Pandemic Preparedness:
Adaptable Design Interventions for Acute Care

WISCONSIN HEALTHCARE ENGINEERING ASSOCIATION

Sarah Cypher

DIRECTOR OF NURSING

FROEDTERT & THE MEDICAL COLLEGE OF WISCONSIN

DNP, RN, NE-BC

Isaac Larson

EXECUTIVE DIRECTOR, FACILITY DESIGN & CONSTRUCTION

FROEDTERT & THE MEDICAL COLLEGE OF WISCONSIN

Kara Freihoefer

DIRECTOR OF DESIGN RESEARCH

HGA

Ph.D., NCIDQ, EDAC, LEED ID+C

WISCONSIN HEALTHCARE ENGINEERING ASSOCIATION

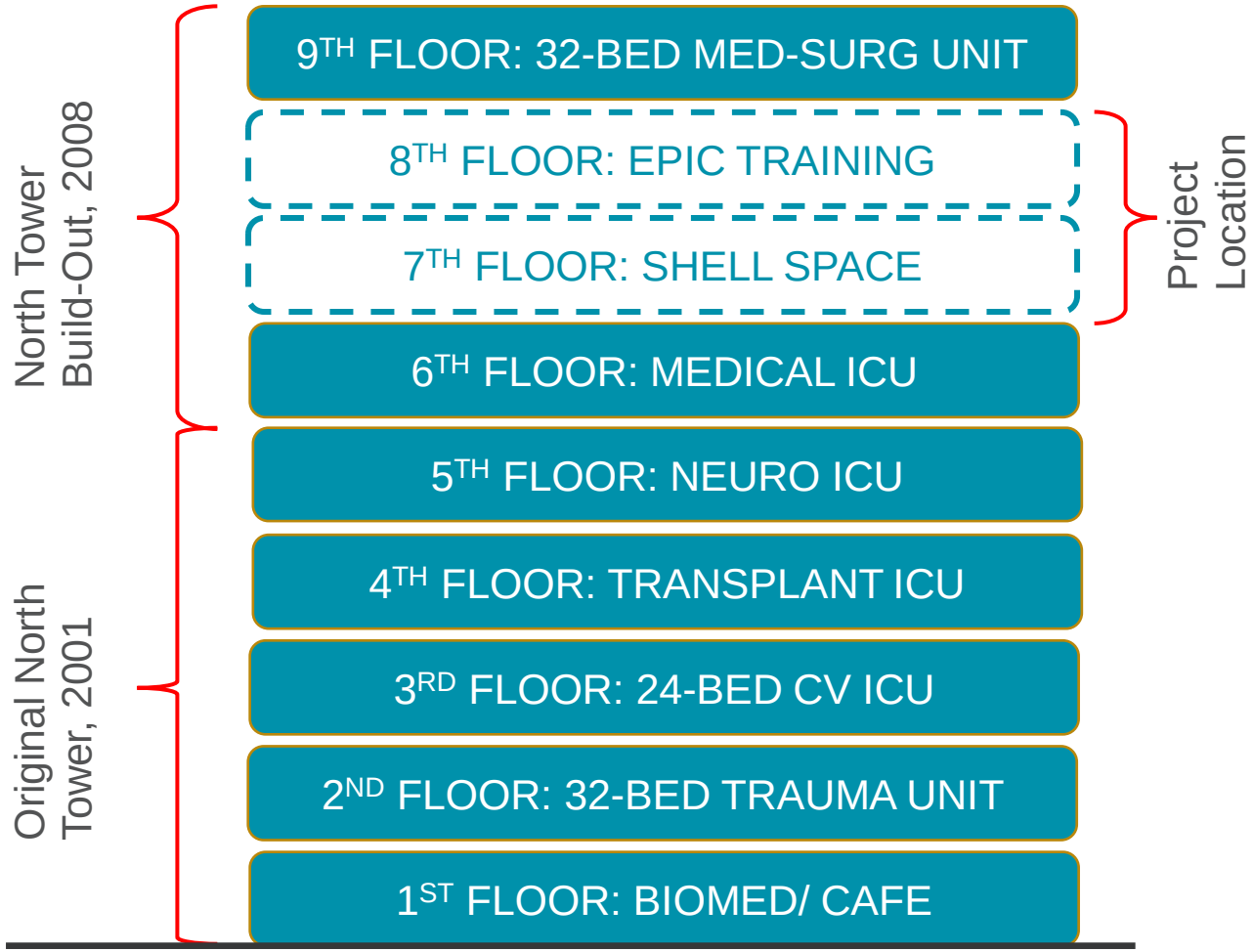
HGA

- Founded in 1953
- Integrated A/E since 1958
- 11 offices coast to coast
- 900+ employees
- Experts in healthcare, corporate, government, manufacturing, cultural, and higher education environments

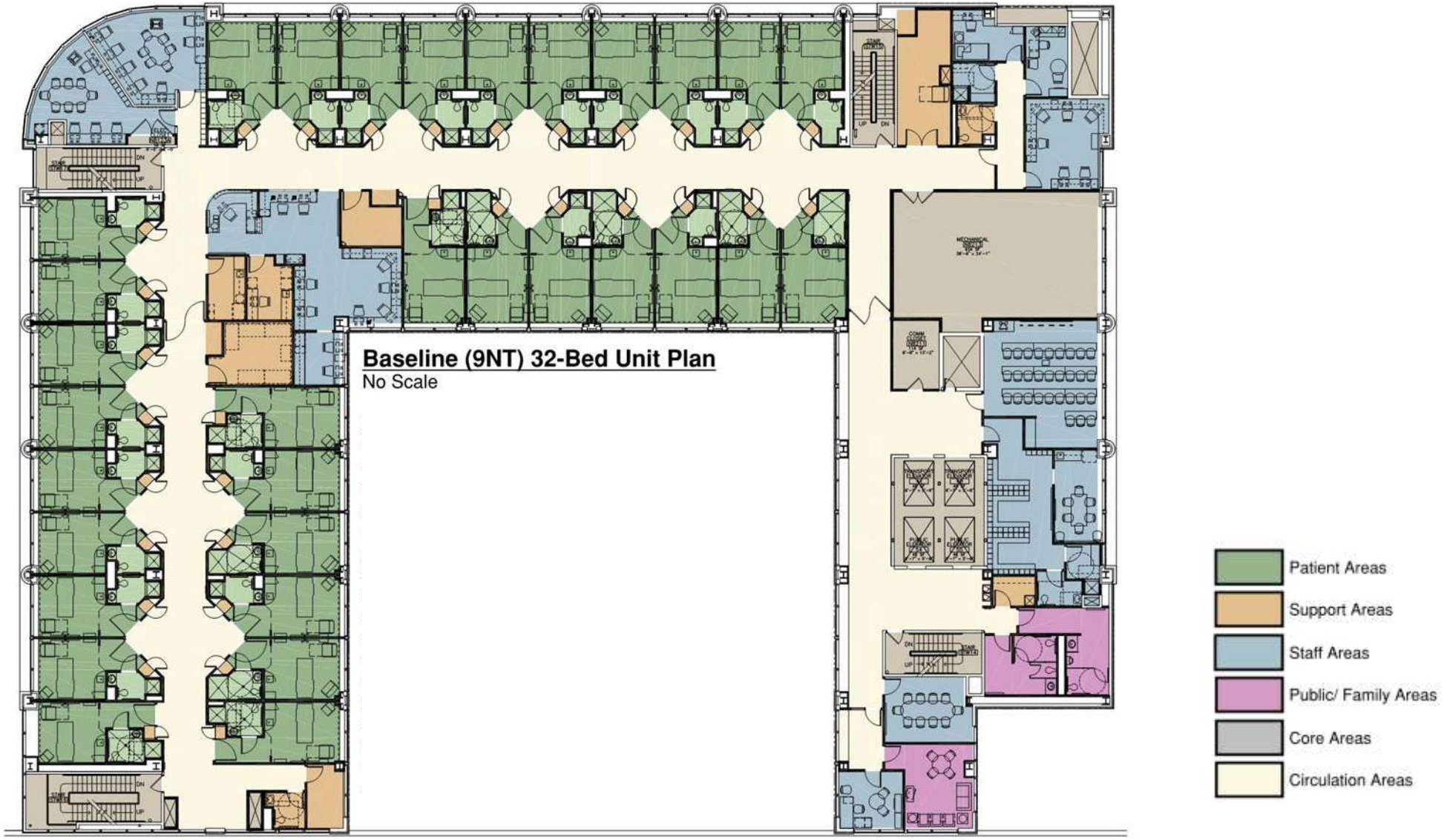
Froedtert & The Medical College of Wisconsin

