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Hospital, Outpatient Facilities & Medical Office Buildings Summit

What's Next for Healthcare Facilities in These Unsettled Times?

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- Issues & Answers: What's on the Mind of Health Systems Leaders

Reported by
Rosemary Siciliano
Writer/Editor
romanidomani@me.com

Healthcare Trends: View from Senior Leaders

Alyeah E. Ramjet, MS, MHA, System Vice President/Department of Medicine at One Brooklyn Health and President-Elect of Healthcare Leaders of New York

Michael Gatto, Senior Vice President, Integrated Care Strategies

"Groups establish habits…in closed, very contained units that are consistent with their protocols. But in the pandemic, those habits were lost to logical thinking when it came to contamination and practical considerations." — Michael Gatto

Pandemic Revelations:

- The pandemic exposed the weakness of a fractured US health care system, but has been a powerful engine of transformation
- It posed challenges to staff — in the form of stressors and need for support and there was no adequate space provided for them to deal with that
- The pandemic forced us to transform and think in a different way about how patient care is delivered, but also about staff wellness, size, and scope—what we put in rooms
- The trend to adopt remote technology was accelerated — we had to be agile
- There was a need to move and redefine the provision of care, for example, acute to non-acute space.

"Resource allocation restraints, especially financial, forced us to how to look at how we think about utilizing grants and every dollar we spend." — Alyeah E. Ramjet

Pandemic Challenges to Healthcare:

- Finite resources
- Unprecedented patient volume
- Capacity challenges — how to deal with small spaces and flex spaces
- Dealing with existing infrastructure challenges — older hospital buildings not designed for flow, volume, or patient-centric care.
- As increased capacity was utilized in the ER, alternate areas were then used
- Staff had to be brought down to those areas—which enabled cross-contamination throughout the institution
- Habits and protocols of a closed, contained group or unit that normally work led to a loss of logical thinking with regard to contamination and stress.

"Considering a traditional design of a hospital, basically the entrance point is the ER, which we found to be biggest bottleneck as the virus and pandemic began to take hold," Michael Gatto explained. "What was key, is as that surge of patients began to infiltrate the ER, traditional aspects of protocols were null and void."

The Big Strive to Success:

- There's the potential for healthcare to emerge better — including acute care delivery, more resilient infrastructure, ventilation, etc.
- There's a better way to design a patient room to address the acute and diagnostic sides of care all, at the same time, with the proper ventilation and HVAC considerations
- More Resilient Infrastructure: Planning and design of a unified center of care that no longer will be segregated for one or two operations.

Facility Design: The Hospital / Room of Tomorrow

As you enter a facility, you often enter into a reception, then snack bar, gift shop, administration office…everything that promotes a positive presentation. it's about accessibility," Gatto pointed out. "Because to a great extent healthcare is perception when it comes to patient experience and satisfaction."

- Need agile, flexible spaces
- Compartmentalize the large hospital and create an interface that can enable cross- communication
- A "New Healthcare Model" borne of the Covid pandemic involves a multifaceted experience level

Base the model upon measures hospitals engaged in responding to Covid and forced the adoption of new regulations, processes—and *habits*

- Think about the patient experience when you design? How is the patient feeling, monitored, and their privacy supported?
- The goal is get patients in a positive state of mind and feeling cared for
- Emphasize through design: emotions, experience, and brand—for patient and staff — help them feel like they "belong" there
- Connect emotions to the design
- The emotional component of the space also impacts staff — this was seen with Covid as staff became the surrogate families in the ICU, a space designed for direct patient care— and figures prominently into the overall infrastructure design.

The Environment: Optimizing Adaptability

- Quickly adapt remote technology to improve agility
- Shift care from acute sites to ambulatory sites - flex the latter to an emergency site so high priority patients could be seen in the ER
- Reduce contact barriers, i.e. replace wood doors with transparent plexi/glass
- Alter the view to ways hospitals look and feel: Rethink how 24/7 spaces are used
- Staff, patient, and family wellness: Taking physical, planned spaces like waiting areas and turn them into wellness centers.

Infrastructure Challenges

- Access Points and Capacity: Creating the bones of the facility involves careful attention to access and capacity where the pandemic surge challenged ability to maintain and expand capacity
- The ability to move patients in and out effectively impacts finances
- An overwhelming amount of pressure on capacity, where one solution was to take Ambulatory Care spaces and turn them into decompression units
- Bed availability, particularly for specialized beds such as ICU isolation
- The need for special beds and rooms to treat and contain infection left many patients in hallways and ED wall space
- Often an overuse of the ED and too many admissions; only 20-22% truly needed Emergency care, the rest need primary care. In the ED, evaluating who's sick and who's not was challenging (challenges to testing and caring with patient with or suspected Covid)
- Need to create a larger ambulatory primary care environment so that non-urgent patients can be redirected quickly
- Need to address the need for general room conversions with portable exhaust
- Dealing with the financial impacts of maintaining and expanding capacity
- Post-acute care (SNIF) facilities required negative Covid-19 tests prior to accepting new patients discharged from hospitals—but there was a lack of isolation.

"Hospitals are not necessarily for the sickest of the sick — but also for the homeless, mentally ill, or those who can't be released to nursing homes. All this creates capacity issues," said Alyeah E. Ramjet. "Care was occurring in hospitals—but hospitals were also providing housing for patients who were entering through the ER."

Air Filtration — Gas Systems — Ventilator Considerations:

"Oxygen ran out, suction ran out, because distribution - the areas that needed it were too great," Michael Gatto pointed out. "Most spaces were not set up to handle airflow in an effective manner, allowing contaminants to spread throughout the entire environment, or the capability to provide high volumes of medical gasses in some spaces."

- Anticipate the number of ventilators required and determine if medical gas systems are available in all areas
- Need to increase filtration and air exchanges since often air filtration in some areas was not sufficient
- Increasing ventilator capacity can be achieved in several ways:
    - Utilize oversized vaporizers
    - Retrofit patient rooms with more gas outlets
    - Verify that gas pressure can be safely increased
    - Add temporary oxygen manifolds
    - Adjust the air handling so the room can be negative pressure
- Address the need for standalone air re-circulators with HEPA filters to improve filtration of contaminants before they can be spread
- Adding a HEPA recirculating unit with 4 air changes greatly reduces the risk of spreading airborne disease.

Looking to the Future

"The pandemic set us back in the practice and protocol of embracing outpatient services," according to Michael Gatto. "How do we establish a…meaningful outpatient organization? Design.

