2024

# The State of Healthcare Construction


ROBINS & MORTON

Building With Purpose®

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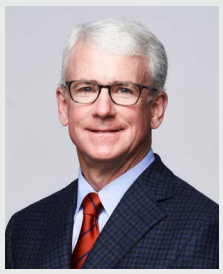
## FROM THE CHAIRMAN & CEO



I am pleased to introduce the fourth edition of our State of Healthcare Construction Report.

In the past three editions, we have documented the landscape of healthcare construction and identified emerging trends. This year, we directly address the most pressing industry topics, including sustainability, carbon reduction, predictive analytics, artificial intelligence, and patient and staff wellness.

Once again we tap into the collective knowledge of healthcare leaders, consultants, construction experts, and design professionals to uncover key insights.

Your continued support of this publication is deeply appreciated.

Bill Morton
Chairman & CEO

# Introduction

Welcome to the fourth edition of The State of Healthcare Construction Report.

In this year's report, we asked our contributors – healthcare leaders, architects, consultants, and builders – to respond to some of the biggest questions in healthcare construction today.

These conversations confirmed the benefits of taking a long-term, holistic approach to decision-making. Whether navigating life-cycle cost or facility resiliency, rightsizing spaces, or building the healthiest patient and staff spaces possible, we know these decisions will impact the communities we serve for a century to come.

The report contains four sections. We open with a fundamental question asked of each report participant: What do healthcare leaders need from their design and construction teams today? Section one shares several of their timely answers that inform the remainder of the report.

Next, we examine the relationship between economic constraints and the needs of health systems to plan and fund capital projects. Contributors to this section described several emerging ideas to provide greater efficiency and value throughout the design and construction process.

The remaining sections explore digital automation, AI, and predictive analytics, and how sustainability and its goal to reduce carbon emissions present new opportunities for strategic gain.

We hope you find the insights valuable. We also invite your comments and ideas. Click or scan the QR code below to provide your thoughts in the Robins & Morton-developed PlusDelta app, which is also available for your personal use at plusdelta.app.

02

# Partnerships in Construction and Design

***What do healthcare leaders need from their design and construction teams today?***

Any new exploration of trends, challenges, and innovative approaches in the construction industry must start by understanding what healthcare leaders need and expect from their construction and design teams.

**Today, healthcare leaders say they need design and construction partners that can help respond to their organization's economic pressures, competition, environmental stewardship goals, and patient and staff safety priorities.**

In a time of rapid change and mounting expectations, the 2024 State of Healthcare Construction Report shares insights from more than a dozen contributors – healthcare leaders, architects, contractors, and consultants – highlighting the issues they believe to be most critical in the coming years.

## ASHE AND ACHE 2023 CONSTRUCTION SURVEY INSIGHTS

The 2023 Hospital Construction Survey, conducted by the American Society for Health Care Engineering's (ASHE) Health Facilities Management magazine, reports that health system respondents prioritized **sustainability, technology,** and **safety** in their decision-making on construction and renovation projects.

**Workforce challenges** topped the list of hospital CEO concerns in 2023 according to the American College of Healthcare Executives' annual survey of top issues confronting hospitals.

For the third year in a row, **financial challenges** ranked second among the CEOs.

**CLINT RUSSELL**
*Vice President, Design and Construction*
HCA Healthcare

**“It’s so important for our design and construction partners to see themselves as an extension of our department.** When they view the budget as though it was their money and investment, that helps.

Over the past three years, for example, we shifted from purchasing products when needed during construction to buying them immediately after the bid to lock in pricing. Our partners have a big part in helping make these purchasing decisions.

We all benefit from candid feedback and open dialogue throughout the process. As the client, we exist to remove roadblocks. You hire a fantastic team, let them do their job, and help them by removing obstacles.”

**“Clients need creative, collaborative partnerships.** They need design and construction firms to work together to accomplish the client organization’s goals – both the large, obvious goals and the smaller subtle ones that exist on every project but may not be as visible or as talked about.

We also need to help them deliver the project faster and at a lower cost. To do this, we must challenge the status quo by helping them reconsider the established clinical needs of the past. That will mean digging in and separating true needs from the wants to make design and construction more effective and stringent.”

**CHRIS DUNLOP,** AIA, ACHA
*Associate Principal*
HuntonBrady Architects

**“From design practices to construction practices, it’s the human side of the project that matters.** Wayfinding, for example. When guests come in, is it intuitive? Where is the registration, the stairs, the elevators, or the bathrooms?

Construction can be intrusive. We want to try to minimize that. I’m always looking for our contractors to come up with new ideas, different ideas, on how to keep the infection control measures in place but not be overbearing, not be intrusive on the look and the feel of the hospital. Yes, we know we have construction going on, but we don’t need to be in the way of everybody as the hospital is going about its normal day-to-day operation.”

**MATTHEW WALDROP,** CHC
*Director, Construction & Development Real Estate & Facilities*
UNC Health

**“The best design and construction partners think of patients, families, and caregivers first.** Listening and learning about the needs of those who will use the spaces they create is critical. Collaboration then becomes the driver.

A true partnership between those with clinical knowledge and those with knowledge of state-of-the-art design and construction allows for innovation, out-of-the-box thinking, and the creation of spaces that truly promote healing and well-being for patients, families, and caregivers.”

**CAITLIN STELLA,** MPH
*Chief Executive Officer*
Joe DiMaggio Children’s Hospital

**EDWIGE CLARK,** CDG, LEED AP
*Senior Project Manager*
Robins & Morton

**“Clients need trustworthy partners, people who can be adaptive and flexible to meet evolving requirements.**

I can’t tell you how often I’ve been on a project where the client has to move the occupancy date up because of a major need on their end. They ask if there is any way the project can open three months, or six months, sooner.

Saying, ‘Hey, sorry, that’s not what the contract says, we can’t help you,’ is not an acceptable answer. So, coming together as a team, figuring out how to tackle it and solve their dilemma, is what they’re looking for – somebody who can adapt and be flexible to their needs.”

**“Brutal honesty.** It starts up front with being honest with the client when asked about their project budget and schedule. That is when direct, honest feedback and counsel is needed instead of a drawn-out analysis.

Understanding production rates, labor availability, and product lead times is essential in being able to develop a true schedule that reflects what’s going to happen in the field.”

**PATRICK DUKE,** CRE
*Americas Healthcare Solutions Lead*
Turner & Townsend Healthcare

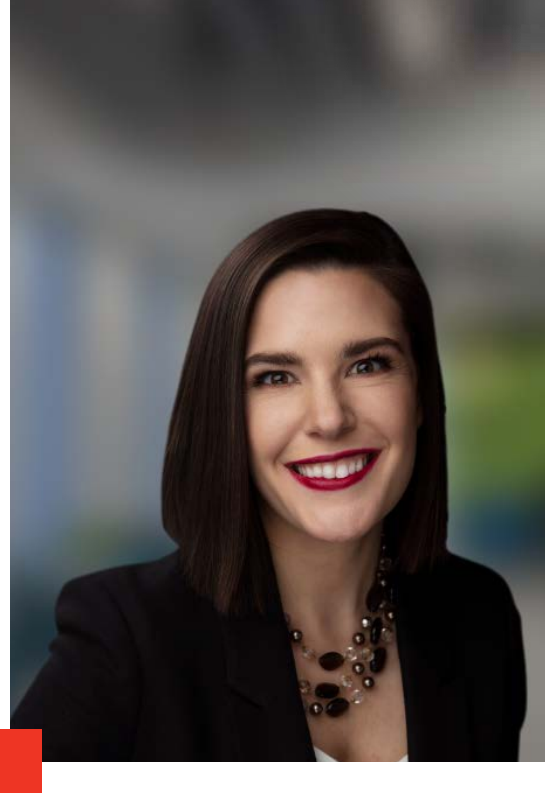
**“Innovation and a willingness to reassess things that maybe once were looked at as expensive or risky.** We need to be eager to do the analysis to be able to make the most informed decisions.

Putting myself in the client’s position, I want a team that’s not going to just settle on what was done last time. Whether the goal is to be more efficient, provide a better patient experience, or meet any number of different conditions of satisfaction, I want a team that will collaborate with a goal of validating more innovative ideas.”

**JACKIE MUSTAKAS,** LEED AP, WELL AP
*Senior Sustainability Manager*
Robins & Morton

**“Being very clear about what my purpose is as an individual working on a hospital project,** and making sure that purpose of caring for people and creating healing spaces is embraced by the entire team is a good place to start.”

**BILL HERCULES,** FAIA, FACHA, FACHE
*President / CEO*
WJH Health



**LINDSEY BRACKETT,**
CHC, CHFM, SASHE, CHOP
*President and Chief Empowerment Officer*
Legacy FM

**“I think above anything else, if you work in healthcare, you have a calling to serve.** And if you can cultivate that passion for quality patient care to all of your business partners, your vendors, your contractors, and your architect, understanding that at the end of the day, our common mission is to provide quality, safe patient care, everything else should point to that.

We always need to ask, ‘Is this the best decision for the patient?’ And I think that mindset will inform the short- and long-term decisions about design, construction, operations, and compliance.”

**“Helping with the long-term strategy – 30 years or more out – is needed today.** With so many facilities aging out, more master planning and strategic thinking are important steps before allocating funds.”

**CULLEN PITTS,** AIA, LEED AP
*Principal*
McMillan Pazdan Smith Architecture

**BEN LEAVER,** CPA, CCIFP, CRIS
*Chief Financial Officer*
Robins & Morton

**“Given the complexity of healthcare building, our clients need transparency.** There are always going to be unknowns, things that evolve in the project, and risks that need to be addressed. We cannot promise certainty, but we can provide transparency and integrity throughout.

Clients need to know if they want to build a 10-story hospital tower, that Robins & Morton thinks it can be done for X dollars and on X timeline, based on these current factors. And if any of that changes, Robins & Morton will tell them why it changed, how we can mitigate it, and what the cost and schedule impacts are.”