- Froedtert is an Academic Medical Center serving the Metro Milwaukee area in SE Wisconsin
- 8 Hospitals
- 45 Community Health Centers
- 1200 Licensed Beds

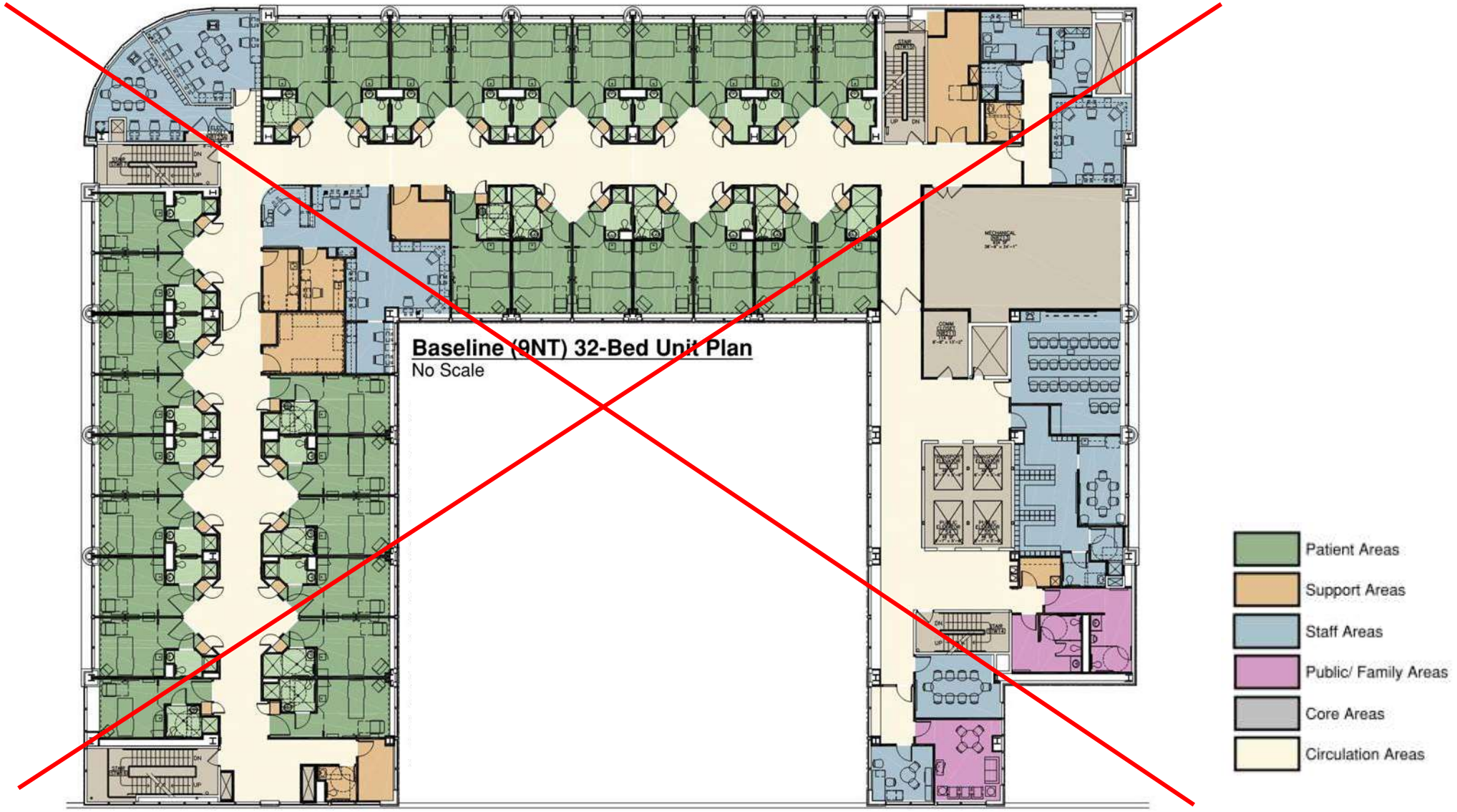
North Tower (NT) Build-Out



7 & 8 North Tower (NT) Build-Out Concept: "Copy and Paste 9NT"



7 & 8 North Tower (NT) Build-Out Concept: ~~"Copy and Paste 9NT"~~ *Rethink*



Merging Methods

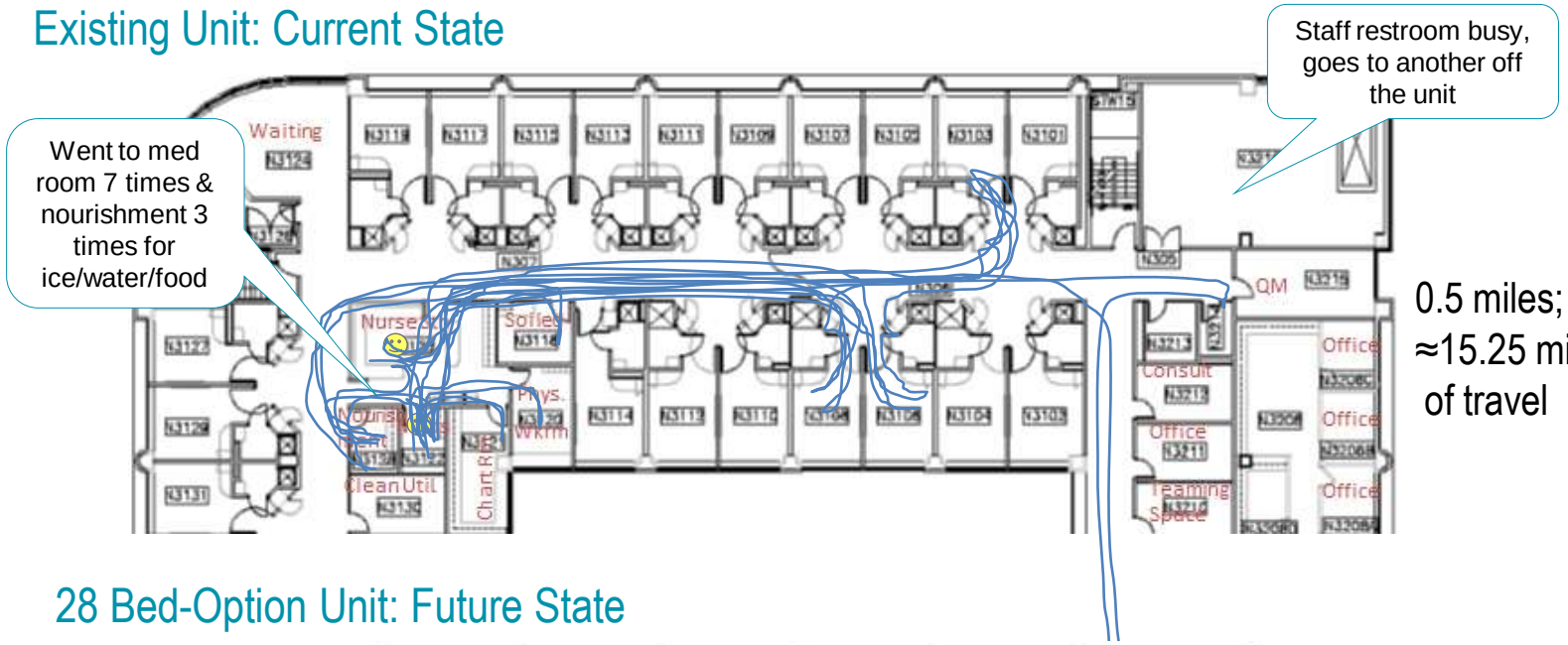
Model Process and Apply Findings to the Next Project