- Pre-pandemic, the hospital trend was to downsize larger hospitals to smaller ambulatory care — going, say, from 800 to 80 beds
- During the pandemic, it was the larger hospitals that were used for Covid and had to reopen and staff up to size, because they had beds, space, medical gas.
- The state has now recognized that we can't just have an 80-bed hospital, we have to have the flexibility to adapt and up-size based on need at any given time.

The Patient-Centered Room of the Future

- Holistic design and planning makes adaptability easier
- Design patient rooms to be flexible, more agile, Article 28 spaces
- The patient room should be about what care is at any given time
- A room should be able to house all the care that a bed-bound patient needs in order to minimize transport—bring services where possible to the patient instead.

Patient Flow Processes

- The main access points are the ED and lobby. Can we design so open areas can they be flexed?
- Lobby / Admissions and ED: During Covid, the small lobby or ED vestibule became a screening space — a poor patient visitor and patient experience
- Concept of a multi-modal entry portal that could help steer infected patients away from well patients
- Create high tech entry points with air sensors or biometric systems to sense ill persons before they enter the ED, and UV systems that quickly identify pathogens as well as sanitize and reduce cross-contamination

- Think of the lobby as a functional place where can care can occur — is the big, beautiful atrium a necessity?
- Take a page from the hotels: check in and find your room yourself. It's a controversial, but not a new idea to eliminate waiting areas
- Consider using waiting room space for exam rooms instead of creating special pandemic units—in a much smaller area—to improve flow
- Eliminate the physical nightmare of isolation rooms and give future design consideration to keeping isolated patients together in a smaller area to reduce cross-contamination
- Rethink the present the distribution philosophy
- Visitor areas are important, not just frivolous or artistic as well as areas for staff to go for respite.

Emerging Concepts and Technology

- Departure from traditional facility utilization
- Video Conferencing / Telehealth
- Pre-hospital patient assessments / EMS allowed decisions to be made from the ER or ambulance
- Implement a discharge process that supports transitions of care

Out of the Storm - Lessons Learned

- We can emerge from the pandemic with better, more resilient infrastructure and practices
- Understand the new measures healthcare facilities adopted by leadership in response to the pandemic include dynamic rules, policies, and habits
- Facilities Planning begins with a detailed, systemic risk assessment
- Goal: Evaluate a facility's ability to deal with all types of widespread pathogens (create your own definition of holistic care and design)
- Identify areas that need to be strengthened
- Design with future pandemics in mind.

Don't Be Blindsided: How FM & PDC Managers Can Create Resilient Healthcare Facilities

Nicholas Gabriele, CFPS, Vice President, Global Service Line Leader Healthcare+Emergency Management, Jansen Hughes

Roger Glick, FACHE, Market Leader, Healthcare + Emergency Management, Jensen Hughes

Using Systematic Risk Assessment to Build Resilience into Facilities

In conducting a Risk Assessment, which is required for healthcare facilities to inform the facility design (whether for new or existing facilities), Gabriele and Glick strongly advised adhering to three guiding principles to ensure a comprehensive and effective assessment process:

- Look ahead, not just behind
- Use an all-hazards approach: Look at all that could happen and be prepared
- Use a systematic approach

Two Key Terms to Know: There are two core approaches to completing a Systematic Risk Assessment.

Hazard Vulnerability Assessment (HVA):

✓ Provides factual basis for what could potentially happen to a facility and guides an emergency preparedness program from operational and infrastructure standpoints and what can be done to mitigate those risks.

Disaster Emergency Vulnerability Assessment (DEVA)

✓ Addresses emergency preparedness program as it pertains to proactive design or renovation of a building.

✓ For each space in the building, involves regulatory requirements from FGI and changes from 2022 edition that refill ct lessons learned from COVID.

- Both concepts are intertwined and inform proposed actions by focusing attention and resources on the greater risks. They usually include disaster, emergency, vulnerability, and security risk assessments and use them to help inform the design and construction of a building.

Regulatory Requirements: The following were identified as the key elements of regularly/annually meeting regulatory requirements for healthcare facilities for existing buildings via various state agencies or other accrediting bodies:

1. A Risk Assessment that identifies potential / possible emergencies
2. A facility-based, all-hazards review
3. A community-based, all-hazards review
4. The development of strategies to mitigate risk and/or impact emergency events
5. An Emergency Plan (addressing both infrastructure and the physical response to disasters)

Four Key Components of the Risk Assessment:

1. Identifying potential hazard events
2. Establishing hazard event likelihood/ frequency
3. Defining the impact to people/life, property, business
4. Defining what is the preparedness (INT/ EXT) / asset inventory and resources available, both internally and externally with community partners.

Risk Assessment Models:

HVA Model 1: The Kaiser Permanente Model

- This model is spreadsheet-based, and involves essentially a listing of what emergencies and hazards could potentially take place based on likelihood, what the impact would be, and how prepared a facility is.

- The result is the formula-based generation of a top 10 list.

HVA Model 2: The Delphi Method

- This is a **more collaborative for** discussion within groups regarding high priority to arrive at consensus.
- This method leverages the strengths of the group experience and results in a final list of potential emergencies built by consensus.

HVA Model 3: The Risk Matrix

- This simpler **"quantitative risk"** variation looks at consequences vs. likelihood of an event.
- Provides a risk framework to work with.

Regardless of the model you choose for your assessment, you need to build **layers of protection** into your HVA that consider **national, state, local/town and facility impacts.**

CASE STUDY: Risk Assessment for Healthcare in an Urban Setting: Indiana University Health

This case study involved the consolidation of two hospitals for Indiana's largest healthcare system. Before breaking down existing facilities, the Jensen Hughes team evaluated the potential hazards that could impact the new facilities.

- In embarking on the HVA for Indiana University Health, the team kept in mind an important consideration—that sometimes the future DOES NOT reflect past trends.

"Be sure to consider new and novel potential hazards and emerging threats, not just what might have happened before," emphasized presenter Roger Glick.

- The Indiana University Health risk assessment process involved four stages:
    1) Reviewing the HVA and project it forward beyond the typical 1-3 years
    2) Reviewing the local public and private utility infrastructure and capacity, including projected demand growth in the future
    3) Identifying risk changes related to extreme weather-related events and health equity (new and emerging threats)
    4) Conducting a peer review of the concept design documentation against these risks to efficiently adapt the design early in the process.