# 03 Industry Trends

***Can design and construction collaborations help advance efficiency, value, and staff retention?***

## TAKEAWAYS

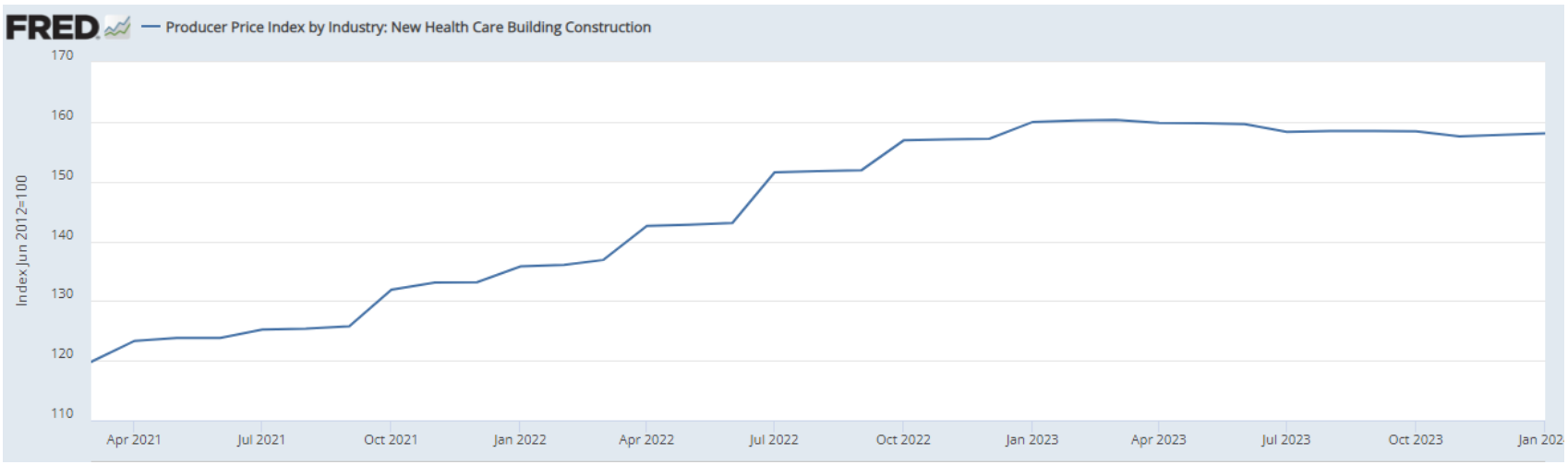
- In the past few years, rising costs for labor, energy, materials, and technology have made it harder to plan and fund capital construction projects for many health systems, especially for community and rural hospitals.
- Early-stage planning and decision-making with cross-discipline teams are providing clients with a longer-term view informed by outcome-based programming and budgeting.
- Wellness initiatives for patients and caregivers are meeting stakeholder expectations for healthy, safe hospital environments while supporting staff recruitment and retention.

In 2024, healthcare providers face a familiar set of budget, competition, and revenue headwinds.

## Benchmark economic data and observations by contributors show a mix of positive news and continuing challenges.

Two positive signs are easing inflation and higher margins for many U.S. health systems. Monthly revenue data tracked from 1,300 hospitals by Syntellis Performance Solutions and reported by Kaufman Hall shows average operating margins on the rise – up by more than 15% compared to 2022, a statistical low point of the pandemic years. Syntellis research also shows outpatient revenue growing significantly, increasing by more than 40% compared to 2020.

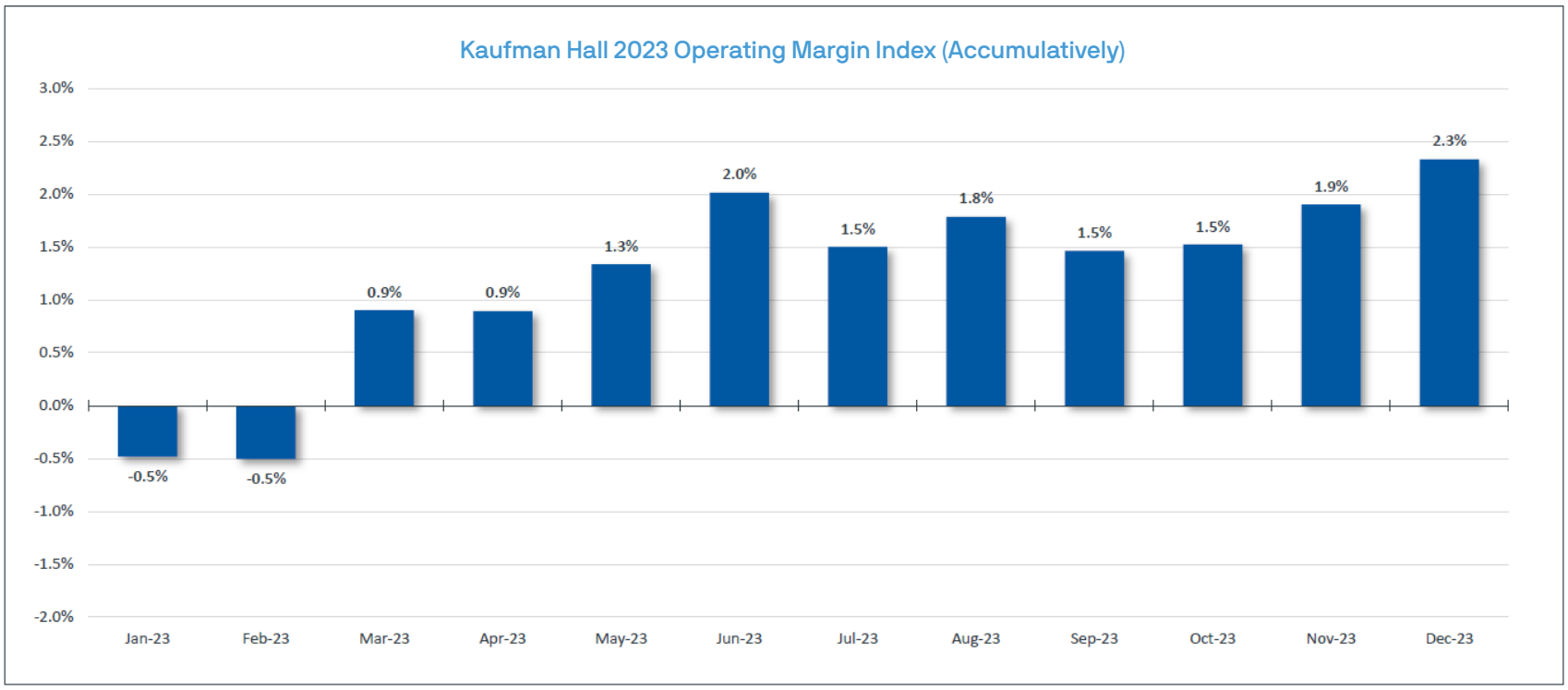
As for the challenges, they are well documented and widely felt. Medicare and Medicaid reimbursements are often below actual cost. Every hospital is contending with rising budget demands: staffing, energy, materials, technology, and maintenance.
The Producer Price Index (PPI) for New Healthcare Building Construction increased by 32% from May 2021 to January 2024, averaging an approximate 10% increase per year. Prior to 2021, Annual PPI increases averaged 2.5%.




Producer Price Index: New Healthcare Building Construction - ***U.S. Bureau of Labor Statistics*** (Graphic by U.S. Federal Reserve St. Louis)

## SEEKING GREATER VALUE

These constraints make it harder to plan and fund capital construction projects, said Bill Hercules, president and CEO of WJH Health. “Healthcare leaders are reevaluating expansion and upgrade plans in light of other critical priorities, or may have hit the pause button, especially with larger projects,” he said. “All of the capital projects on their list are good ideas. So the question is, what is the greatest value for the organization in terms of market penetration and opportunity to generate margin so that their mission is sustained?”




Kaufman Hall, National Hospital Flash Report (December 2023)

When asked whether the quest for value might lead to a dramatic change in design and construction practices, Hercules shared his view that meeting the finance and revenue challenges will reshape the strategy more than the process.

“My sense is that people are generally slow to adapt and wary of wholesale reinvention. More likely, we will see a collection of incremental but more strategic changes—accelerating the schedule by introducing changes that clients already understand, such as prefabricated pods or prefabricating the entire patient room or the entire six-sided surgical environment, for example. Then, it becomes a question of how quickly you can get to market and how quickly you can generate revenue compared to a more traditional approach,” he said.

## EFFICIENCY ADVANTAGES

Lindsey Brackett, president and chief empowerment officer of consulting and training firm Legacy FM, expressed what she sees as the ideal way of thinking about achieving efficiency and value in 2024.

> **“In healthcare, everyone has said for a long time that we’ve got to do more with less,” Brackett said. She further reflected that with today’s staffing and funding challenges, alongside intensifying regulations and aging infrastructure, there are even more hurdles to delivering care.**

To navigate the cacophony of competing priorities, Brackett encourages making practical choices specific to each situation to avoid actions such as overdesigning hospital spaces or upsizing mechanical equipment to exceed code. “Let’s make smart design and construction decisions so we can devote less time and cost when operating, maintaining, and renovating what is built.”

## STANDARDIZING AND RIGHTSIZING PATIENT SPACES

One of the evolving stories in healthcare is the movement toward standardizing and rightsizing.

Clint Russell, vice president of design and construction at HCA, cited his company's experience with prefabrication as an example.

"More than 10 years ago, we started using prefabrication, and we learned that if you want to replicate the prefabrication on the next project, you have to standardize materials and standardize design," he said. "That allows the manufacturer or fabricator to get the level of production that helps you achieve cost and time savings. Without doing that, you are building what we'd call snowflakes."

Chris Dunlop, associate principal with HuntonBrady Architects, suggested applying standardization and prototype designs to gain budget and schedule efficiencies.

"We started with medical office buildings where the building type is easier to standardize," he said. "When we began using prefabrication and modular construction for hospital spaces, we saw the benefits of developing standard sizes for some major room types. The important step is to work closely with the clients and their staff to go through the process of developing the standards. The goal is to streamline the design, make it replicable, and turn that into a speed and cost advantage for your client."


## Rightsizing hospital space was also a popular theme in discussions about value and greater efficiency.

“We work hand-in-hand with the clinical staff to rightsize the project by looking at historical trends and current needs,” Dunlop explained. “Clinicians are used to a certain amount of space. We help work through needs versus wants and assess patient needs and well-being. How can we design leaner and more efficiently and help clients reduce the square foot cost per bed?”

Dunlop and other report contributors pointed to the emergence of mainstream artificial intelligence (AI) and other digital tools that will help provide benchmark information and inform innovations around downsizing and prototype use.

> *“There are AI tools already in process today. We are just scratching the surface of possibilities for more efficient design, construction, and patient care,” Dunlop said.*