	Pre-Design DISCOVER	Schematic APPLY	Development TEST/PREDICT	Documentation VERIFY	Post-Occupancy COMPARE
LEAN	• Go to Gemba • Develop Data-Driven Critical-to-Quality (CtQ) Metrics	• Develop Future-State Operational Models • Rapid Prototyping • Strategic Space Program	• Evaluate and Assess Prototypes and Mock-ups with CtQ Metrics	Set Optional Standards & Goals Special Project Support (if necessary)	• Metrics Evaluation • Performance Report of Improvements and Continuous Improvement
EBD	• Gather Baseline/ Current-State Data with Valid Methods (shadowing, surveying, focus groups, & clinical data)	• Use Baseline Data to Develop Future-State Value-Streams, Prototypes & Program • Apply EBD Concepts from Existing Literature	• Test & Predict Improvements of Future-State Models with Baseline Data	Hypothesize Outcomes Verify Application of Evidence & CtQ Metrics	• Collect Data with Same Pre-Design Methods • Compare Post-Occupancy Data with Baseline Data • Identify if Hypotheses are Supported
Change Management	**Step 1: Create a Sense of Urgency** • Shared findings with staff to highlight potential improvement	**Step 2: Build a Coalition** • Engaged and empowered staff to influence design **Step 3: Form Operational and Design Goals** • Created an evidence-based design criterion (CtQ) **Step 4: Enlist & Empower Frontline Staff in Decisions** • More than 50% of the unit's nurses participated	**Step 5: Enable Staff Voice through Mock-up Simulations** • Staff assessed the rooms' performance according to the list of CtQs **Step 6: Generate Consensus through Data** • Data was shared with staff to show workflow predictions	**Step 7: Sustain Success by having Staff Set Future-State Workflows** • All staff participated in a daylong event to work-through operational and flow changes	**Step 8: Institute time to grieve, then change** • Staff were able to provide continued feedback, which turned their frustration into flexibility and acceptance