Hazard Vulnerability Assessment (HVA) Categories Looked at for Indiana Health:

- Natural Hazards: From Storm Surges to Wildfires
    - Thunderstorms, earthquakes, storm surges, flood, temperature extremes, droughts, wildfires, etc.—be forward-looking
    - There usually exists good forecasting data for natural hazards—and many communities and states have mitigation plans developed with this geo-specific data
    - The team found that the Indiana location experiences all kinds of extreme weather events, with a particular susceptibility to both hurricanes and tornadoes.
    - Looked a flooding
- Natural Hazard Mitigation Opportunities
    - They needed to employ High Impact-resistant windows and skylights
    - In case of an event such as a tornado, patients should be moved into the hallways, but with only minutes of warning, the resiliency must be build it in to the facility
    - Below-grade interiors needed to be waterproofed.
    - Keeping utility systems above the flood zones

  A study titled, "Climate Change, Resiliency and Healthcare Systems Considerations (ASPR) was referenced by the presenters.

- Technological Hazards
    - Local infrastructure threat potential
    - Generators
    - IT loss
    - Cyber threats and interruptions
    - Water loss
    - Loss of sewage treatment facilities (potable vs. unportable)
    - Chemical Hazards — internal and external, but also receiving patients (decontamination units, etc.)
- Technological Mitigation/Planning Opportunities
    - Plan for future technologies requiring a different layout than that of the past
        - Robotics (hallway widths)
        - Artificial Intelligence (space to accommodate))
        - Drones (security)
    - HVAC System designed robustly
        - Prevent air intake during an external hazmat incident
        - Exhaust air from an internal hazmat incident
        - Considered during design and planning the Building Automation System (BAS)
        - Need for additional cooling capacity
    - Resiliency Redundancy of water systems coming in and going out of the building
        - Well-designed Storage systems that can meet greater need during service interruption
- Human Threats Hazards:
    - Security
    - Active assailant / shooter
    - Bomb threats
    - Child abductions
    - Mass Casualty Incidents
    - Emergency Infectious Disease / Pandemic
    - Patient Surge (ED and catastrophic)
- Human Hazard Mitigation:
    - Positive / Negative pressure delivery to patient rooms
        - ID and Plan for public access points
        - Develop a plan for ED controlled access
        - Consider security
    - Build structure in to meet and expand capacity for surge, especially in ED on a rapid basis
    - Workforce wellness programs and spaces to help protect the staff, because they won't stay if they don't feel safe.
        - Consider "Safe Rooms" on every floor or unit, though they have limited practical value, they have a big impact on morale.
- Lessons Learned in Indiana included:
        - Assume a loss of sewage treatment facilities

- Assume an extended water outage
- Assume a loss of sewer function
- Design HVAC system to consider hazmat releases
- Prioritize Storage: Stocking space for supply chain failure
- Just-in-time storage systems, for when transportation is interrupted, there's a need for more storage systems in the hospital
- Real-Time Locations System to manage inventory
- Ensure you can understand outage alerts on the CEG's website
- Consider how mitigation strategies impact others.

Final Takeaway:

The speakers reiterated the points they made at the outset of their presentation, focusing on key steps for completing an effective Systematic Risk Assessment:

- Prioritize the hazards
- Implement mitigation measures
- Refine the risk assessment and mitigation plan
- Look forward, not just backwards
- It's a constant evolution to stay safe and resilient

Prefabrication & Modular Construction of Medical Facilities: The Art, Engineering, Management, and Economics

Mitch Green, First Vice President, AECOM Tishman
Mogens Smed, CEO, Falkbuilt LTD
Jack Conway, Senior Vice President, Gil-Bar Health and Life Sciences

From Pandemic to Pre-Fab: Untangling the Supply Chain

Mitch Green, First Vice President, AECOM Tishman

What supply chain problems were there during the Pandemic and what did we learn? The presenter gave an overview of some typical supply issues experienced while building 20 projects, including a temporary hospital, during the pandemic, including long lead times for:

- Chips
- Air Handling Units
- VAVs
- Tracking Parts
- Switch gears
- Doors
- Glass
- Gaskets
- Flooring
- Substations
- Emergency Generators

Vinyl spackling was the surprise supply challenge for the presenter's team.

How to deal with supply chain issues:

- **Pro-active vendor monitoring**—by mechanical, electrical, exterior, structure, fit-out, etc.
- Schedule-driven design specs
- **Pre-purchase** to r**ebalance the equation between quality, time and cost** to help clients understand that items might cost, say, 10% more to get faster, but getting the facility (such as ambulatory care, operating rooms) open and running pays off in terms of bottom-line revenue flow
- **"One Design Program"** - Brought froward actions into the pre-bidding process, things that were previously done after hiring the trades (like hiring sketchers), i.e. **pre-coordinate early on** to save time afterward and onsite
- **Work on the detail areas that come together** and often cause the most trouble, the details Revit isn't really good at, on the construction site to save time.
- Speeding up the process with pre-fabrication

Construction Issues exacerbating problems include:

- Skilled **labor force** problems
- **Productivity** is in dramatic need of improvement in construction

How Pre-Fab can help:

- Pre-Fab is not new, but can enhance safety (injury rates are much lower than onsite) and
- improve quality with fabrication done away from the elements
- Increases speed to market, particularly for renovations (such as with prefab OR ceilings and wall systems)
- Productivity gains
- Reduce construction costs

Where does Pre-Fab happen and who does it?

- Many companies make pre-fab components from patient headwalls and bathroom pods to exam room pods, integrated OR ceilings, OR walls, bathroom wet walls, and ceiling SVC racks onsite
- Pre-fab can be used all over the healthcare environment
- Product take-up ranges from proven alternatives to early adopters
- Mostly made in nearby warehouses or vendor factories—rarely onsite.

Who needs to be involved?

Everybody needs to be involved

- Needs collaboration and early engagement
- Need real cost analysis with modular manufacturers
- Decision timelines need to be tuned to supply chain risks
- Doesn't matter what kind of contract
- Traditional Design-Bid-Build **doesn't work**

Additional Tips for Success with Pre-fab

- Early Procurement
- Utilize a "Special Teams" Playbook
- Working with Agencies to Maintain Compliance
    - Bring on agencies to the big idea from the beginning, or you will never get it approved
- Design Freeze
    - Late changes are costly and adversely affect production and schedule
    - But there is some flexibility with most of the manufactures if done early—one size doesn't have to fit all.

LESSONS LEARNED: 3 PROJECT CASE STUDIES

The presenters offered some case studies to offer some perspective regarding how pre-fab works by focusing on four (4) common project elements: Ceiling service racks, bathroom pods or wet walls, patient head walls, and OR integrated ceilings (see slides for details, which indicate agencies involved, size, date and project construction method).