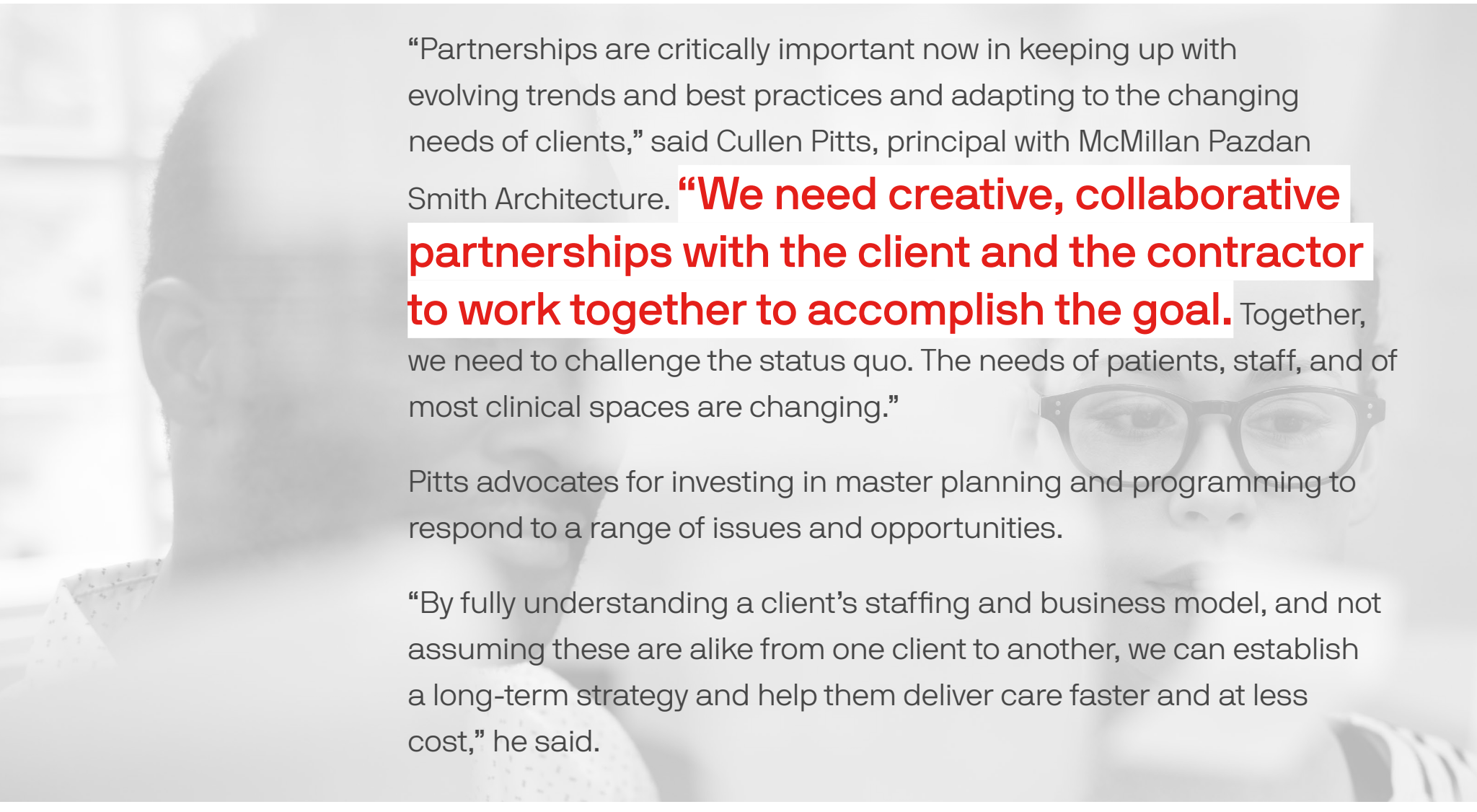
## IMPROVEMENTS IN PLANNING AND PERMITTING

Contributors raised three powerful influences that will inform how building strategy, design, and digital automation will help deliver value.

1. Healthcare staffing and labor challenges are changing how hospitals function. Virtual care and hospital-at-home models will place a greater emphasis on facility planning.

2. New entrants, including deep-pocketed players Amazon, Google, CVS, and Oak Street Health, will compete directly or indirectly with current providers.

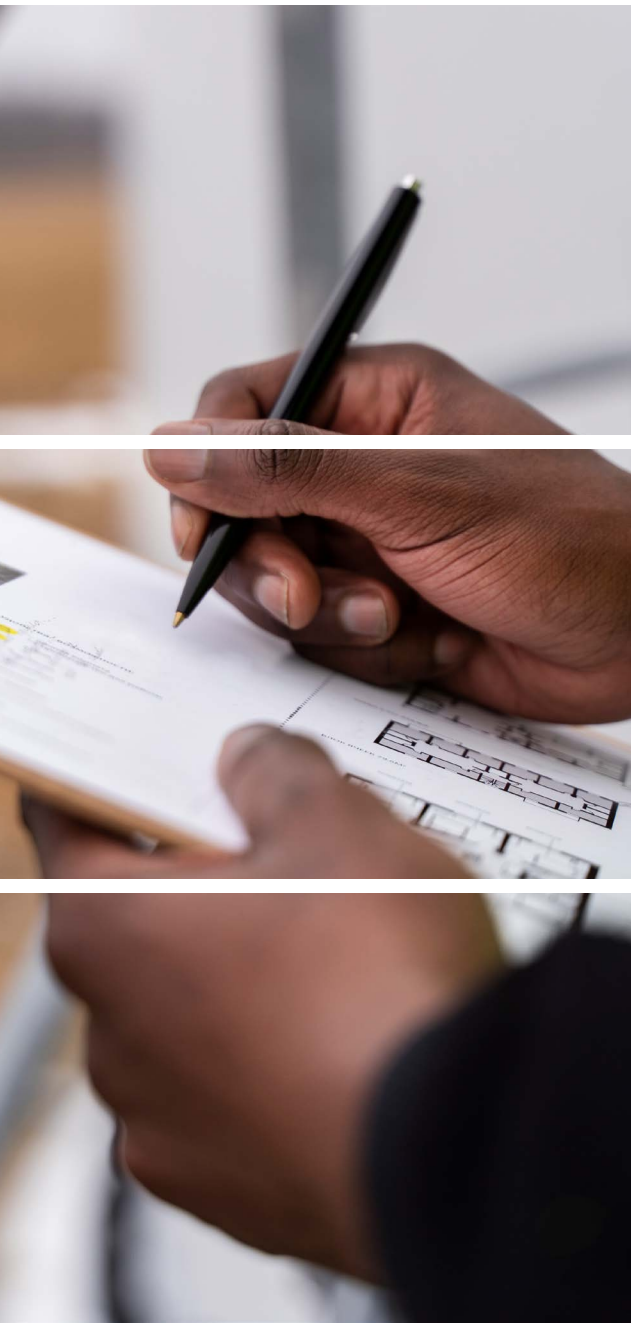
3. The need for greater collaboration among project team members – healthcare leaders, planners, architects, contractors, and specialty consultants – to integrate AI, digital data, and outcome-based design and construction goals will help health systems reduce rising risk.



"Partnerships are critically important now in keeping up with evolving trends and best practices and adapting to the changing needs of clients," said Cullen Pitts, principal with McMillan Pazdan Smith Architecture. **"We need creative, collaborative partnerships with the client and the contractor to work together to accomplish the goal.** Together, we need to challenge the status quo. The needs of patients, staff, and of most clinical spaces are changing."

Pitts advocates for investing in master planning and programming to respond to a range of issues and opportunities.

"By fully understanding a client's staffing and business model, and not assuming these are alike from one client to another, we can establish a long-term strategy and help them deliver care faster and at less cost," he said.



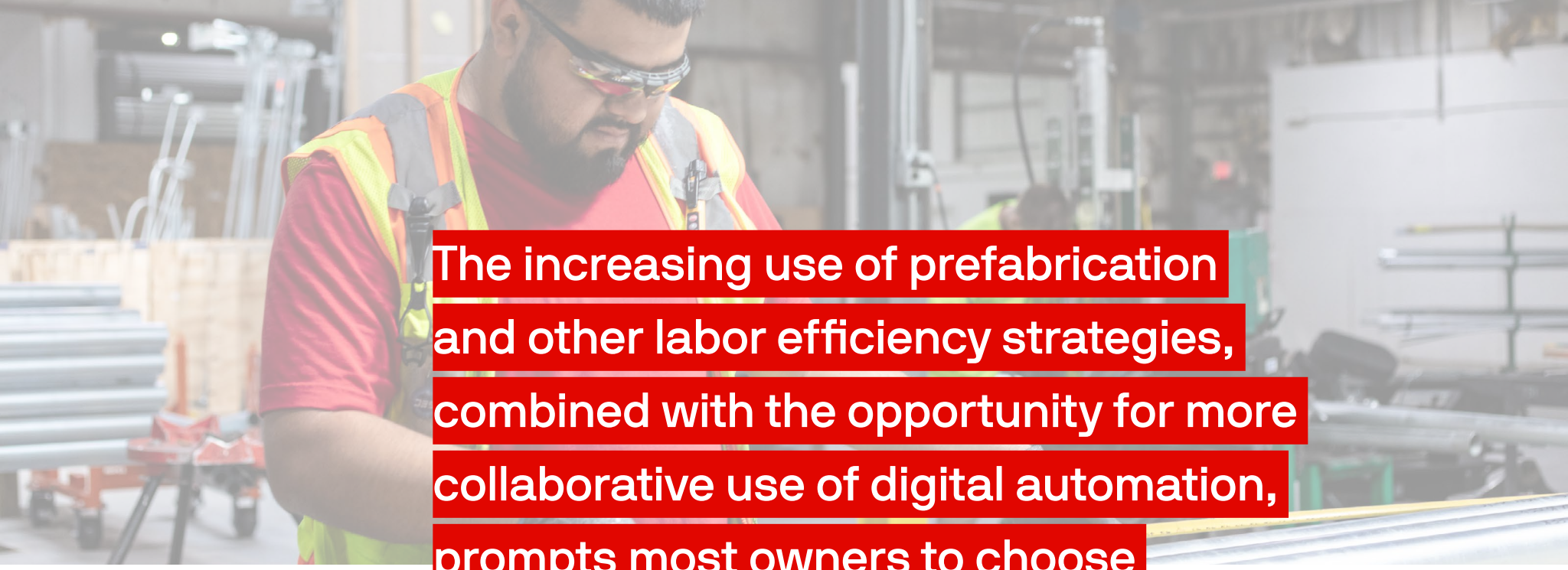
A related early focus area that is increasing in importance is project permitting. Edwige Clark, senior project manager with Robins & Morton, sees permitting as crucial in keeping a healthcare project moving forward.

“Everyone tends to focus on the budget and the schedule, but the permitting aspect can derail a project before we even get started,” he said. Clark advises starting early and getting in front of the municipal officials as soon as possible.

“If the project is a brand-new facility and the land uses might need to be changed for the existing site, or a development agreement must be put in place, it will consume valuable time. It goes beyond completing and submitting the drawings to the city.”

Clark reports that many city and state authorities do not have the capacity to keep up with the permitting demand and related zoning, land use, and environmental reviews.

“When the client asks, ‘How long do you think it will take for permitting?’ we need to be informed about the timeline and what type of review we need to work through with the municipality’s building department. There is a lot at stake, and as the saying goes, time is money.”



**The increasing use of prefabrication and other labor efficiency strategies, combined with the opportunity for more collaborative use of digital automation, prompts most owners to choose integrated project team approaches.**

## PROJECT DELIVERY OPPORTUNITIES

Patrick Duke, healthcare solutions lead for Turner & Townsend Healthcare, envisions the economics of building complex healthcare facilities will also lead clients to seek greater integrations.

“Ninety-five percent of my clients ask for increased and enhanced collaboration on their projects,” he said. “Each client must define it for themselves. To get there, you need to define what your desired outcomes are and decide what delivery model will work to achieve those goals. The desire for collaboration and more efficient processes for design and construction is leading us there.”

Interest in enhanced collaboration is also evident in the priorities clients express when they evaluate design and construction partners to form a project team.

“We used to see language in the request for proposal (RFP) requiring Lean expertise and examples, and that was an indicator of a collaborative approach ahead,” said Ryan Van Dyke, senior superintendent with Robins & Morton. “Today, we see RFP language asking very specific questions about collaboration, design assist, and our knowledge of integrated delivery methods. It’s an encouraging shift.”

## What's behind the increased interest in early integration?

"Our clients each have individual reasons and motivations," said David Pratt, director of corporate and operational technology at Robins & Morton. "A cross-discipline, truly integrated team can unearth the real value and manage the downstream risk.

### HUMAN HEALTH AND WELL-BEING

More than 80 years ago, Sir Winston Churchill said, "We shape our buildings; thereafter they shape us." Countless building science and health advances have happened since, but that important link between the buildings we occupy and our well-being still resonates.