Pre-Design Data Collection

Prototype Testing: 2-hr shadow of RN rounding

Existing Unit: Current State

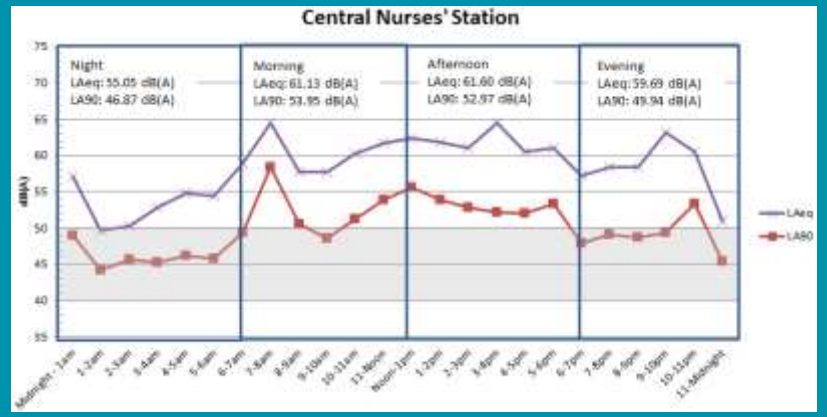


0.5 miles;
≈15.25 min.
of travel

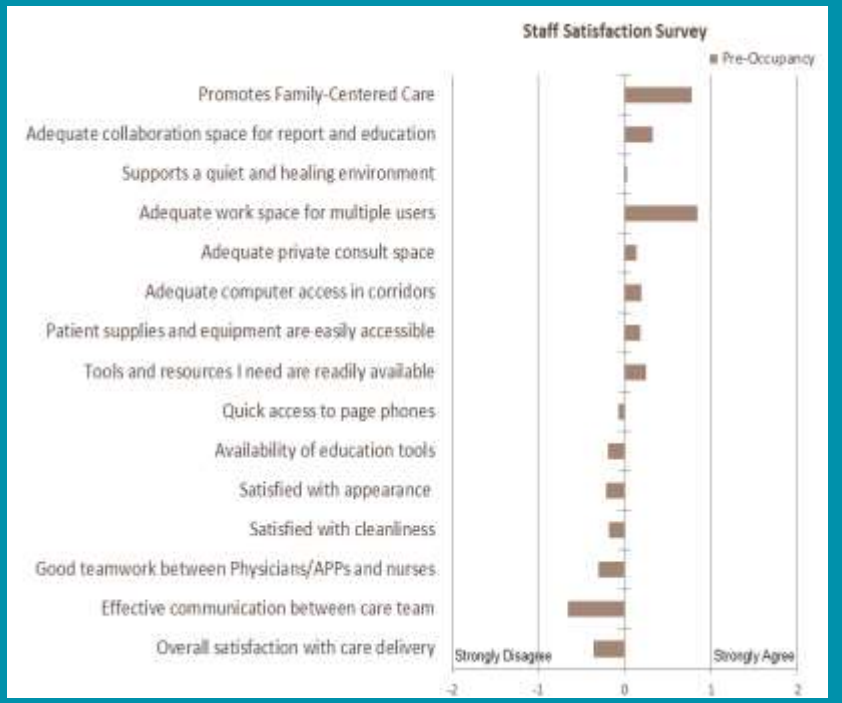
28 Bed-Option Unit: Future State

0.23 miles;
≈7.5 min.
of travel
56% decrease

Acoustic Readings



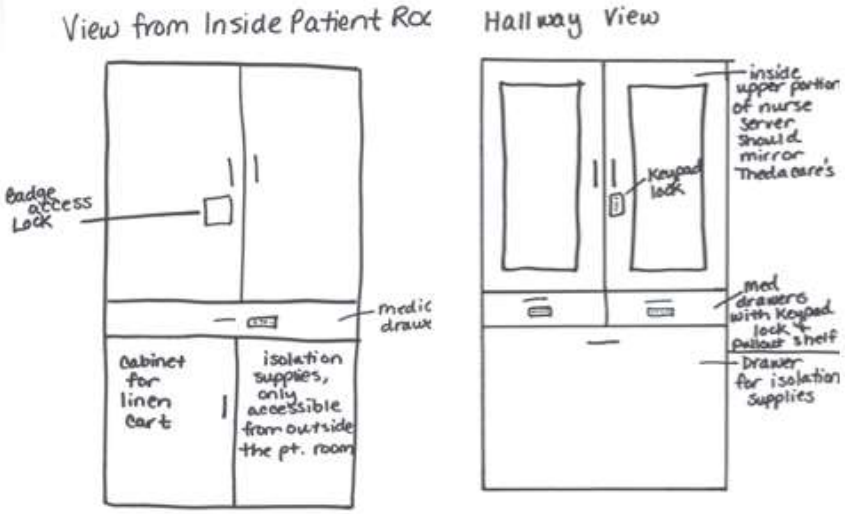
User Satisfaction



Pre-Design Interdisciplinary User Engagement

Information Gathering

Users Gathered Data + Insights

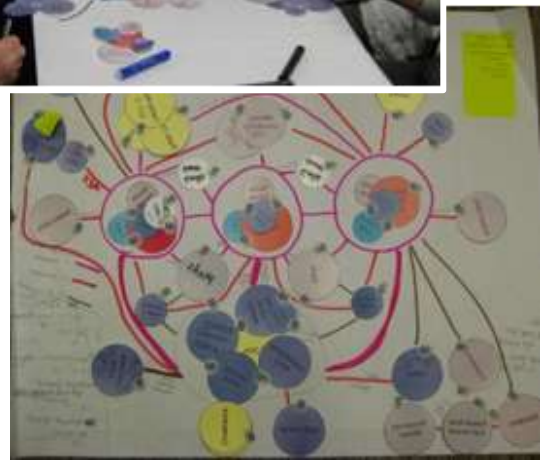


Speed Dating

Onboarding + Understanding Needs

Critical Adjacencies

Identifying Critical Relationships, Translate Process into Space



Critical to Quality Metrics

Identifying Critical ***Needs*** to produce ***Quality*** outcomes

CTQ #1: Patient Satisfaction

- Privacy
- Comfortable environment
- Space to "call my own"
- Sense of control

CTQ #2: Patient Safety

- Safe environment that prevents falls
- Clean environment free from infection
- Efficient way of monitoring each patient

CTQ #3: Physician Satisfaction

- Adequate workspace
- Space to educate / collaborate
- Easy access to patient information
- Equipment and supplies close at hand

CTQ #4: Efficiency

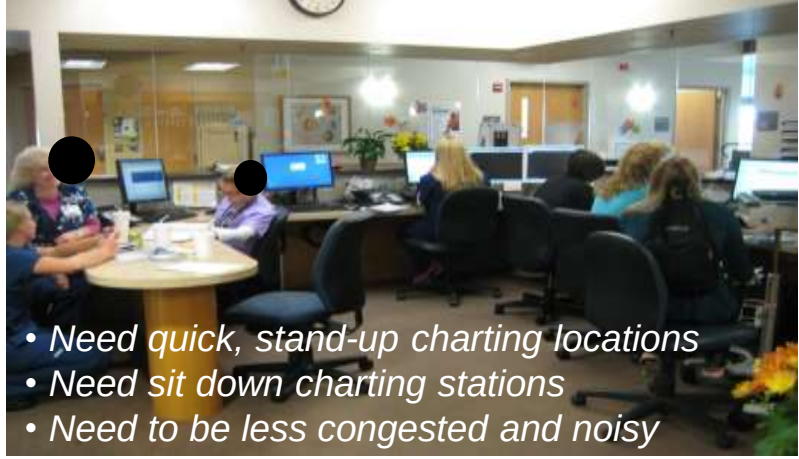
- More efficient
- Place to chart
- Communicate with others
- Safe work environment
- Focus patient care at the bedside

CTQ #5: Flow and Utilization of Supplies, Medications, Equip. & Linens

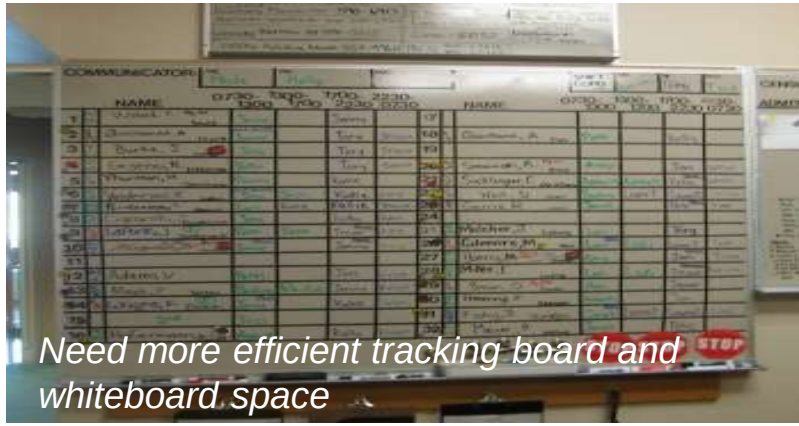
- Meds at the right place at the right time
- Linen at the right place at the right time
- Supplies at the right place at the right time
- Equipment at the right place at the right time

CTQ #6: Family-Centered Care

- Feel involved in the patient's care
- Feel comfortable visiting patients



• Need quick, stand-up charting locations
• Need sit down charting stations
• Need to be less congested and noisy



Need more efficient tracking board and whiteboard space

Patient room windows are drafty and cold so patients / family move chairs in the way of staff flow

Acuity Adaptable vs. Universal Design

'The **Acuity Adaptable** concept is centered on eliminating patient transfers by providing a comprehensive care combined staffing model where the flexibility is utilized real time, patient-to-patient.' *Patients stay in the same room from admission to discharge, and care comes to them.*

'The **Universal Room**'s focus is to provide an adaptable room design that can accommodate changing acuity or clinical needs over a period of years and does not specifically alter the current care practice and transfer of patients.' *Patient Rooms are designed to meet the highest critical care patient in order to flex to any patient type.*

This unit was designed to meet Critical to Quality Measures and Evidence-Based Design Practices revolved around a higher acuity med-surg patient and proved itself to be very adaptable to unexpected pandemic needs.

Brown, K. & Gallant, D. (2006). Impacting patient outcomes through design: Acuity adaptable care/universal room design. Critical Care Nursing Quarterly, 29 (4), 326-341.

New 24 Bed Unit, Evidence-Based Design Features

Decentralization

HGA Research (Freihoefer, 2012):

- An 8-hour day shift nurse spends roughly 2.4 hours at charting stations (in this floor plan, that is a 6.66% usability among the 6 charting stations with 3 RNs).
- Nurses only spend roughly **45 minutes of their day hunting and gathering** for supplies and medications.
- Roughly **50%** of nurses' visits to decentralized charting stations involved face-to-face interaction.

Natural Light Access

- Increase access to natural and full-spectrum lighting can improve staff outcomes such as **error rates** (Ulrich et al., 2004; Joseph, 2006)
- Nurses were **less stressed and more satisfied** at work when they were exposed to daylight for 3 hours a day (Alimoglu and Donmez, 2005)
- **70%** of respondents stated increased natural light in the new facility had a positive impact on their work life (Cochrane et al., 2012).

Lighting and Med Errors

Significantly lower **(2.6%) medication-dispensing errors** when with higher lighting levels (146 fc) at the worksurface (versus 3.8% at 45 fc); (Buchanan et al., 1991).

Surveillance

Significantly reduced patient falls when direct visibility from commonly occupied workstations versus no visibility ($p<0.000$); (Calkins, 2012).