Project 1: UTSW Hospital

- Make bathroom pod decisions earlier
- Build a prototype for review
- Don't let bathroom doors get exposed to UV (sunlight)
- Don't use Pods as a corridor wall as a savings strategy - just doesn't integrate well

Project 2: Mt. Carmel Hospital - Columbus

- Got involved in the owner's process too late
- Rack walls and beam coordination - monitor production
- Beam / stud issues — if steel is not placed exactly where it should be per drawings, the connections suffer
- Wet walls were not a good replacement option for pods
- AHJ fire-stopping review

Project 3: Houston Methodist Hospital

- Bathroom pods were a problem — they used floorless bathroom pods, which was not a good option—but now there are thin floor bathroom pods available)

- Ceiling service racks couldn't be used because of floor to ceiling heights
- The team experienced install logistics issues

What's Next?

The presenters closed their presentation with the observation that uncertainty about the future remains, and frustration will continue, but there are opportunities for products that will improve the quality, time on site, and compress the construction schedule and get the owner's revenue flowing faster for a net decrease in costs.

What lessons were learned over the years and how has Prefab evolved?

Mogens Smed, CEO, Falkbuilt LTD

Jack Conway, Senior Vice President, Gil-Bar Health and Life Sciences

Moderated by B. Alan Whitson, RPA, CEO, Corporate Realty, Design & Management Institute

Question: How do you expedite prefab?

Morgens Smed, CEO Falkbuilt Ltd.

- The problem with modular pre-fab is that there's no architect that specifies in modular. Architects use Revit, and that's how it specified, so you have a challenge with the design process, because even if you give them the REVIT models for the modules, modular isn't in alignment with the conventional construction process.
- Regarding bathroom pods, twenty years ago, Falbuilt had a job where you had to have building interventions to bring them into the space. Some of them wouldn't fit: a column wasn't where you thought, mechanical wasn't in the right spot, corridor widths and corridors had to be fire-rated, but these weren't fire-rated pods. The building inspectors had to tear about the pods on site.
- In 2004, when Morgens started a company, there were no iPads, AI, big data — but there are now, and it's been a game changer.
- The big thing is the design process right up front, and it's starting to work now. Morgens sited a project with 632 rooms, where the prefab was manufactured in Alberta and shipped to Kuwait—and it fit. That couldn't have been done in the past.
- The way headwalls are built, most of the time the GC will build them in a warehouse off site and then bring them in…but that's not real prefabrication.
- Real prefabrication is being able to define something clearly that so everyone knows what they're getting, it fits into the natural sequence of conventional construction, and is sustainable.
- There are better solutions than dry wall in hospitals in the US — in Abu Dhabi or Kuwait or Saudi Arabia, they build a hospital in 25% of the time that we do here.
- Technology is changing the game, it takes the complexity out of what we're doing, the way we build, the process that's changing everything.
- Build in a way that can be changed later on down the line — it doesn't become obsolete right away.
- You need access and flexibility as the technology changes, so you need to build in a way that addresses and accommodates the future.
- Build it so it's truly sustainable, infection control, acoustics, sanitizable, etc. It's the most important thing is to build in a sustainable way and really addresses the future.

Question: How are you approaching outpatient care facilities?

Mogens Smed, CEO, Falkbuilt LTD

- Much easier than hospitals, it's not nearly as complex. We're building faster and better.

Jack Conway SVP, Gil-Bar Health and Life Sciences

- Ten years from now, modular concept is going to be standard—it's going to be a no brainer in terms of schedule, etc.
- Technology and finance companies, for example are applying modularity in a more consistent way than institutions, particularly in NYC. In healthcare, the owners want to know how to implement care and how to get buy-in from the c-suite down.
- It's not worth exploring modularity once the design process is underway, it doesn't work, and it's a waste of time once the contracts are awarded.
- The most important thing when considering prefab is speed to market. It's the number one reason for utilizing pre-fab, more so even than for institutions looking for capital cost savings, though that certainly can be a positive.
- The hardest thing for institutions is implementing modular and being clear about what the advantages are from the outset.
- To succeed, you need to get key team players involved from the very beginning: pre-construction, the design development process— you can save the architect hundreds of hours.

Mogens Smed, CEO, Falkbuilt LTD

- Clarity: You will get a cost number from the outset. There's a degree of cost certainty with pre-fab as it minimizes change orders.
- Back to Revit: You can't build or manufacture anything with the Revit, everything is done with 3D models. There's not yet a connection between the design tool and the actual fabrication and construction tool.

Question: What about the maintenance side of the equation? You can now go back and upgrade, maintain and change products.

Jack Conway SVP, Gil-Bar Health and Life Sciences

- Absolutely

Mogens Smed, CEO, Falkbuilt LTD

- Non-modular projects have to deal with change orders and are frequently off-budget, whereas with modular construction you have a degree of cost certainty. You can see what the advantages of what a change means before anything goes into production
- With regard to price certainty, prices for steel packages for conventional construction might hold for 72 hours, but then they want all the money up front for the procurement. But with outside fabrication you have a fixed price, it's not a moving target, you don't deal with material escalation. Right now, there's no "just in time."

Question: What's the last word?

- The agencies having jurisdiction are a fundamental part of the equation and the way people design and the guidebooks and rules they use are another.

2022 FGI Guidelines Update: What's Changed From 2018

David B. Uhaze, RA, Principal, Health Facilities Design Consulting and Chairman, FGI Guidelines Revision Committee, Retired AHJ - State of New Jersey

Uhaze gave the attendees a detailed overview of what's in the updated 2022 FGI Guidelines, including updates that resulted from the lessons learned during COVID-19 pandemic. Here are key additions, updates, and useful information from the new edition by topic / facility type below.