"One of the big lessons coming out of the pandemic is a focused emphasis placed on healthy buildings," said Jackie Mustakas, senior sustainability manager at Robins & Morton. "Human health and well-being initiatives for patients and caregivers are a heightened priority with our clients."

Mustakas' observations are reflected in recent legislation such as the CARES Act and the Inflation Reduction Act, which include provisions for building renovations that address indoor air quality, energy efficiency, and carbon reduction, as well as other sustainability measures.

Mustakas also pointed to increased requests for green building and associated certifications such as LEED and WELL as evidence of heightened interest. From 2022 to 2023, Robins & Morton's annual green building revenue increased 34%.

## CARING FOR THE CAREGIVER

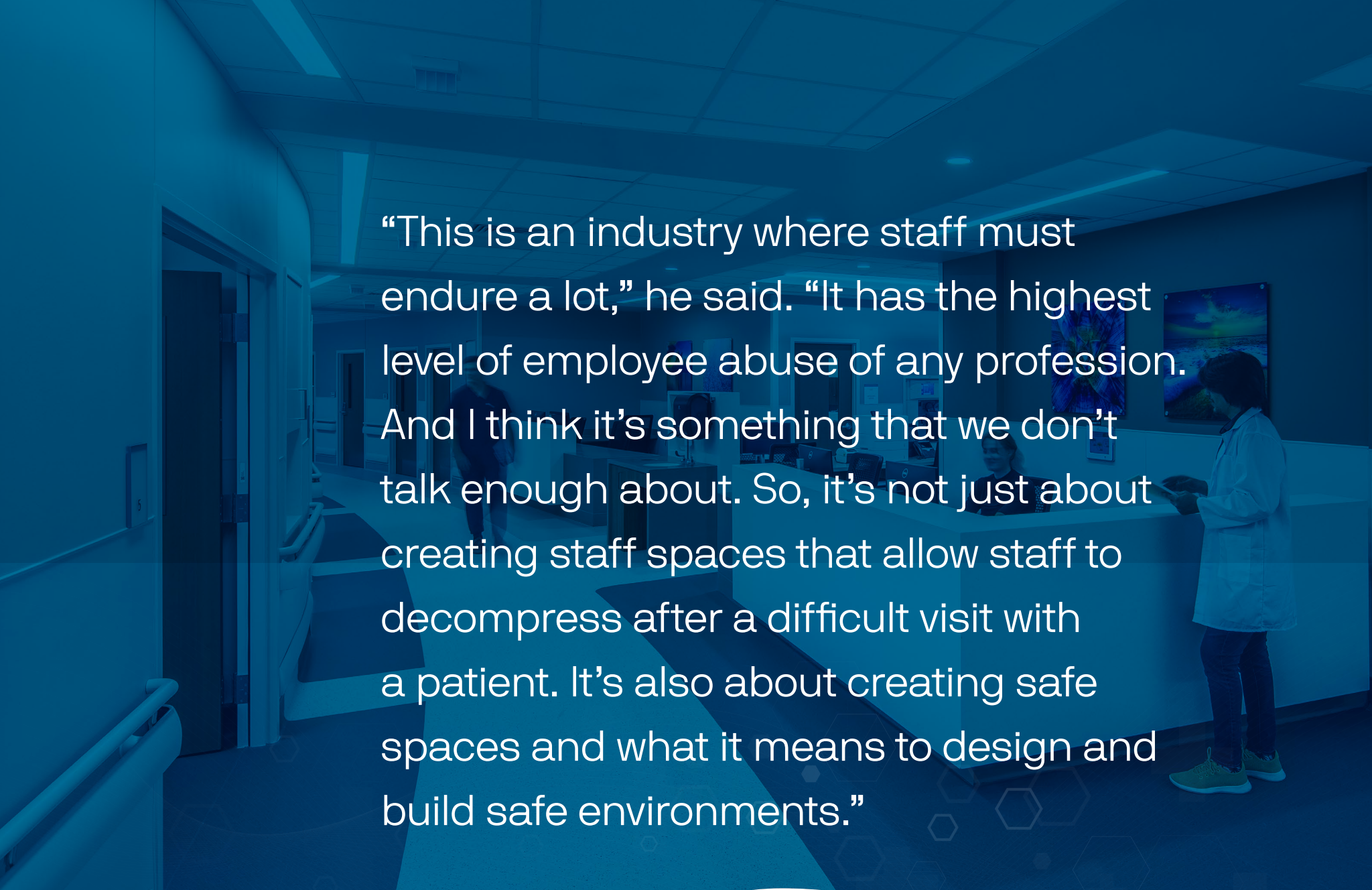
Among the benefits of wellness and health practices is helping clients address the industry's staff shortages. In an interview with Modern Healthcare, Jim Molloy, vice president of Ochsner Health, talked about the challenge.

**"Labor is the number one issue. Look at turnover, staffing shortages, and looming staffing shortages throughout the industry... We are looking to work on things that make our employees happier, and many are things that can also make the system more productive."**

Derek Veilleux with SMRT Architects concurs.

"There's a renewed interest in staff retention today. We are learning that the long-term costs associated with staffing a new hospital will far exceed the first cost of construction," he said. "It's a balancing act, designing spaces that support staff recruitment and retention while keeping construction costs in control."

An additional challenge, and one that Veilleux and his team have seen within hospitals, is patient-on-staff violence.



“This is an industry where staff must endure a lot,” he said. “It has the highest level of employee abuse of any profession. And I think it’s something that we don’t talk enough about. So, it’s not just about creating staff spaces that allow staff to decompress after a difficult visit with a patient. It’s also about creating safe spaces and what it means to design and build safe environments.”

Looking ahead, Veilleux is confident that with staff, administrators, contractors, and other stakeholders working together, a more holistic, staff- and patient-centric experience will evolve.

“The WELL building standard helps. It’s been a big conversation starter. We have been bringing it to every client, and whether they intend to pursue certification, they just want to use it as a guide to help them understand what it means to design an environment that supports a whole person’s well-being.”

CASE STUDY
RUSK STATE HOSPITAL

# Providing a Healthy Environment for Behavioral Health Patients and Staff

*Patient wellness and caregiver flexibility features in the new Rusk State Hospital are helping the Texas Health and Human Services Commission (THHSC) meet a high standard of care and well-being.*

THHSC committed to building a new 225,000-square-foot, 200-bed behavioral health facility to replace a 100-year-old facility in dire need of a makeover. Architectural firms HKS and Architecture+ and Robins & Morton collaborated to redefine the patient experience while meeting the ever-mounting need for safe, effective, and compassionate spaces for behavioral health treatment.

## Patient Care Priorities, Staff Retention and Recruitment

One complication in delivering quality behavioral healthcare is the global shortage of mental health professionals. In recent years, workplace conditions and record-setting patient demand translated to caregivers leaving their positions and fewer young people going into behavioral health careers.

The client's goal for the new Rusk State Hospital was to advance the health and wellness of staff members and patients.

With all private rooms and ensuites, abundant natural light in both patient rooms and common areas, and outdoor spaces — including gardens, courtyards, and spaces for recreation, socialization, and quiet reflection —the building's thoughtful design embodies patient-centric values that ripple through everyday life at the hospital.

"From intake to discharge, the facility is designed to optimize trust and collaboration between patients and staff," said Rachael Farrell, director of mental and behavioral health design for HKS. "The programmed amenities and warm materiality promote normalcy in the environment, while concealed technologies help to enhance safety and security."

**Interior Comfort, Community, and Safety**

In addition to areas for group therapy and activities for daily living, the interior of Rusk State Hospital has a unique feature: a "main street" area that includes a movie theater, music room, salon, library, general store, gym, greenhouse, teaching kitchen, and other recreation and social areas.

"The theater was strongly advocated for by the facility's wonderful superintendent, Michelle Foster," Farrell said. "Michelle wanted patients to have the opportunity to come together, share in a positive distraction, and enjoy the community that they are a part of."

Throughout the hospital's construction, the Robins & Morton team navigated challenges inherent to building a behavioral health facility. These specialized facilities require painstaking quality management to ensure that no element of the built environment could be harmful to a patient. Specialty items included impact-resistant windows, ligature-resistant fixtures, and health and safety systems to prevent accidents and injury.

"The whole hospital building required specialized construction materials, finishes, and fixtures," said Robins & Morton Superintendent Scott Campbell. "These required an installation tolerance of only an eighth to a sixteenth of an inch. Quality was paramount."

Opened in June 2023, the hospital provides adult psychiatric services for 36 counties throughout East Texas. For individuals seeking treatment, and those providing care, Rusk State Hospital is quickly gaining appreciation as a place with a healthy, caring, and socially connected purpose.

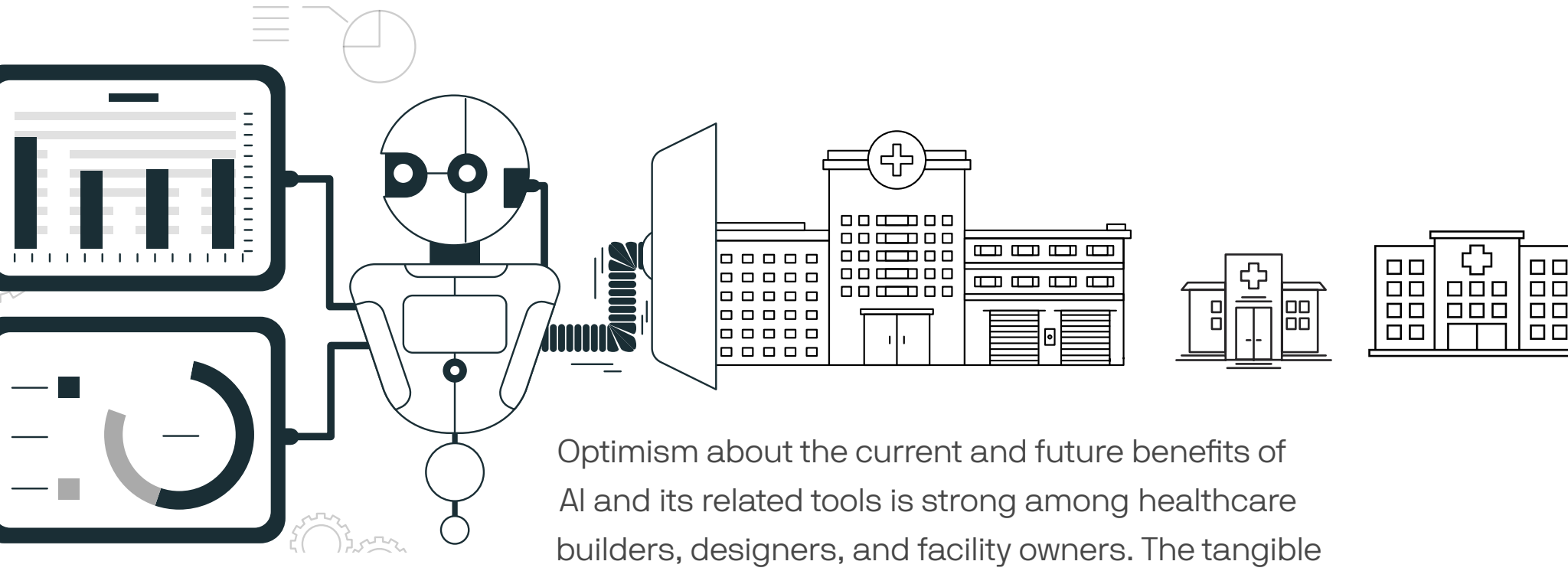
"Staff at Rusk shared stories and photos of parents and great, great grandparents that have either worked at the facility or received services there, so having something that they could recognize as part of their history was critically important," Farrell said. "I hope that when the residents of Rusk look at the new hospital, they see hope in familiar places."