New Patient Room, Evidence-Based Design Features

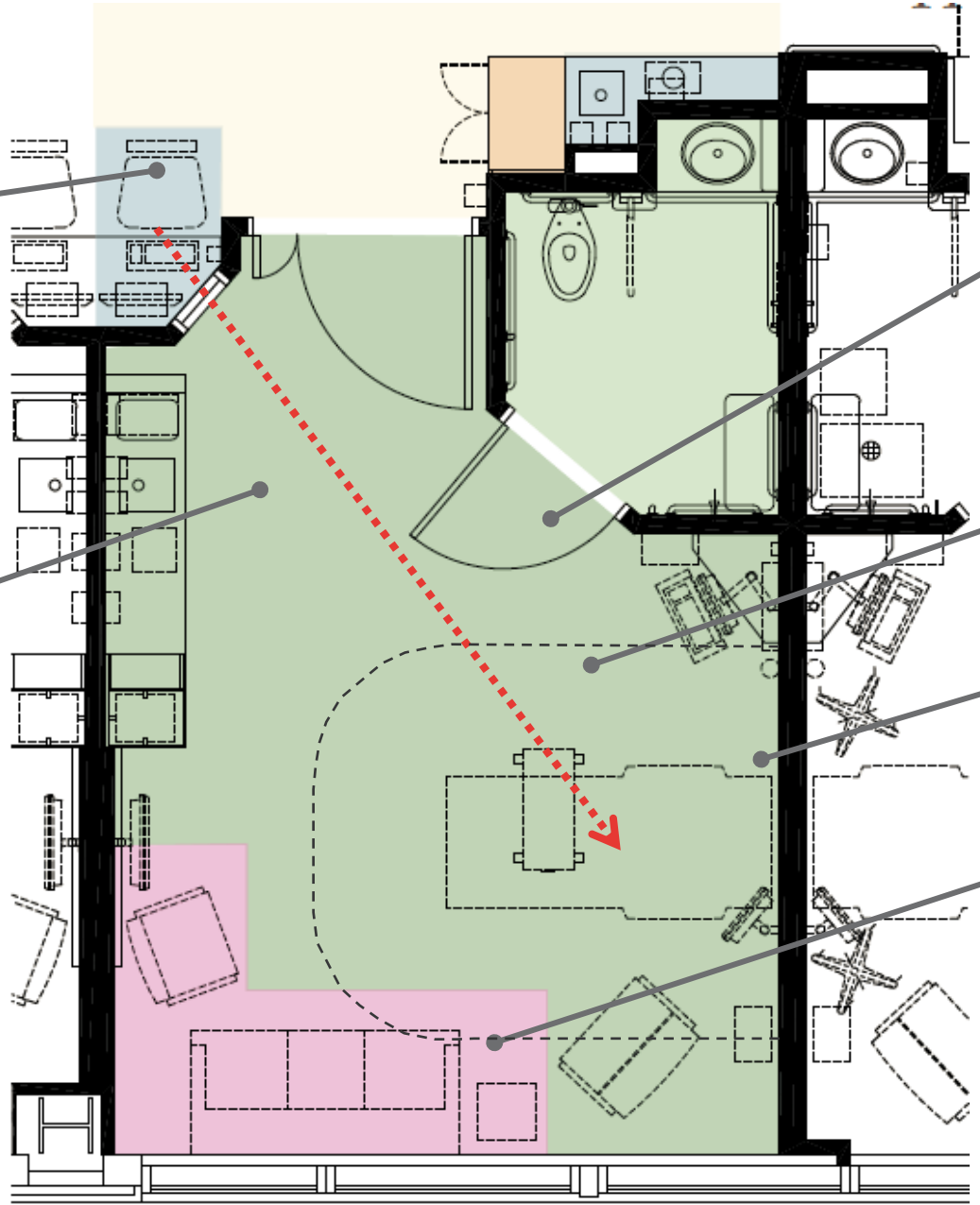
Surveillance

Rooms with low visibility had a **30% higher mortality rate** for high acuity patients (Lu, Ossman, & Leaf, 2014)

Rooms not visible from work areas had **31% higher fall rate** (Choi, 2012)

Room Standardization

No difference in process and workflow standardization between same-handed and mirror-image configured rooms. The main factor to reducing cognitive load is a global view of the patient care environment at entry (Pati et al., 2010).



Fall Reduction

Doors that can remain open and have direct access from the bed, shows nearly **50% reduction in fall** (Calkins, 2012).

No equipment or other obstruction in the path from bed to bathroom (Calkins et al., 2012; Hitcho et al., 2004)

Adaptable Rooms

Adaptable rooms with ample space can reduce the risk of patient and staff injuries and patient dissatisfaction with a **90% reduction in patient transfers**. (Hendrich, Fay, & Sorrells, 2004).

Headwall Standardization

Standardization of the headwall is critical, not single- handed rooms (Pati, et al. 2009; Pati, et al, 2010; Pati, et al, 2012).

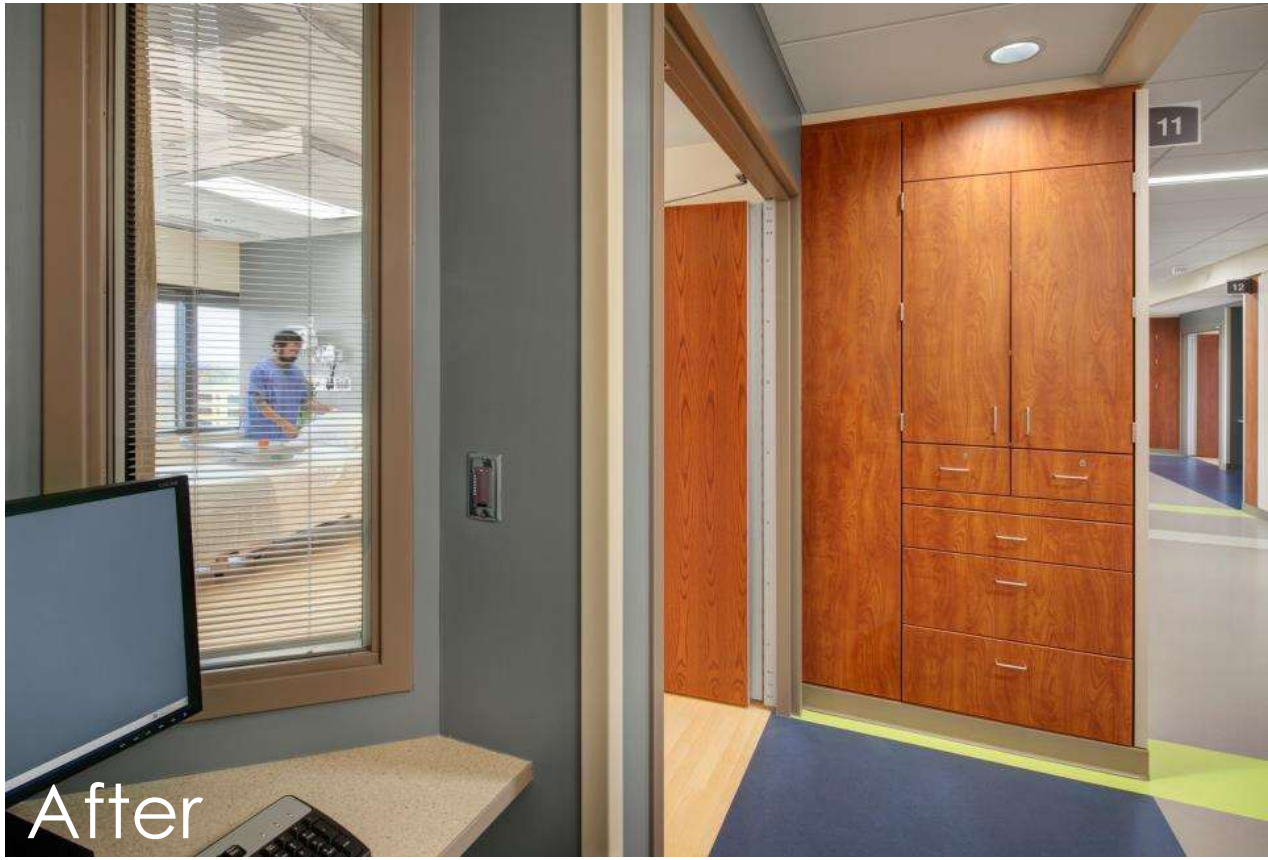
Family Space

Patient rooms with a designated family space had **nearly half the patient falls** than compared to those without (Calkins, Biddle, & Biesan, 2012).