- **Sustainable Design:** The FGI publications refer to standards and guidelines already issued rather than duplicating those already published by other entities. Otherwise, they recommend a variety of references, such as ANSI / ASHRAE / IES 90.1 in the absence of a locally or state adopted energy code.
- **Palliative Care:** These design considerations is a recommended holistic approach to symptom management, treatment side effects as well as accommodations for and support of quality of life for the patient, their family, friends, and caregivers.
- **Lighting:** FIT offers guidelines via two (2) IES publications: ANSI / IES RP28 and ASI/IES RP-29. These address, for example, the special lighting needs of older adultcare populations as well as practices for lighting for the general population in health care facilities and special lighting for medical procedures). These are more recommendations than requirements
- **Burn Trauma Critical Care Unit (NEW):** This new section includes guidelines from regarding such design specifications as the temperature of burn patient operating rooms, the inclusion of radiant heat panels over patient beds, and the design of the patient room as a protective environment.
- **Hospice Patient Care:** Guidelines have been updated with requirements for family care / patient-centered care and comfort, such as clear floor area, and inclusion of a chair for long term sitting, a space for overnight family stay, a patient toilet room, bathing facilities and an outside window. Some items are required, others are recommendations.
- **Neonatal Couplet Room:** These design standards specify that the hospitalized mother and NICU patient need to be cared for in the same room to foster critical bonding between mother and baby, as well as clear floor area for the adult bed and neonatal care station, among others.
- **Emergency Departments:** Guidelines address the area of hospitals that have seen the most growth. Guidance includes pediatric areas, and revised Behavioral Health requirements — and involves not only mental health, but also drug addiction and people coming in from the street.
    - **ER Low Acuity Treatment Area:** Developed for people going to ER's, changing the previous approach from whole cubicles in favor of low-acuity treatment stations, because whole cubicles are not always needed, and the stations enable patients to be treated and fast tracked. The stations cannot be used to replace other ED treatment room types in their entirety. Ratio of bays / stations to cubicles depends on the expected patient acuity mix and planned facility use. A list of requirements to support the standard of care, such as handwashing stations and privacy, is included.
    - **ER Behavioral Health Area:** Addresses secure holding rooms with a min. clear floor area of 60 SF, minimum ceiling height, guidelines to limit the patient's ability to convert architectural features or equipment into weapons, and ligature-resistant design criteria for all spaces, among others.
    - **Decontamination (INTERIOR):** Specifies that the outside entry door be located 10 feet minimum in any direction from the closest other entrance, with a separate external entrance next to ambulance entrance lighted and protected from the environment in the same way as the ambulance entrance.
    - **Decontamination (EXTERIOR):** Specific requirements include inclusion of at least two temperature-controlled shower heads, separated by at least 6 feet, provision for containment of the contaminant/infectious agents, and water runoff capability to prevent contaminated water from entering community drainage systems, among others.
- **Behavioral Health Crisis Unit (NEW):** This detailed section specifies guidelines for a separate, dedicated emergency services unit to respond to behavioral and mental health crisis unit. Means for visual observation of

unit corridors and patient care areas shall be provided. Electronic surveillance shall be permitted only as means of visual observation. Includes guidelines for an observation room, room size and toilet room.

- **Behavioral and Mental Health Hospitals:** Includes updates to environmental safety and prevention of harm. Privacy is not required for Behavioral Health, as observation can be critical. No shower curtains are to be included for safety reasons, but a toilet room must be included for each patient room. There is an emphasis on security and elopement prevention.
- **Geriatric Patient Care (NEW):** The published standards specify that each room must have access to a bathtub, and that a Geriatric Patient Care Unit must exist as a separate from Adult and Pediatric Units.
- **Transcranial Magnetic Stimulation Rooms (NEW):** Guidelines specify a minimum clear floor area of 980 SF, and a hand washing station. Consideration of light dimming controls are very important for patient relaxation. RF shielding may be necessary. Accommodations for documentation are required.

Additional Hospital Guidelines Revisions:

Updated appendices for the behavioral and mental health risk portion of the safety risk assessments, and include providing an anteroom for airborne infections, and clarifications on clean and sterile storage in operating suites.

- **Emergency Department:** Includes new ED design guidance to improve flexibility, accessibility, and safety.
- **Outpatient Guidelines:** Freestanding ED requirements are now only included in the *Outpatient Book*. These include the removal of the clear floor area requirements of several patient care stations, with clearances now determining their size. A new appendix table is now included with examples.
- **Birthing Rooms:** The updated standards reduce minimum birthing room size from 200 SF to 120 SF, among other guidelines.
- **Multiple Patient Exam Rooms:** Guidelines have been added to the Urgent Care Center chapter, and includes various room clearance requirement updates.
- **Sexual Assault Forensic Room:** The guidelines must meet the standards of a single patient room, but will include pelvic examination bed/table, a lockable storage area for forensic collection kits, private toilet and shower, and readily accessible consult room. Everything should be contained together in a grouping of rooms.
- **Hyperbaric Oxygen Room Facility (NEW):** Recommendations for Multi-place (Class A chamber) facilities, Mono-place (Class B chamber) facilities and Support Areas for the Infusion Center to be provided for the hyperbaric facility.

Residential Care Facilities Guidelines

- **Residential Care Facilities Guidelines:** Updates include some changes to spatial requirements for resident rooms in nursing homes, expanded telemedicine, and revised noise levels recommendations for rooms and kitchen and food service areas, among others. Also includes streamlined model typologies for assisted living facilities, revised noise level recommendations for resident rooms and kitchen spaces.
- **Food Service Types:** The type and size of the nursing home facility determines the dietary environment and the food service facilities provided, including Commercial kitchen, Retail kitchen, Household kitchen, Social activity kitchen, Outpatient therapy kitchen and Warming/serving kitchen.
- **Resident Room Sizes:** Now includes minimum standard sizes for rooms, based on clearances.
- **Dialysis Services:** Establishes minimum clear floor area for each station, minimum headwall length, and minimum space between treatment chairs. Treatment areas shall have privacy screens or cubicle curtains and handwashing. Sufficient storage shall be provided for each resident's dialysis supplies and dialysis machine when not in use. Dialysis areas shall be separate from day, dining, and activity space.
- **Telemedicine Services:** Specifies that a dedicated room shall be provided for telemedicine services, unless volume does not justify it, in which case an office, exam room, or conference room can be used. Addresses lighting and sound requirements and recommendations.
- **Acoustics:** New updates include noise criteria and acoustic treatment for dining rooms.

- **Inclusive Environments:** Provides inclusive design principles to support quality outcomes for older adults with varying degrees of health concerns that may impair mobility or vision. Design recommendations for inclusive environments include identification of formal and informal resident needs in health, care, and support settings and the related physical elements that support these needs. Long term care settings often designed to look like a street, where each place has a front porch / facade, works especially for patients with dementia. Reflects the emphasis on patient-centered care.
- **Sustainability for Long Term Care:** Revisions have been made and extensive appendix language included regarding how to formulate a sustainability strategy.
- **ASHRAE 170 - 2021:** Includes changes to the Residential Guidelines (including residential health, care and support settings), is a separate publication, and includes revisited references for ASHRAE 62.1 and 62.2 nontransient vs. transient residents.