# 04 Automation

***Will predictive analytics, AI, and integrated tools deliver strategic advancements?***

## TAKEAWAYS

- Report contributors singled out predictive analytics as a best practice for schedule efficiency and labor productivity.
- AI-informed automation tools such as real-time progress tracking, virtual mockups, and the strategic use of robotics offer tangible, time-saving results.
- A promising wave of adoption and experimentation is underway, inspired by improved technology and advanced by field research and increased knowledge.



Optimism about the current and future benefits of AI and its related tools is strong among healthcare builders, designers, and facility owners. The tangible benefits of digital technology and the future value of analytics tools using automation and AI are stoking a wave of adoption and experimentation.

Is the enthusiasm by industry stakeholders justified? Skeptics will point to a history of overblown promises around countless technologies once touted as revolutionary, only to fade into obscurity.

What's changed? In healthcare construction, the ability to harness reliable data and integrate it with new AI technology is informing project analytics and decision-making in significant ways.

**When asked about AI's potential to advance construction and design efficiency, report contributors singled out safety, supply chain decision-making, AI-informed virtual mockups, and the ability to apply generative AI and analytics to make the building process more predictable and future-proof.**

## MOVING THE NEEDLE ON PREDICTIVE CONSTRUCTION

**“The biggest opportunity right now is the amount of data available to acquire and integrate into our project efficiency,” said David Pratt, director of corporate and operational technology for Robins & Morton.**

“We can finally take and apply a range of available information and analytics to better predict costs and project schedules.”

He cited what he considers one of the most opportune and available sources for this information: the real-time and historical data from Robins & Morton’s healthcare projects. Other helpful sources include manufacturer research and data, client operational and post-occupancy information, and generative AI tools to corroborate and expand on existing analytics.

Chris Dunlop of HuntonBrady Architects anticipates significant advantages for every stakeholder.

“Generative AI and other digital tools already in use are just ramping up,” he said. “Everyone is going to app-based approaches that are easy to use and help improve communication and collaboration.”

Dunlop said AI-enhanced apps will also foster a better patient and staff experience.

“Navigating your way through most hospital campuses can be a big challenge. If patients have a user-friendly phone app to guide them, it will ease the stress,” Dunlop said. “For hospital staff, better data management apps for patient records and real-time communications within the hospital will improve everyone’s day-to-day human experience.”

## USER REVIEWS VIA VIRTUAL MOCKUPS

The convenience and agility of AI-informed mockups will help speed the process of presenting design options to clinical staff for review and approval, noted Matthew Waldrop, director of construction and development with UNC Health.

“The technology continues to grow and grow. One of the areas where I see automation and AI helping is with mockup reviews. Mockups are an important part of large projects, and if we can use digital mockups, AI mockups, virtual mockups, and visual imagery that our people can understand, that could be a significant development,” he said.

“We often struggle with the fact that doctors and nurses cannot visualize space by looking at the plans as we do because that is not their job. So, I think if we can get to that point in the virtual world, it could help expedite the process and get those questions answered more quickly versus having to build a full-scale mockup. If we can create that physical mockup space as a virtual reality mockup, a clinical nurse, a department manager, or a director can put on a VR headset and virtually feel it, touch it, and walk inside the space. That helps us get to a completed design quicker and without the need to pull staff away from their day-to-day responsibilities.”

## AI AND ANALYTICS CREATE CONNECTEDNESS

“There is enormous potential for artificial intelligence to accelerate construction efficiency and reduce costs,” said Clint Russell of HCA Healthcare. The Nashville-based company uses Doxel, an image recognition tool with 360-degree mobile cameras, to track construction progress and verify installations.

> *“In addition to providing real-time progress tracking and matching progress photos to the schedule, Doxel has the potential through AI to document how much material is being used,” he said. “In the future, we can calculate prefabrication metrics by volume instead of measuring how many labor hours were shifted offsite.”*

Doxel and other 3D-imaging tools use video capture to track progress and identify errors. A project team member wearing a camera walks the jobsite to document construction progress and capture a comprehensive scan of recent installations. Once the worker completes the site walk, they upload the data and the software measures progress based on the project schedule and its building information model.

## OVERCOMING RISKS AND OBSTACLES

Along with all the optimism about AI and automation's upside comes a dose of caution and a few unanswered questions.

"The superhero needs to be used as a force for good," Dunlop said. "In hospital environments, every innovation presents a new or different challenge to solve."

The most significant challenge is that automation and AI will work only if the data is accurate and available. For example, the Doxel app capturing video scans to measure progress relative to schedule has an essential ingredient for success, explained Christina Till, technology implementation coordinator for Robins & Morton.

"How well everyone understands how to use and benefit from the tool is essential. To work as intended, it relies on what is modeled as the baseline to compare against what is being installed," she said. "So, every team member responsible for updating the model and schedule needs to ensure everything is accurate and current."

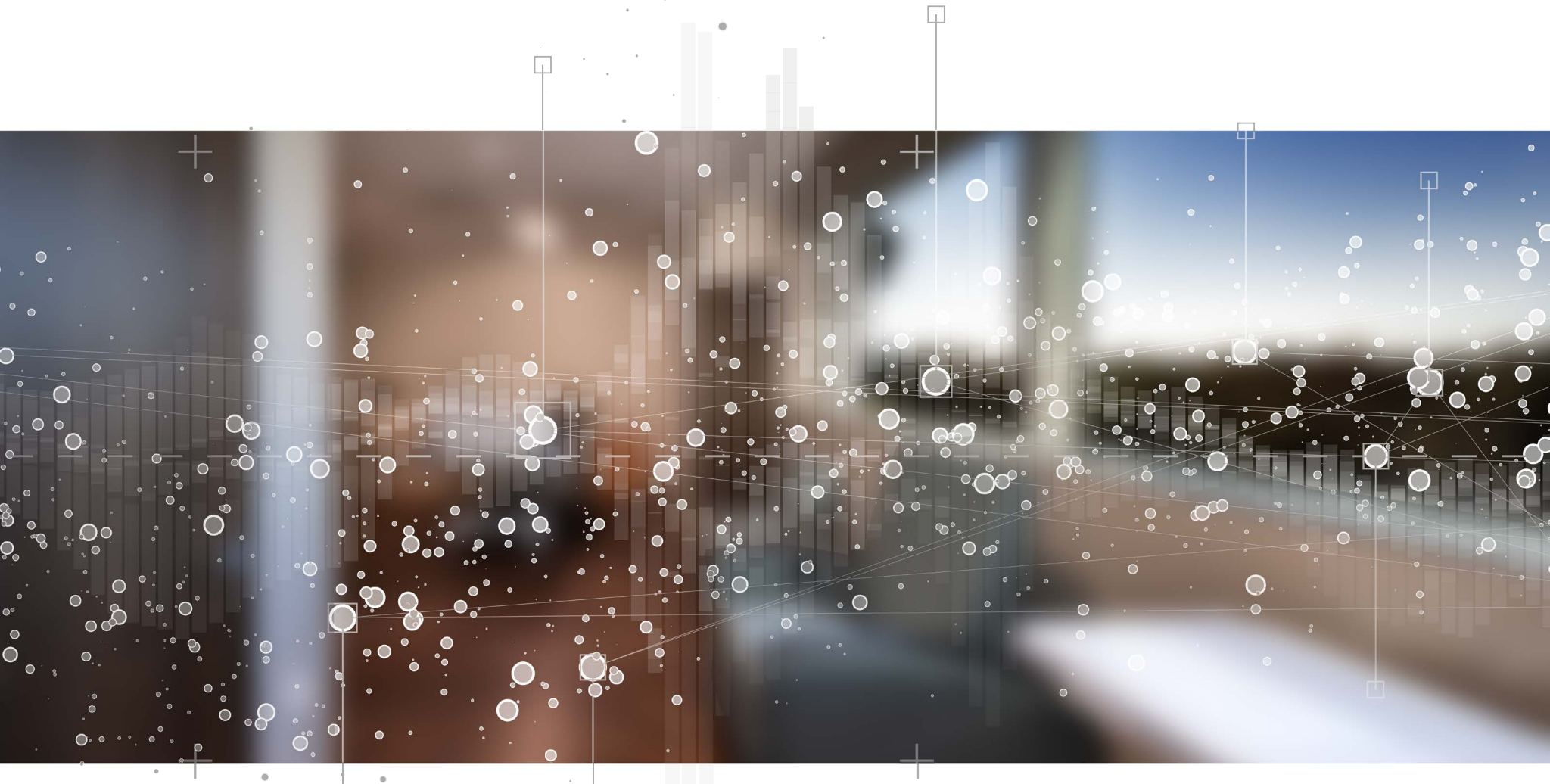
**"AI systems often rely on vast data to train their algorithms and improve performance. This data can include personal information such as names, addresses, financial information, and sensitive information such as medical records and social security numbers."**

*AI and Privacy, The Economic Times*

On the data side, questions abound. In a report titled "Predicting the Future: Construction and Engineering Trends That Will Define 2024," global enterprise software company IFS cites data security and integrity as a colossal challenge for organizations that construct, operate, and maintain buildings and infrastructure.

Derek Veilleux of SMRT Architects and Engineers considers the macro challenge of managing all the data needed in today's healthcare environments.

"As we fulfill the Internet of Things (IoT) concept and the hospital-at-home model, a lot more infrastructure and network capacity are required. Where does all this information live?" Veilleux said. "Are we creating onsite data centers for these systems that need to talk to one another? Are we migrating patient and facility data to the cloud? I still have many questions about how privacy, security, and access will work for our clients and their patients."



# NEXT GENERATION OF DESIGNERS AND BUILDERS

One of the most promising observations of report contributors was the zeal for tech experimentation they see from the newest entrants to design and construction. David Pratt of Robins & Morton points to the desire for progress and sheer creativity that he sees in young professionals entering the field.

“One of the most enjoyable things about my job is speaking to students. When I talk about emerging technologies, they want to know what is changing the game,” Pratt said. “I make sure to emphasize that the most significant innovations are the ones that help us respond to labor shortages and add project efficiency and speed. It helps students see the bigger picture when they can appreciate the importance of all our design and trade contractor partners working together to introduce new applications and learn as much as we can from using these tools.”