Before


After


Before


After
11


Before


After


After

Project Budget for Both Floors

- Approved Capital Budget ≈ $11.3M
- Cost of CTQ Enhancements ≈ $1.2M
  - Represents a 10.5% premium

Business Case

- What is ROI?
  - Quantifies project value and builds stakeholder support
- Why clinical metrics are commonly used to demonstrate ROI?
- Why is ROI important?
  - Decreased reimbursement
  - Payer/consumer demand
  - Value
- What can ROI translation do?

PATIENT METRICS

In 2017, there were 5.2 FEWER STAGE 2 AND ABOVE PRESSURE ULCER INCIDENCES with a ROI of

$224,536 yearly

Significantly less ALOS, approximately 30 less patient days yearly with a ROI of $93,765 yearly

35% reduction

in falls (per 1,000pt/days); 5.75 fewer falls with injuries yearly with a ROI of $53,667 yearly

Significant increase in key HCAHPS items:

15% in Quietness ($p<0.000^{***}$)

7% in Cleanliness ($p<0.000^{***}$)

7% in Overall Care ($p<0.000^{***}$)

4.5% in Likelihood to Recommend ($p=0.003^{**}$)

3.5% in Communication with Nurses ($p=0.024^{*}$)

STAFF METRICS

Improve staff efficiency
by 6% with a ROI of

$182,097 yearly

Seven less

voluntary staff turnover with a ROI
of $23,949.24 in recruitment yearly

IMPROVED STAFF SATISFACTION

by 31.76% and a 6.3% turnover rate

with a yearly ROI of

$103,962 in hiring and training of new staff

and $160,200 in premium pay

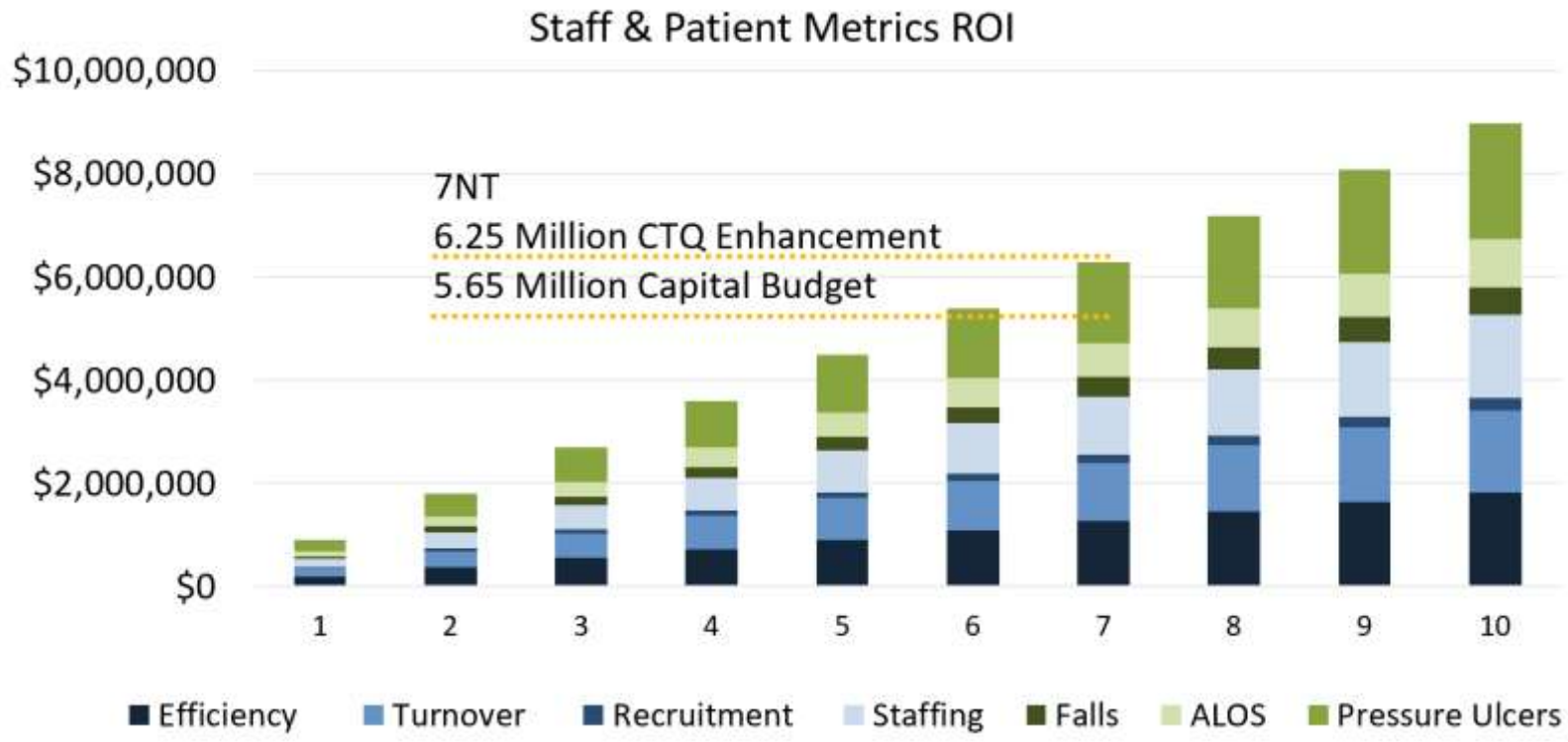
Business Case, 7-year ROI Per Floor

ROI Staff Metrics

Efficiency	182,097.55
Turnover	160,025.50
Recruitment	23,949.24
Staffing	160,200.26
Annual ROI	**$526,272.55**

ROI Patient Metrics

Falls	53,667.00
ALOS	93,765.00
Pressure Ulcers	224,536.00
Annual ROI	**$371,968.00**



2017 (Silver) & 2019 (Gold) Evidence-Based Design Touchstone Award Recipients; The Center for Health Design