Additional Resources

- **Beyond Fundamentals:** FGI provides access to a growing collection of health care design resources that show what kinds of changes have taken place in healthcare since the last guide was published. These include white papers and the Illustrated Guide to FGI Guidelines.
- **Guidelines for Emergency Conditions:** Provides guidance on setting up temporary facilities and adapting existing facilities in response to the COVID-19 pandemic, but for weather emergencies, other pandemics, wildfires, and other emergency situations.

High Rise Urban Hospitals: Rising Above Time, Money and Space Challenges

Doug King, AIA, CSI, NCARB, ACHA, Vice President, National Healthcare Sector Lead, Project Management Advisors, Inc.

The Vertical Healthcare Campus

- Doug King wrote his first blog on high rise hospitals in 2018, and followed up with an article in *Council on Tall Buildings and Urban Habitats.*
- King began his presentation with the statement that people are building giant hospitals all over the world, which he called "fascinating." Two such hospitals that King worked on include the **Prentice Women's Hospital,** the third largest women's hospital in America at 1,000,000 SF, and the second was the award-winning **Feinberg Galter Pavilion** at **Northwestern.**
- King noted that, **"We build entire cities in healthcare buildings every day."** Yet many medical centers are becoming very spread out in terms of space, with three examples represented by:
    - Barnes Jewish Hospital in St. Louis, MO
    - Texas Medical Center in Houston TX
    - Northwestern Memorial in Chicago, IL
- Because of space constraints, it's necessary to build what King dubbed "mammoth structures." He noted that large hospitals can have a large number of user groups (constituents), giving an example of one with 125 user groups. He called managing a large number of constituents "not unusual," and had a project with 2,000 user group meetings.

What constitutes 'Tall' in Healthcare?

- In one Chicago, neighborhood, King noted, there are four hospitals and a nursing home that are each over 400 feet high. Houston, also has four, though New York does not compete yet in terms of high-rise healthcare facilities. King presented a slide listing the top 20 tallest healthcare buildings (hospital and outpatient) in the world, and described some in brief, including:
    - Memorial Hermann Tower in Houston — **498 feet**
    - Guy's Hospital in London, UK — **488 feet**
    - O'Quinn's Medical Tower in Houston — **475 feet**
    - Wuhan Xiehe Hospital Tower in China — **469 feet**
    - David H. Koch Cancer Care at MSK in New York — **449 feet**

What's coming up in tall healthcare buildings?

- **Centennial Tower at Houston Methodist (467 feet)**, designed by EYP (2027) is 29 floor tall, a bit higher than most, encompassing 1.5M SF. The building uses a traditional stack approach.
- **Peter Gilgan Mississauga Hospital** in **Ontario (420 feet)** with 24 storeys, 2.8M SF and 1049 beds, is an interesting design featuring layers like a wedding cake—layers of community engagement to the outside.
    - Most of the examples are within a certain height range — there seems to be a limit to how tall the buildings are
    - Sometimes design firms designing the tall buildings don't have much high-rise experience, which poses limitations to how high they can go
    - Trend towards taller high-rise buildings in areas with congested urban sites, especially in the Mideast and Asia.
    - Outpatient Focus trend is driving the ability to create taller structures

- Integration of three elements of comprehensive care (Clinical, Research and Education) — rather than side by side in 3 different buildings, co-located vertically in a singular structure. Ex. **Shirley Ryan Ability Lab** in Chicago.

What is the definition of a hospital?

- For stays 23.5 hours or more
- For patients that are not capable of self-preservation

Challenges with building vertical in urban hospitals:

- Site access and wayfinding challenges:
  - Use simple wayfinding
  - Connect whole floors as public "pathways"
- Code / Regulatory / Life Safety
  - In tall hospitals, think about the coordinated fire protection policy that gets layered in early on
  - Design for "defend in place" to provide safety without moving patients
  - Create different areas of integrity, different buildings with shafts and exiting
- Mixed-use challenges
- Structural coordination issues
  - Planning Modules: Carry up through the building
  - Core Placement
  - Structural Floor to Floor Heights
  - Determine Optimal heights — how to get the most clearance with the material
  - Special loading coordination with MEP equipment
  - Grid spacing to accommodate clinical uses
- Mechanical / Electrical / Plumbing / FP / IT Challenges
  - Benchmarking Core / Shell and MEP/ FP/ IT spaces
  - The "forgotten rooms" in the design process
  - Integrate early on in the planning
  - MEP / FP and IT coordination list (see slides)
  - Location of major equipment
  - Technology - in most health systems have 40-50 systems, must coordinate
- Vertical Transportation Challenges
  - Success of the building depends on the elevator
  - The MULTI is now on the market - ThyssenKrupp's sideways moving horizontal-vertical elevator system offers more design freedom and a shift in height limits
  - Automated Guided Vehicles, Power Chutes, P Tubes integrated into larger buildings
- Facade Design in the Hi-Rise Healthcare Environment
  - Hospitals are much more affected by the "Stack Effect"—than office buildings
  - Research in progress on how to control or divert the Stack effect
  - Moves humidity to the outside wall and turn to frost and mold

    - Envelope considerations: thermal resistance, thermal breaks, high performance glazing, resistance to humidity.
    - Air leakage and ventilation affected by the air tightness of the envelope and pressure differences inside and outside the building
- Sustainability Challenges
    - Hospitals are big energy and water users, open 24/7
    - Many requirements are regulatory mandated
    - Durability of materials is a work in progress
    - Biophilic Design: Nature of Space is the best opportunity for instituting Biophilia in High Rise Design
    - Integration of green space
    - Green roofs
- Acoustical Challenges
    - Relationship between acoustics and average length of hospital stay Acoustics and Noise
    - Vibration
    - Odor and entrainment
    - Wind and climate—building shadows, increased wind activity
- Construction / Project Delivery Challenges
    - Hospitals can take up to 8-10 years to design and build
    - Consider changes to the project team over that time period
    - Adaptability is enhanced by the vertical healthcare environment
    - Phasing
    - Two procedures should be put in place for healthcare design and construction:
        - Interim Life Safety Measures (ILSM)
        - Infection Control Risk Assessments (ICRA)

The Benefits of Building UP: A High Rise Study for a Los Angeles VA Hospital

- King described a study that illustrated the advantages of building vertical healthcare facilities, where the client, the Los Angeles VA hospital, asked for the development of a variety of schemes to explore options for a new, $1.4B, 1.3M SF hospital.
- The high rise scheme emerged as not only the cheaper option — saving $200 million dollars—it could also be built faster, cutting six months off the schedule required for a typical 8-year project.