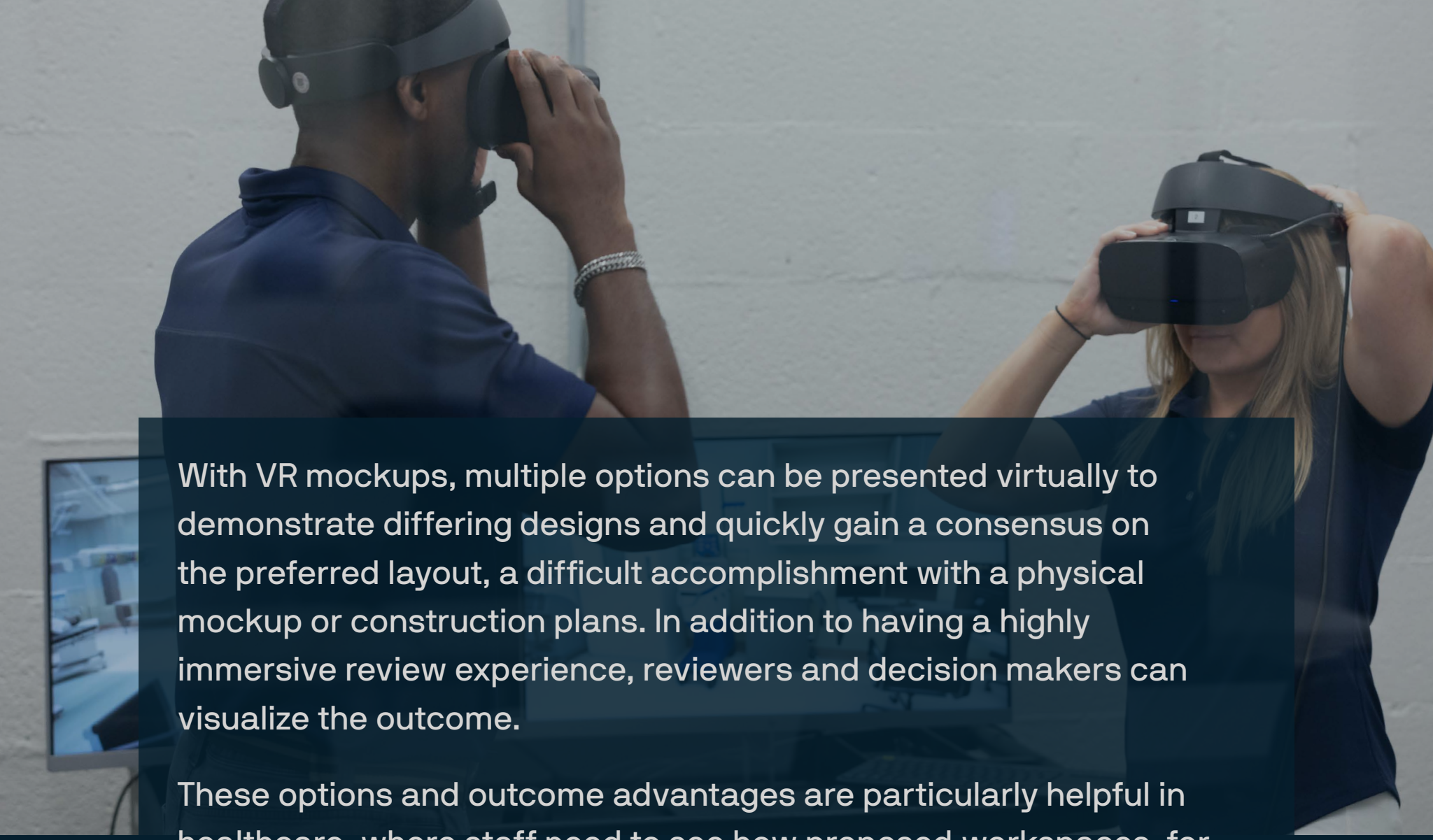
CASE STUDY
VIRTUAL REALITY MOCKUPS

# An Immersive Review and Lowering the Cost of Rework

By using virtual reality mockups of 13 operating rooms and quickly making earlier-stage changes before construction, the Robins & Morton and the project's architect, Arcadis, saved approximately $250,000 at the University of Miami Health System's UHealth at SoLé Mia project.

The advantages of virtual reality (VR) mockups continue to emerge as the user-friendly technology gains widespread adoption. As stated by UNC Health's Matthew Waldrop, one of the benefits of VR is saving review time by hospital user groups. If preferred, clinicians and other hospital staff can virtually review the mockups from their usual work areas instead of travelling across a campus, or further, to visit a physical mockup space.

This convenience results in prompter reviews because neither the project team nor busy hospital user groups are burdened with scheduling specific times for individual or collective review sessions. Prompter reviews and earlier consensus translate to a shorter preconstruction phase, allowing the project to move into construction earlier.



With VR mockups, multiple options can be presented virtually to demonstrate differing designs and quickly gain a consensus on the preferred layout, a difficult accomplishment with a physical mockup or construction plans. In addition to having a highly immersive review experience, reviewers and decision makers can visualize the outcome.

These options and outcome advantages are particularly helpful in healthcare, where staff need to see how proposed workspaces, for example, will allow for sufficient circulation in a bustling nurse station or a 24/7 operating room. Seeing the exact amount of swing area for wheeled equipment, or how many steps it takes to reach a storage space, is crucial information for caregivers.

### Labor, Time, and Budget Savings in Roanoke

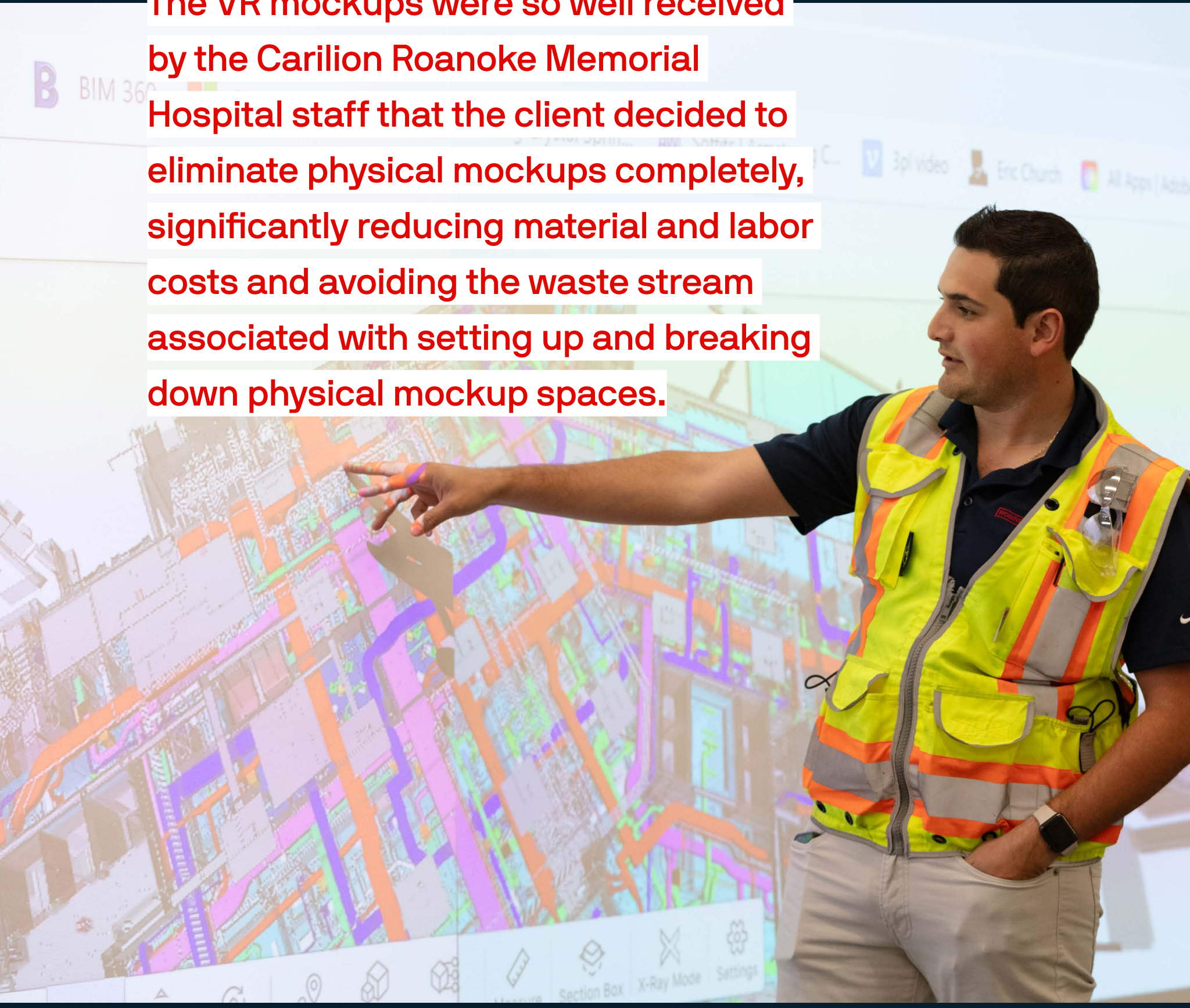
Robins & Morton worked with Nashville-based project architect ESa to develop initial VR mockups for user group working sessions during preconstruction and design of the new 500,000-square-foot, $342 million Crystal Spring Tower for Carilion Roanoke Memorial Hospital in Roanoke, Virginia.

Robins & Morton and ESa set up four VR headsets and invited the client and hospital staff to experience the mockups and provide feedback on the design. After experiencing the VR mockups, participants were asked to scan a QR code for a digital survey designed to capture feedback in real time. The survey allowed each user to tag comments on 2D images of the spaces.

The team then reviewed all feedback and determined which comments could be incorporated into the next design iteration.

The decision to fully embrace VR mockups resulted in nearly $400,000 in true-cost savings for the client, as well as time saved by more effective design iterations.

**The VR mockups were so well received by the Carilion Roanoke Memorial Hospital staff that the client decided to eliminate physical mockups completely, significantly reducing material and labor costs and avoiding the waste stream associated with setting up and breaking down physical mockup spaces.**



# 05 Sustainability

*Are sustainability and carbon reduction initiatives evolving from an expense consideration to a strategic investment for healthcare systems?*

## TAKEAWAYS

- Sustainable design, carbon reduction, and project resilience are top priorities for healthcare leaders. Commitments to reduce emissions and energy costs inform client decisions on materials, infrastructure, and operations.
- Achieving holistic and long-term carbon reduction is supported by analytic-focused initiatives, including life-cycle analysis during design and preconstruction.
- Engaging a cross-discipline team in the conceptual stage of a project provides a range of options to mitigate environmental impact and identify long-term economic benefits.

With clients and their building teams resolved to meet sustainability goals and carbon neutrality commitments, Robins & Morton sees heightened interest in adopting new and data-informed approaches.

Health systems and their governing boards, hospital staff, patients, and local communities desire more sustainable, resilient, and healthy buildings.

Jackie Mustakas of Robins & Morton described the evolution taking place. “The opportunities and progress we see now started when the conversation shifted from hesitation about initial costs to an eagerness to investigate broader metrics,” she said. “Increasingly, clients want to explore and validate the long-term data and benefits associated with carbon reduction in construction and operations.”

Mustakas and other sustainability leaders suggest the best days for sustainability — and the most dramatic breakthroughs — are still to come. Public and industry commitments are a strong indication that healthcare systems and their design and construction teams are working to reduce carbon emissions.

