-life" scenario planning with multidisciplinary input from CV surgeons, the anesthesia team, perioperative services, and the Intensive Care Unit (ICU) team (Figures 1 and 2). Together, the teams worked to anticipate real-world challenges and refine workflows accordingly. We created an environment where high-fidelity care could be delivered consistently and efficiently across the CV continuum.

Central to the program's success was a robust CV team onboarding strategy. This included multi-campus immersive clinical simulation and structured mentorship. The curriculum emphasized both technical competency and psychological safety, promoting early team cohesion and resilience. The result was a highly engaged workforce evidenced by early metrics including 0% YTD RN turnover and strong employee opinion scores. This strategic investment in human capital ensured that the team was clinically prepared and culturally aligned.

Between March and July 2025, HMCY recorded several notable clinical and operational outcomes:

- STEMI length of stay (LOS): 4.1 days, in line with national standards of 3 to 4 days[2]
- Coronary artery bypass graft (CABG) LOS: 6.3 days, outperforming the national average of 6.9 days (Figure 3)[3]
- CABG extubation time: Average of 3.6 hours; excluding one outlier (50.5 hours), the mean is 3.45 hours—surpassing Society of Thoracic Surgeons (STS) goals of < 6 hours[4]
- STS reportable metrics: 0% mortality, 0% readmission, and 8% reintubation rate

Figure 1 Staff engagement during "day in the life" hospital-wide simulation. Printed with permission from Houston Methodist.

Figure 2 Coronary artery bypass graft dry run. Printed with permission from Houston Methodist.

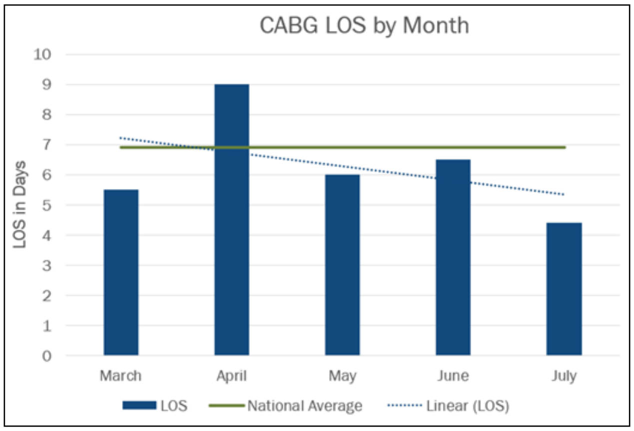

Figure 3 Houston Methodist Cypress CABG LOS March–July 2025 (unpublished raw data, 2025).[5] CABG: coronary artery bypass graft; LOS: length of stay

These early results reflect successful alignment with national quality metrics and underscore the importance of intentional design in care delivery.

To support continuity of care, HMCY implemented nightly virtual ICU rounds with the CV surgeon, nurse practitioner, ICU charge nurse, and virtual intensivist. This digital bridge between disciplines enhanced real-time clinical decision-making and situational awareness. The model contributed to reduced care variability and improved interdisciplinary communication, both key drivers of patient safety and outcome optimization.

High-reliability principles were operationalized through structured handoffs, secure chat platforms, and routine debriefs across the catheterization lab, operating room, ICU, and anesthesia. These touchpoints created closed-loop communication channels, accelerating rapid-cycle process improvements and embedding best practices. Feedback from frontline clinicians drove continuous refinements in care pathways, reinforcing a learning culture within the CV program.

POINTS TO REMEMBER

The following are some points to consider when building a high-performing smart CV unit or hospital.

- **Start with vision and stakeholder alignment.** Early leadership engagement and inclusive planning fostered ownership across departments and ensured alignment with Society of Thoracic Surgeons (STS) and national benchmarks.
- **Design infrastructure around technology.** Purposeful integration of platforms such as HemoSphere Alta (Edwards Lifesciences) and Apella created the conditions for efficient, high-fidelity, team-based care.
- **Prioritize human capital.** A comprehensive CV nurse onboarding program incorporating simulation, mentorship, and multicampus exposure built clinical readiness and psychological safety.[6]
- **Build feedback into practice.** Structured handoffs, secure communication, and debriefs across disciplines enabled iterative refinement and high reliability in care delivery.
- **Leverage virtual capabilities.** Nightly interdisciplinary virtual ICU rounds reinforced continuity and optimized care planning for high-acuity patients.[7]
- **Optimize ventilation practices.** Extubation times exceeding STS benchmarks reflect the team's commitment to quality metrics, recovery acceleration, and protocol alignment.

CONCLUSION

Smart hospitals are not defined solely by their technology but by how technology, people, and processes are purposefully integrated to serve patient-centered outcomes. The early achievements at Houston Methodist Cypress affirm that success is built through strategic design, not serendipity. As we move forward, continued focus on data-driven insight, adaptable innovation, and cross-functional collaboration will ensure sustained excellence in CV care. These insights offer a practical blueprint for other institutions aiming to build high-performing CV programs in the evolving landscape of artificial intelligence-enabled healthcare.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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