What Does the Future Hold?

- King ended his presentation by noting, “Vertical hospitals are not as high as super tall, but we hold our own—and there’s a lot of opportunity for research in this area.”

Adaptive Reuse — Hard Lessons Learned When Converting to Medical Purposes

Ciro Fraschilia, President of Mascioni & Berman, Architecture, PC

Rahul Tikekar, PE, MS, MBA, Principal/Senior Vice President, Loring Consulting Engineers, Inc.

The presenters focused their presentation on a project that transformed a historically and architectural significant bank building on Queens Boulevard in NYC into a healthcare facility. They acknowledged that this 22,000 SF project speaks to the current trend of creating retail-oriented healthcare delivery facilities, and that many such facilities are outpatient specialty facilities with special MEP considerations that must be explored from the very outset.

They began with an overview of the key A/E and MEP challenges generally relevant to the adaptive reuse of an existing building for use as a healthcare facility:

Overview of A/E Challenges for Adaptive Reuse

- Determine the intended healthcare type and develop
- Program with client
- Review zoning and code to make sure a healthcare facility is allowed
- Conduct a NYS DOH Article 28 review
- Review building structure to make sure it can be adapted to healthcare
- Looking at MEP infrastructure is a critical step
- Building envelope and energy code compliance plays a big part

Overview of MEP Challenges for Adaptive Reuse

- FGI Guidelines Requirements must be followed if the project will be filed under the DOH
- Understand the Mechanical Systems for proposed spaces existing in the building
- Specialty rooms, MEP requirements
- MEP building services: i.e. condenser water, chilled water, electrical capacity, domestic water, storm sprinkler lines, back flow preventer, is there natural gas?What is the temperature of the water in summer/winter? Is there water 24/7?
- EM Power requirement - generator
- Medical Gas requirements

Key Questions to Ask for Adaptive Reuse for Healthcare

- What kind of space are you looking at? Outpatient surgery center or outpatient dialysis center?
- Will you have an MRI? What does that mean for MEP? Is the chiller going to be air- or water-cooled?
- Will it have CT-scan or X-ray? If so, it will need special de-cooling.
- Will you need emergency power? Medical gas systems?
- What does the site provide at the outside?

Tikekar said, “For MEP systems, the message is that it’s really important to do initial site surveys and look carefully at existing conditions,” for critical information in making MEP decisions and coordinating with the architect to make sure the project is well defined.

CASE STUDY: Mount Sinai Doctors Outpatient Facility, Queens

Original Building Design and Construction – 1952 - Adaptive Reuse Renovation - 2019

Project Initiation: The team had a test fit made available to them, but they decided to go back to the site assessment, to make sure the location of the available services was most appropriate for the base building

infrastructure and structure and its intended use. They soon realized that the structure was going to present challenges.

Background: Fraschili explained that the two-level modernist Metropolitan Bank building to the west end of the site was designed by noted NY architect, Philip Birnbaum, but the long facade had been butchered up by many tenants over the years. The team strove to bring back the original style on that wall. The other part of the building was designed and allocated for retail, with upper story for office. The property sloped down to the west, with the basement originally used for storage. In 2018, when the team began the adaptive reuse project, Frashilli explained, "The long facade was butchered up, with a gym in the basement, a retail chain pharmacy that had blocked off windows with stucco, and a college with a separate entrance."

Program: The Mascioni & Behrman designed space featured a primary care entrance that spills out along the flat, long portion of the building. Below that, the architects located the imaging suite, with light specialty spaces located in the middle and cardiology and nuclear medicine on half the floor. On the upper portion of the mezzanine space, was allocated for support spaces.

The Design Challenge: How do you bring this all together and make it functional for a 21st century medical facility that's ADA code compliant

Summary of Challenges Unique to the Metropolitan Bank Building project:

- The bank building and the retail space turned out not to be the same elevation, which had to be addressed across disciplines, but especially structurally to connect the two
- Different ceiling heights
- Full-height glass (30 to 40 feet height) posed a challenge to heating and cooling the spaces. The team added a film to reduce solar gain from windows
- New AHU's - proper zoning was important
- Repurposing original, abandoned shaftways for new ductwork and piping
- Specialty spaces with dedicated cooling and VAV reheat, SS double-wall venting along building to roof with combustion air intake
- Had to include new, high-efficiency condensing boilers in basement for proper heating
- Rooftop VAV systems
- Specialty spaces like a nuclear camera room and x-ray, needed specific exhaust and filtration solutions
- Coordination with the facilities / owner to determine if there was a requirement for emergency power, ultimately deciding not to include emergency power
- Needed fire alarm system and to ensure proper pressure for sprinklers
- Sprinkler booster pumps and dedicated sprinkler zone valves were needed for each tenant
- Integration of the FA System
- Gas service: required separate high-pressure and low-service feeding different tenants with independent distribution to the roof

Design and Historic Considerations

- The team strove to preserve as much of the existing space, original design / look of the building and materials as possible, including the terrazzo floor
- Facade really couldn't be touched.

Adaptive Reuse: Lessons Learned at Queens Boulevard

- "Bring in the architect and engineers early on," Ciro Fraschilli stressed. "Had we just moved forward with the original test fit on this project, it would actually extended the construction schedule. But by taking 2 more weeks in design—to do the site assessment— to provide a plan, identify, and avoid all the potential issues, we actually had no surprises during construction," adding that "we will use this as a basis for many more projects."

Issues & Answers: What's on the Mind of Health System Leaders

Randolph G. Howard, Senior Vice President, Corporate Facilities Services, Northwell Health

Tina Macica, PMP, LEED AP, Associate Vice President, Design & Construction, Montefiore Health System

David Sullivan, MBA, Senior Vice President of Facilities, PDC, Real Estate and Support Services, Maimonides Medical Center

Moderator: Marisa R. Kelly, CHC, Project Executive, LF Driscoll Healthcare

Key Takeaways from Panel

Question: What are you seeing in terms of the healthcare built environment anywhere from one to two years out?

Facilities:

- Looking at expanding ED capacity and ICU units — and what can we do next to accommodate an emergency like the pandemic and stay at the forefront.
- "Right sizing" facilities, both existing and as we build new, to be able to flex up or down as needs change.