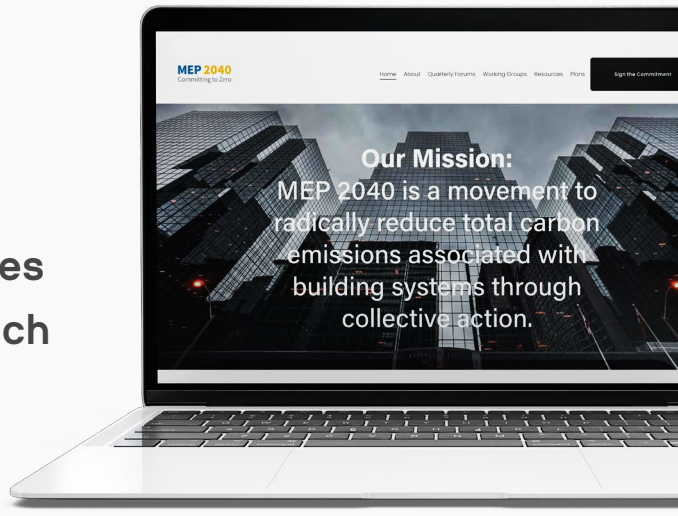
**Architecture 2030 (AIA), MEP 2040, SE 2050, and the Contractor’s Commitment are examples of the architecture, engineering, and construction (AEC) industry’s resolve to improve the built environment.**

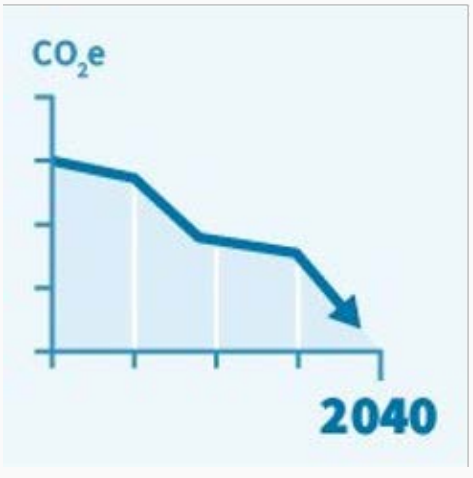
**Major medical associations, including America’s Essential Hospitals, the American Association of Medical Colleges, and the National Academy of Medicine, have committed to acting on climate change.**

**Sixty-one of the largest U.S. hospital and health sector companies have committed to achieving a 50% reduction in greenhouse gas emissions by 2030 and achieving net zero emissions by 2050 via The Health Sector Climate Pledge.**

Leading health suppliers, particularly large public companies in the life sciences and medical products sectors, are committed to achieving net-zero emissions ahead of the Health Sector Climate pledge timeline. However, more than just large companies and health providers are stepping up.

**A coalition of building system designers — mechanical, electrical, plumbing, and process engineers — joined together to develop the MEP 2040 Challenge. Signatories pledge to achieve net zero carbon in their projects, which includes eliminating operational carbon by 2030 and embodied carbon by 2040.**




"The Challenge demands more than vague promises by building designers to do better. It requires a set of solid commitments to take specific actions, including reducing refrigerants, requesting data from manufacturers, and becoming active participants in industry-wide efforts to decarbonize building systems."

*Kate Simonen, executive director of the Carbon Leadership Forum*

## PATIENT, STAFF, AND COMMUNITY AWARENESS INSPIRE ACTION

Derek Veilleux and his team at SMRT are working with a community critical access hospital on the coast of Maine to design a master plan and an expansion program. Sustainable design, greenhouse gas reduction, and project resilience are top priorities for hospital leaders and individuals in their close-knit communities.

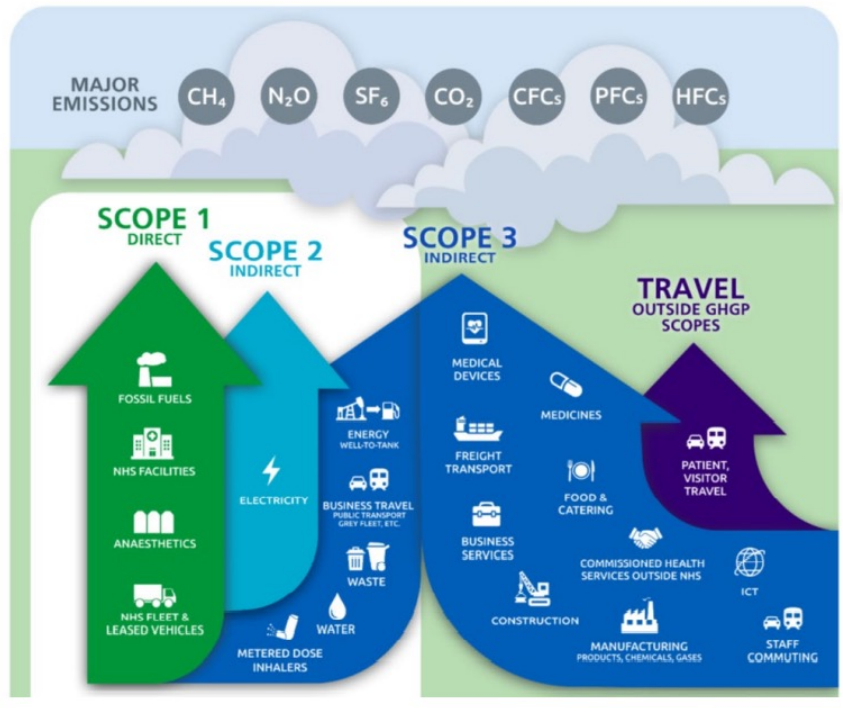
"There's more awareness of what needs to be done and why," Veilleux said. "The fact that I'm having a conversation about this with a small critical access hospital in Bar Harbor, Maine, is a testament to that. The hospital leaders we work with, health systems of all sizes, are getting pressure from the communities they serve. People who live by the ocean are very aware of the effects of climate change. So, yes, the awareness from both clients and stakeholders is starting to move in the same direction."

Several common ways to decrease carbon emissions while building healthcare facilities include reducing the quantities of high-emission materials, reusing building materials, and adjusting building design so that it is more energy efficient. Veilleux noted that progress toward carbon neutrality will require more than a building's design, systems, and materials.

"These scope decisions are important but are only one of many ways that healthcare organizations can reduce greenhouse gas emissions. It includes everything from the equipment and technology they use in clinical procedures, radiology, and imaging, to the manufacturing footprint of their medical supplies. Being thoughtful about how and where they purchase goods and services is just as important as thinking about the facility itself," he said. "Even routine decisions, such as where and how they purchase their food, how it's transported to them, and what fuels are being used to transport it, impact the hospital's long-term carbon emissions progress."

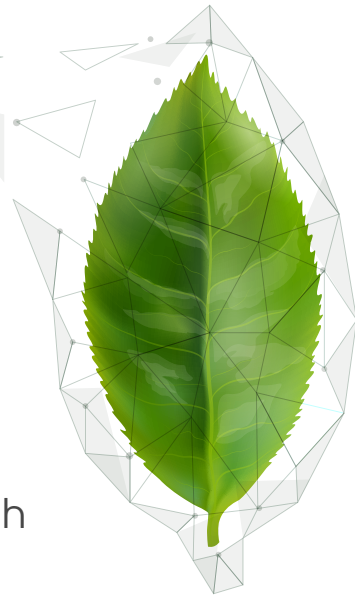
# Climate Change & Health Equity

- To meaningfully track and reduce GHG emissions, healthcare organizations should use the Greenhouse Gas Protocol (GHGP) framework, a comprehensive, globally recognized standard for quantifying and reporting on emissions. The GHGP organizes emissions into three categories based on their source:
- Scope 1: Direct emissions from owned or directly controlled sources
- Scope 2: Indirect emissions from the generation of purchased energy
- Scope 3: All other indirect emissions, such as those that occur in producing and transporting goods and services across the supply chain




*Graphic illustrating the scope and sequence of the work that the healthcare industry needs to do to decarbonize and reduce greenhouse gas emissions (Source: National Health Service, Great Britain)*

## LIFE CYCLE ANALYSIS INFORMS HEALTHY OUTCOMES



Supporting the move to more holistic and long-term measures for project sustainability is the increasing use of life-cycle analysis (LCA) during the design and preconstruction stages. Using an integrated team to analyze the environmental and economic impacts of products, materials, and equipment provides a thorough review of options by applying the collective wisdom of the project team.

**This step goes beyond energy modeling and offers a strategic look ahead to evaluate impacts and return on investment before making important decisions.**

For major infrastructure equipment such as HVAC and electrical, these cross-discipline collaborations – designers, the general contractor, MEP trade contractors, and hospital facilities staff – offer valuable insights on both initial and long-term costs – and lead to significant savings.

> *"Giving these team members an active opportunity to collaborate can also advance healthy indoor air quality, reduce greenhouse gas emissions, and avoid the costly replacement of components that fail due to early obsolescence," Mustakas said.*

Whole-building LCAs measure the facility's cradle-to-grave environmental impact, typically focusing on a building's structure and enclosure, and empower teams to make early design decisions. Beginning with raw material extraction and extending through production, transportation, maintenance, and deconstruction and disposal, a whole-building LCA provides data to inform decision-making for a connected, verified plan at the early stage of project decisions.

"The practical benefits of whole-building LCAs include forecasting a building's baseline metrics and making strategic adjustments in design or materials to demonstrate a reduction in embodied carbon and carbon emissions over the building's life," Mustakas said.

With this knowledge, teams can balance outcomes with other project priorities, such as healthcare system preferences, first cost, and material availability.