2017 Audience Choice Award; Stanford Nursing Symposium

SURGE RESPONSE

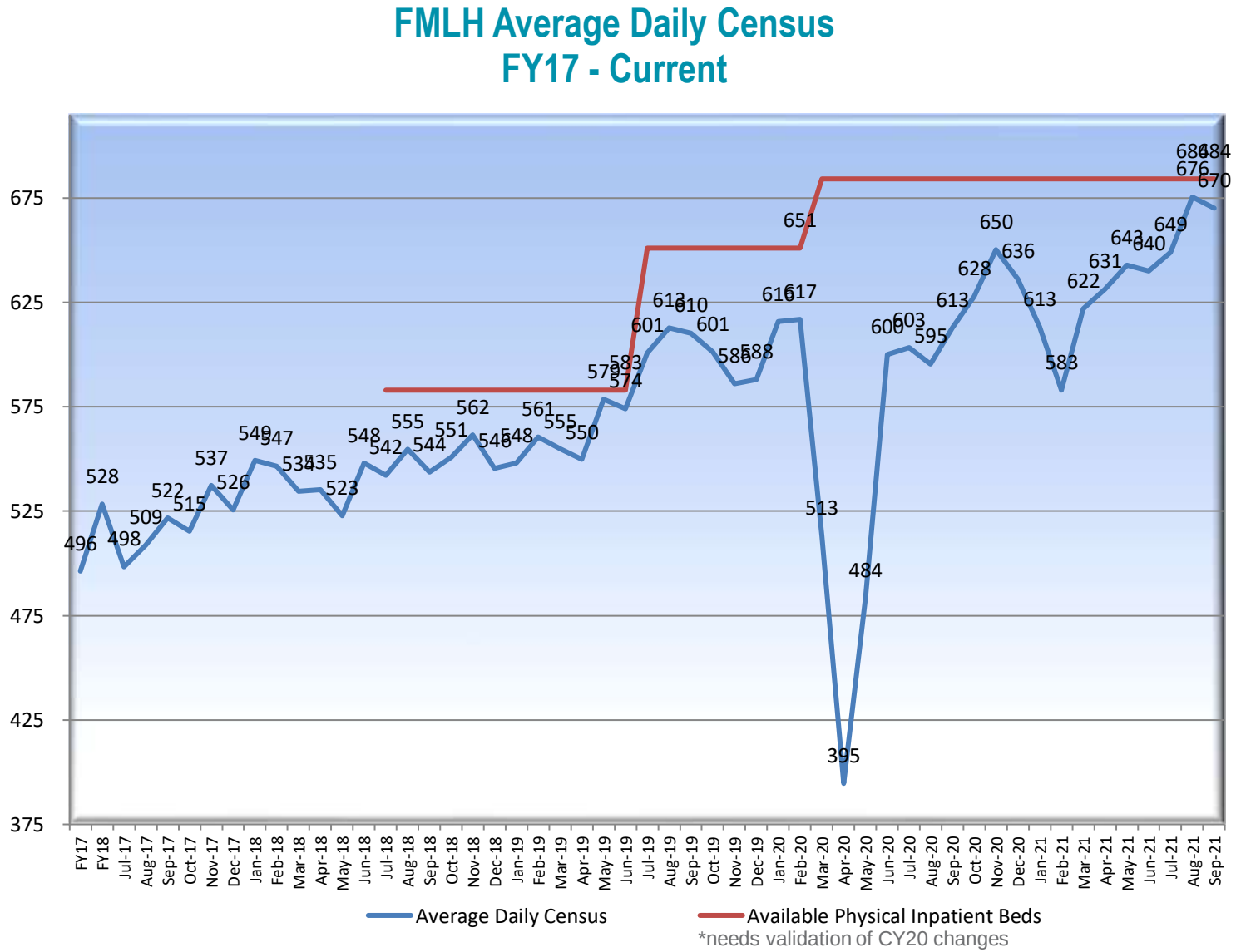
Froedtert Covid Timeline

- March/April 2020: First cases in Wisconsin and at Froedtert Hospital.
  - Moved to incident command structure
  - Surge planning
  - Developed clinical practice guidelines
  - Updated facilities policies related to visitation, access, entrance screening
  - Began to cancel electives
  - Deferred elective cases and moved more appointments to a virtual format
  - Supplies/resources

- May-September 2020:
  - Covid activity stabilized
    - Watch/wait, new "normal" operations continued

- October-November 2020:
  - Moved to incident command structure
  - We were doubling in covid patient volume every 3 weeks

Inpatient Services Demand vs. Bed Capacity



1. Graph updated and reformatted November, 2018.
2. Includes inpatients and outpatients in a bed.
3. Includes Women's Services (6EL, 7EP, 8EL).
4. Excludes ERU, ED Observation Unit, IP Rehab, Nursery.

Surge Planning

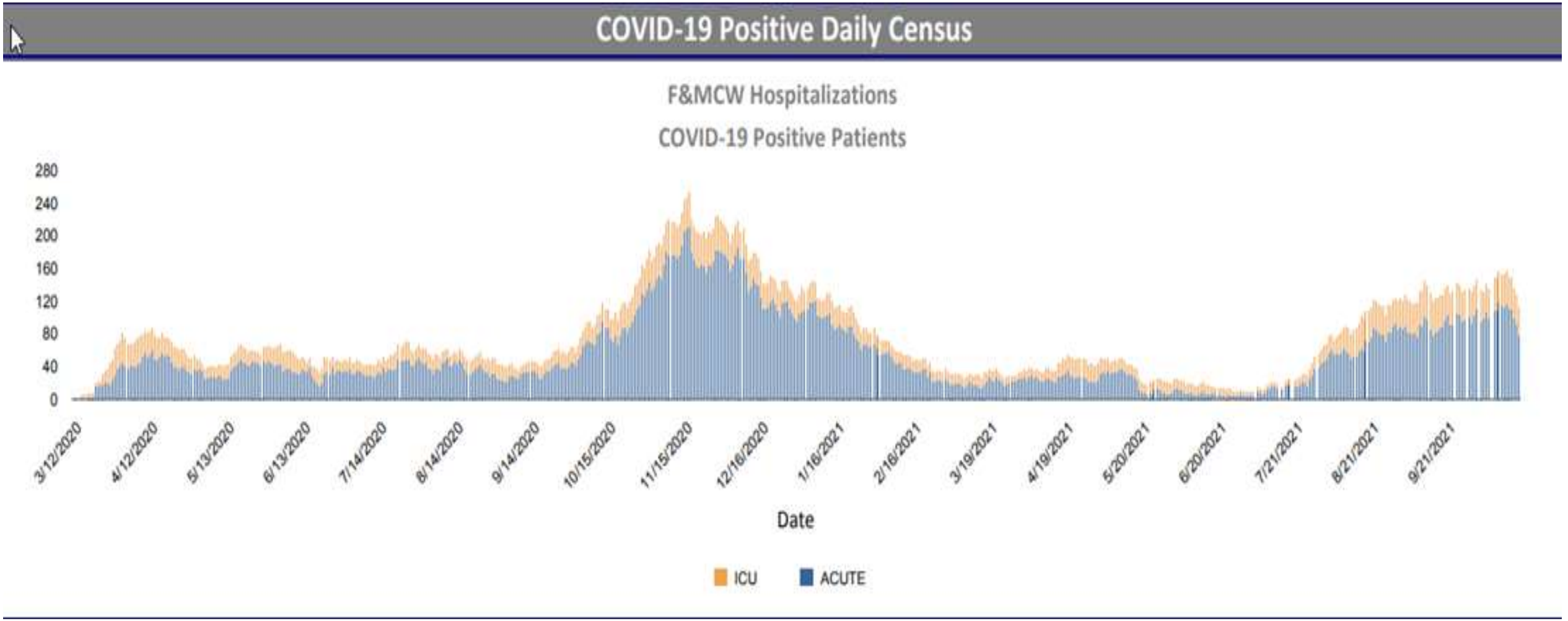
Why?

- Initially 50/50 split of ICU/Acute Care COVID patients, now somewhat stable at 1/3 ICU and 2/3 Acute Care

- Distribution of ICU vs. Acute Care in a hospital
  - At Froedtert, 17% ICU/83% Acute Care

- In fall 2020, COVID-Positive hospitalizations were doubling every 3 weeks in Wisconsin