Digital Technologies:

- Really including digital transformation and leveraging that technology— a huge friend during Covid to take care of the "patient of the future"
- How to build the units leveraging what Apple and Google have to offer — like nurses utilizing their cellphones for notes and reducing their note-taking time.
- Walls that have digital displays of biometrics for all the patients.

Environments:

- Making sure the environment very welcoming - customers have higher expectations than they had 20 years ago.

Inpatient Hospitals vs. Ambulatory Care"

- Being mindful of the paradigm shift in migrating away from inpatient and more towards ambulatory care
- That hospitals will be more for the sickest of the sick, very complex procedures, super ICUs, birthing centers, etc.
- A focus on delivering care at home, where the bed, doctor ,and nurse show up and, through telemedicine, are able to take care of the patients.

Real Estate Department Role:

- Have apartments available to house people that need to be at the hospital—without worrying about transporting them back and forth.
- Reimagining what real estate development can bring to the hospital to sustain employment, but serve as revenue source that was not realized in the past.
- Give resources to it to facilities up to the modern standard.

Question: Covid meant a lot improvement projects got shelved for a while. Are you starting to see a lot of those come back, or is Covid still driving the train on what you're investing in right now?

Active Projects Post-Covid:

- Essentially 100% back—projects that were put on hold have come off of hold, and new projects are coming out.
- Most agreed that they are regularly pushing forward with projects now.

Capital Needs and Shifting Code Requirements:

- Pushing to do capital needs assessments for capital needs equipment as equipment ages, and address new code requirements as more procedures moving to outpatient, and different types of procedures are happening in rooms in which that didn't used to happen.
- Upgrading utilities to meet changing capital needs, for example, in cardiology, putting in a pacemaker in an IR room — that's triggering new codes.

Strain on Resources:

- The stock market is down and affecting availability of resources.
- Looking at bringing in products locally, manufacturing locally. give opportunities to the people in the communities the healthcare systems serve.

Building Hospitals of Tomorrow:

- A large focus on building the 'Hospitals of Tomorrow' as much as possible.
- Investing in infrastructure—often we open a facility and some of technologies are already obsolete.
- Any of the health systems in the area have old hospitals and infrastructure, and there's a need to invest in updating.
- "You can't run a great hospital if the infrastructure isn't great. You can have all the modern bells and whistles, but if the fans and chillers go, and you don't have some redundancy, it's a problem." (*Randy Howard - Northwell)*

Sustainability:

- Focusing on minimizing the carbon footprint in the communities that the health systems / hospitals serve and how to build in a sustainable way.
- Looking at sustainability from when the building comes out of the ground through when it's operating,
- Minimizing the carbon footprint overall so healthcare institutions are contributing to the health of the communities they serve by not adding to the pollution in those areas.

Post-Covid Facilities Upgrades:

- Working with end users to imagine what they need post-Covid.
- Such changes are a little more expensive to change up during construction, but there's a commitment to making changes to meet the needs of what those end users want.

Question: Based on what you are seeing for the future, what do you want the people in this room, especially in design, construction, and operations, to know—and what you are looking for from them.

Limited Capital:

- Health systems and hospitals have not fully recovered from Covid financially.
- Be sensitive to the fact that institutions need to get the biggest bang for the buck.

Sustainability and Durable Products:

- Understand the need for products that last, that are both sustainable AND durable.
- Design teams and individuals need to reach out to manufacturers and express the need to use sustainable products that last.
- Really understanding code requirements are—immediately meet with user groups and ask what procedures a space will be used for or if infection control involved.
- Understand what's needed for a space before starting design.
- Understanding what the costs are up front before designing.
- Some panelists are having high-level estimates completed before a project becomes a project, so leadership doesn't cancel the project based on cost—after funds have been spent.

- Equally weigh a lot of different requirements, don't just let user group drive a project.

Client-Team Partnerships:

- Looking for that true partnerships that teach the client what's latest and greatest—balanced with how to bend the cost curves.
- Partnerships that balance cost, quality and efficiency, so the facilities teams can deliver high quality products that stand the test of time—especially for MEP.
- Don't sidetrack the client with the latest and greatest if it's not ready for prime time yet.
- A partnership based on the business model of the department or unit being built.
- Don't forget the operational cost of the infrastructure to keep going; work with end users to build that in so that P&L shows and reflects the cost of the proper infrastructure maintenance.
- You can build something new, but if you don't put the money in to maintain it, it will become very old very quickly.

Audience Questions

Question: Tina, you mentioned doing facilities assessments. Are you doing that with an in-house team or going out to do that?

Facilities Assessments:

- Rather that implementing facilities assessments in-house, some panelists are bringing in experts from engineering and risk assessment to determine what equipment is most critical and aging quickly.
- Need to make a priority list on how to conquer the long list of equipment that needs to changed out.
- Look at the maintenance long-term to really to prioritize what's going to affect patient care.

Question: As materials for hospitals are getting longer and longer lead times, I've heard about sort of design-build environment becoming popular…but sometimes there's not enough connection between the facility builder and manufacturers. How are you trying to bridge that gap, or are hospital really looking at that?

Design-Build and Other Alternatives:

- One panelist expressed an openness to looking at Design-Build in the future, though they are not involved with it at present.
- Panelist said they were looking to make *early buyouts, or* partnering with large manufacturers and suppliers to strike deals now to pre-buy and the keep items at a safe, controlled environment.
- Panelists are looking for products that are in stock or already on a ship to address supply chain issues.
- Big supply chain challenges faced by health systems involve long lead times for critical items like generators and HVAC, distribution panels and breakers.
- One solution is for partners to be better at reaching out to manufacturers and saying, hey, these hospitals are in need, what can you do?

Question: Regarding cost escalation and early buyouts, I sent in a proposal and the contractor called me 40 days later and said you got the job. But when I said okay here's the new price…these decisions are fast track…and it's insane out there. Do you have anything to add or comment about [rising prices]?

Price Inflation and Supply Chain Issues:

- Some panelists are asking partners / suppliers to hold prices for a reasonable period, because they can't change numbers even every 45 days, as institutions need time to balance cash flow, especially when dealing with large numbers.

- A major concern is how to get priority for deliveries of such critical items and or manufactures to understand that healthcare is serving patients and there's a critical need.
- An issue with pre-buying and leaving items in storage is that it might need to undergo commissioning to ensure it's still functional.
- A prime concern is that if a system fails, can institutions get the replacement items quickly in place.
- Biweekly decision-making meetings regarding purchasing can get buy-in from all users including finance, in a timely way.