**"I think it's important that we take a holistic approach to these decisions," Veilleux said.**

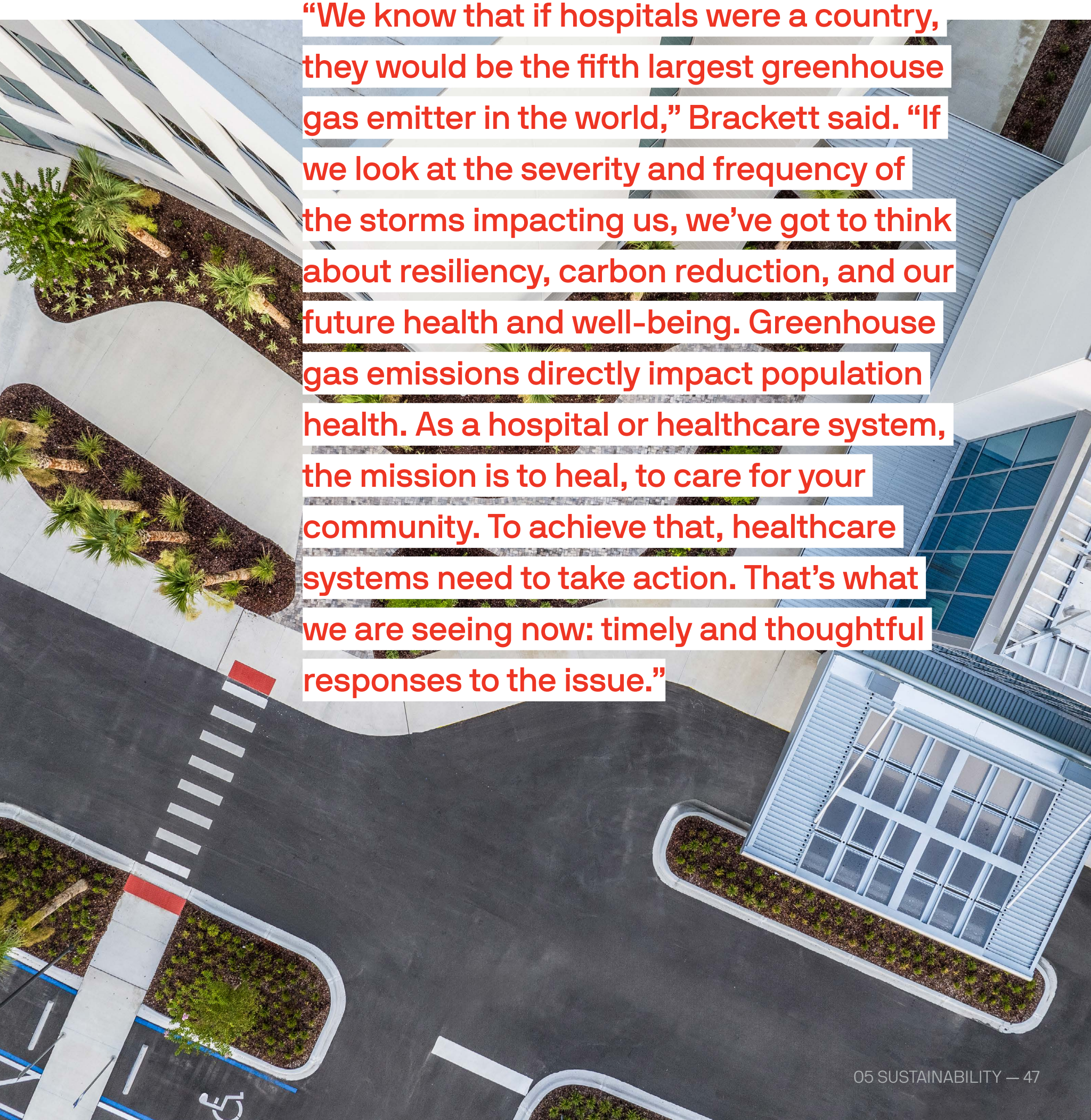
**"We want operations to drive the design of the facilities because otherwise the facility becomes a barrier to an optimized and truly sustainable operation, which we don't want."**

## Climate Change & Health Equity

- If the healthcare industry were a country, it would be the fifth highest emitter of greenhouse gases in the world.
- The American Lung Association reports that nearly half of the U.S. population (more than 150 million people) lives in areas with unhealthy air quality, leading to higher rates of respiratory illnesses, with marginalized communities often facing the worst impacts.
- Approximately 1.8 billion people currently use a source of drinking water contaminated with fecal matter, leading to increased risks of waterborne diseases.
- Climate-related changes in water availability and quality can exacerbate these challenges, disproportionately affecting marginalized communities.
- The Intergovernmental Panel on Climate Change (IPCC) estimates that climate change could lead to a decrease in food availability, resulting in an additional 183 million people experiencing malnutrition by 2050.

Lindsey Brackett and her team work with healthcare facilities and operations clients every day. A Certified Healthcare Constructor (CHC), she offers a timely view of the benefits of carbon reduction action and sustainable practices.

**“We know that if hospitals were a country, they would be the fifth largest greenhouse gas emitter in the world,” Brackett said. “If we look at the severity and frequency of the storms impacting us, we’ve got to think about resiliency, carbon reduction, and our future health and well-being. Greenhouse gas emissions directly impact population health. As a hospital or healthcare system, the mission is to heal, to care for your community. To achieve that, healthcare systems need to take action. That’s what we are seeing now: timely and thoughtful responses to the issue.”**



# 06 Contributors

## LINDSEY BRACKETT, CHC, CHFM, SASHE, CHOP

*Chief Empowerment Officer*
Legacy FM

*Lindsey Brackett is a dedicated professional, keynote speaker, and educator committed to empowering and elevating the facilities management industry. She provides innovative solutions to facilities management teams, including staff assessment and training services. Lindsey brings a wealth of expertise as a Certified Healthcare Constructor, Certified Healthcare Facility Manager, Certified Health Care Physical Environment Worker, Certified Healthcare Operations Professional, and a Senior-designated member of The American Society for Health Care Engineering (ASHE). She serves on the ASHE National Advisory Board and the ASHE National Sustainability Committee.*

## EDWIGE CLARK

*Senior Project Manager*
Robins & Morton

*As a senior project manager with Robins & Morton, Edwige Clark spearheads project leadership along with strategic business development for the company's South Florida team. His focused approach to cultivating lasting, authentic relationships through his leadership, consistently yields remarkable results. In total, he has managed the construction of more than $1.8 billion of technologically advanced healthcare facilities throughout his career. A leader in his industry and community, Clark has earned several recognitions over the years, including Legacy South Florida's 40 Under 40 Black Leaders of Today and Tomorrow, Engineering News-Record Southeast's Top Young Professionals, and the Haitian-American Chamber of Commerce's Top 20 Under 40.*

## PATRICK DUKE

*Healthcare Solution Lead, Americas*
Turner & Townsend

*Patrick Duke is the Americas healthcare solutions lead with Turner & Townsend. He is a key spokesperson on topics ranging from gender equity in the design and construction industry to collaborative project delivery models. He serves as a Board Member of the World Pediatric Project (WPP) and the Young Caribbean Professional Network (YCPN). Duke also serves on the Diversity and Inclusion Committee for Auburn University's Samuel Ginn College of Engineering Industry Council, his alma mater.*

## CHRIS DUNLOP, AIA, ACHA, NCARB

*Associate Principal*
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*Chris Dunlop is an architect with 22 years of experience leading acute healthcare and outpatient care projects including hospitals, cancer centers, surgery centers, and medical office buildings from conception and visioning through design and construction. His recent work includes the AdventHealth Daytona Beach Hospital bed tower and medical office building campus, the AdventHealth Palm Coast 100-bed hospital and medical office building campus, and the Orlando Health Horizon West Hospital campus. Chris completed his Bachelor and Master of Architecture degrees at the University of Florida.*

## BILL HERCULES, FAIA, FACHA, FACHE

*President/CEO*
WJH Health

*Bill Hercules empowers healthcare leadership teams to shape their future places of care. Having planned and/or executed healthcare projects totaling more than 34.6 million square feet and $12.3 billion, Hercules' bold cross-disciplinary ideation accelerates mission alignment and attracts the future. He founded WJH Health, a global consultancy that resolves the place of care at the nexus of mission, performance, and experience. He co-chairs the national AIA/AGC Joint Committee to deepen the link between design and construction. He is a triple Fellow: AIA, ACHA, and ACHE.*

## BEN LEAVER

*Chief Financial Officer*
Robins & Morton

*Ben Leaver is the chief financial officer for Robins & Morton and is responsible for corporate accounting, finance, and risk management. Leaver graduated from Auburn University with a Bachelor of Science in Business Administration followed by a Master of Accountancy. He is a licensed CPA and holds Certified Construction Industry Professional (CCIFP) and Construction Risk and Insurance Specialist (CRIS) accreditations. In 2015, Leaver began his career with Robins & Morton as an assistant controller after an eight-year career at a CPA firm. Since then, he has held the controller, director of finance, and vice president of finance positions before becoming CFO.*

## JACKIE MUSTAKAS

*Senior Sustainability Manager*
Robins & Morton

*As Robins & Morton's senior sustainability manager, Jackie Mustakas leads the company's sustainability-focused initiatives. She also heads the company's Sustainability Council, analyzes sustainable initiatives, and assists clients as part of Robins & Morton's Green Building services. Her certifications include LEED AP, Green Globes Professional, Parksmart Advisor, and WELL AP. She holds a Bachelor of Science in Building Construction and a Master's in Sustainable Design and Construction, both from the University of Florida.*

## CULLEN PITTS

*Principal*
McMillan Pazdan Smith

*Cullen Pitts has guided planning and design for some of McMillan Pazdan Smith's most prestigious healthcare clients. He is a skilled designer with a distinctive ability to create and reinforce the client's brand and culture through the built environment. Pitts is a firm principal in the healthcare practice area with a commanding knowledge of operational strategies for effective acute and non-acute healthcare spaces. In addition to being an architect, he is also a talented watercolor artist, musician, and licensed pilot.*

## DAVID PRATT

*Director of Corporate and Operational Technology*
Robins & Morton

*Director of Corporate and Operational Technology David Pratt is responsible for managing Robins & Morton's Corporate IT department, BIM/VDC department and Jobsite Engagement Team (JET). David has been in the construction industry for more than 25 years, with most of his experience focused on various areas of technology. He holds degrees in computer science and career technical education from multiple Florida state colleges, the most recent being from the University of Central Florida. David is also a proud United States Air Force veteran.*

## CLINT RUSSELL

*Vice President, Design and Construction*
HCA Healthcare

*Clint Russell is the vice president of design and construction at HCA Healthcare. He largely serves in an oversight capacity and leads a multi-disciplined staff directly responsible for facility design, construction, and medical equipment. Russell's orchestration of design and construction's efforts includes approximately $4.7 billion in ongoing projects, resulting in an average annual spend of over $2.2 billion in capital project contracts. Housed within the group are the disciplines of design, construction, medical equipment management, ADA remediation, commissioning, and strategy. In addition, he serves on the ACE Mentor Program of America National Board.*

## CAITLIN STELLA, MPH

*Chief Executive Officer*
Joe DiMaggio Children's Hospital

*Caitlin Stella, MPH, is chief executive officer of Joe DiMaggio Children's Hospital. She began her professional career as the start-up administrator of the multi-million-dollar Center for Autism Research and Treatment at UCLA Health. After completing her Master of Public Health (MPH) degree at UCLA, Stella joined PricewaterhouseCoopers' (PwC) healthcare consulting practice working with payer, provider, and life science clients throughout the country. She was a senior executive at Children's Hospital Los Angeles before becoming chief administrative officer for UCLA Health's Mattel Children's Hospital and Women's Health programs.*

## CHRISTINA TILL

*Technology Implementation Coordinator*
Robins & Morton

*Christina Till is Robins & Morton's technology implementation coordinator. Her role includes testing and overseeing technology used on jobsites throughout the Southeast. Christina holds a degree in mechanical engineering with a minor in mechatronics from Villanova University. She is currently pursuing her master's degree in electrical engineering.*

## DEREK J. VEILLEUX, AIA, EDAC, NCARB

*Senior Principal*

SMRT Architects and Engineers

*Derek Veilleux, AIA, is a senior principal leading the Health and Wellness practice at SMRT. In 26 years of practice, he has developed a deep understanding of the challenges facing healthcare providers. Veilleux strives to collaboratively deliver evidence-based designs with operationally efficient, compliant, and sustainable environments supporting the physical and emotional needs of patients, their families, and staff. His recent work includes acute and ambulatory care, medical offices, and mental health facilities. Veilleux is a Graduate of Rensselaer Polytechnic Institute.*

## MATTHEW WALDROP

*Director, Construction and Development*

UNC Health

*Matthew Waldrop is a seasoned construction and design leader with nearly two decades of experience, including managing operating and capital budgets, and leading diverse teams of co-workers, customers, and third-party consultants across the UNC Rex Healthcare system. He has extensive experience in facilitating complex and often overlapping projects, and navigating projects through project visioning, design, construction, and occupancy phases.*

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