Froedtert Covid Volume



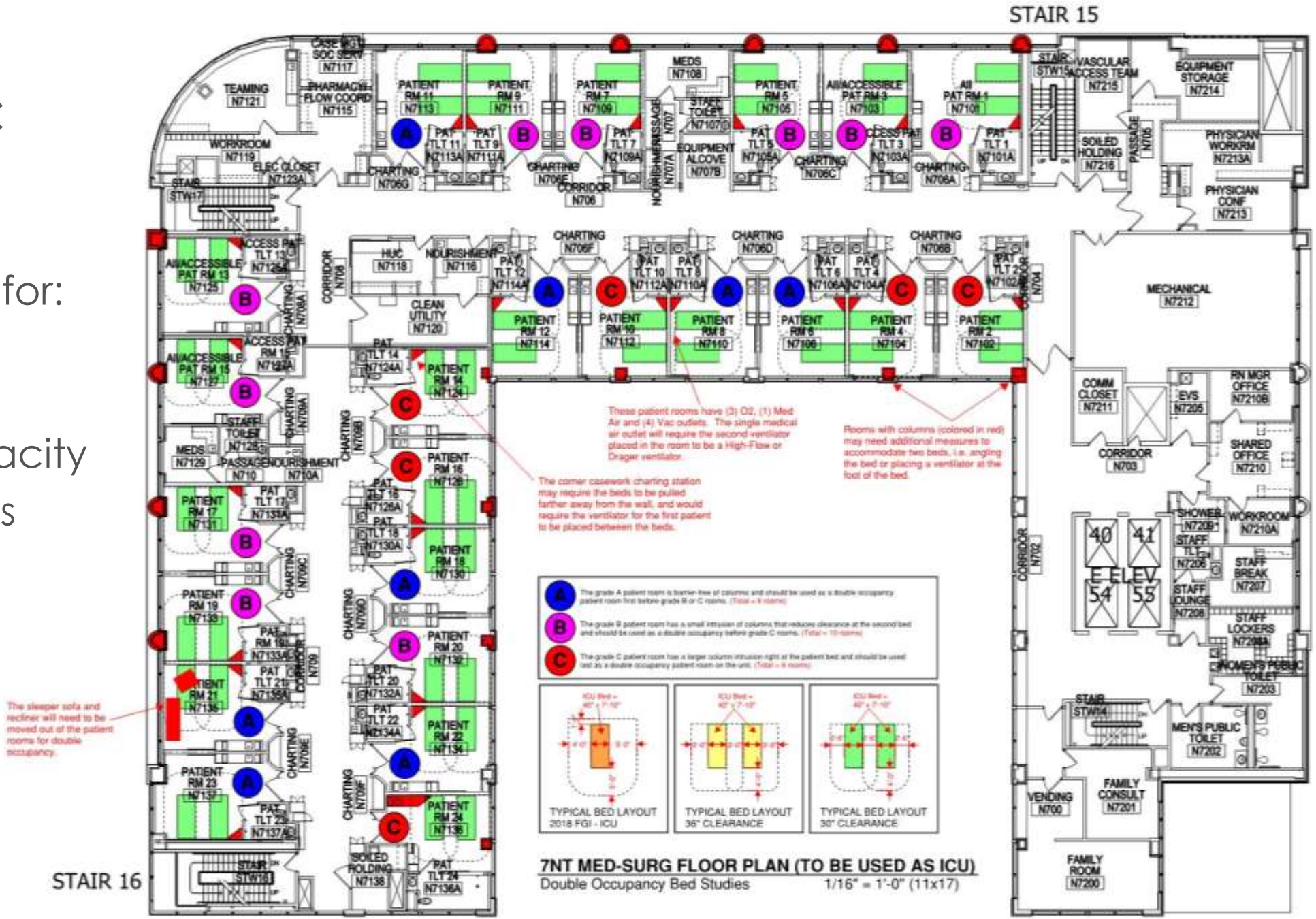
7&8 NT Patient Type History

- November 2013: 7NT/8NT opened for acute care surgical patients.
- July 2019: Original 7NT/8NT patient population & staff move to new units for hospital expansion.
  - 7NT used as overflow space
  - 8NT opened for medicine acute care patients
- April 2020:
  - 7NT staged opening as non-Covid Medicine ICU
  - 8NT transitioned to Covid positive medicine unit

Froedtert Pandemic Planning

NT Floors studied for:

- Double bed occupancy
- Med Gas Capacity
- Electrical Loads
- Air Handling Capabilities

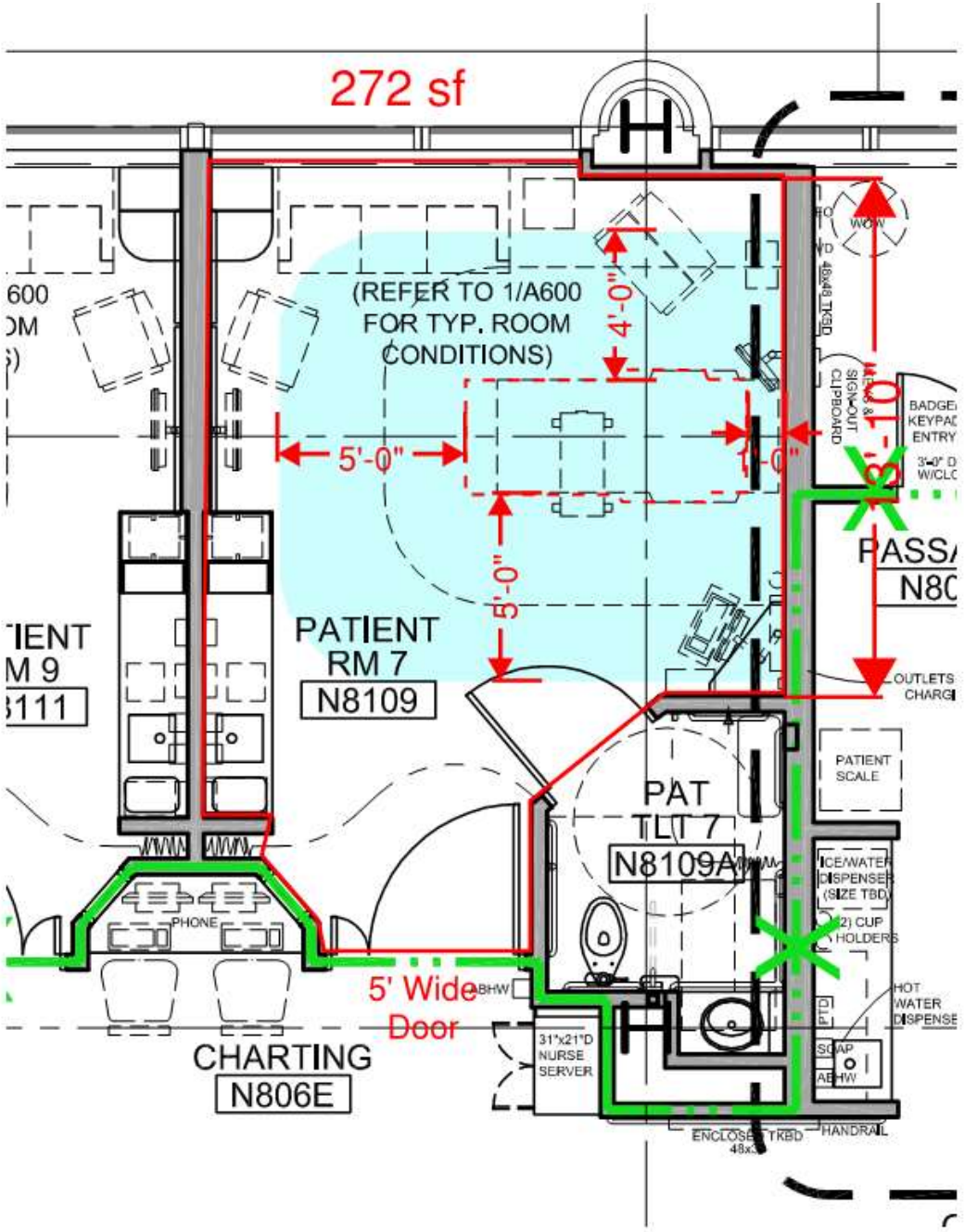


Froedtert Pandemic Planning

NT Floors studied for higher acuity use:

- ICU Bed Clearances
- ICU Med Gas Outlets

	Oxygen	Vacuum	Med Air
FGI ICU Minimum	3	3	1
7/8NT	3	4	1



Patient Room, Adaptable Features **Already Built-In**

Proximity of PPE & Supplies

PPE and Supplies in nurse servers outside each patient room allowed for access for staff without contamination.

Private Bathrooms

Private bathroom access helped with infection prevention measures

Counter Space

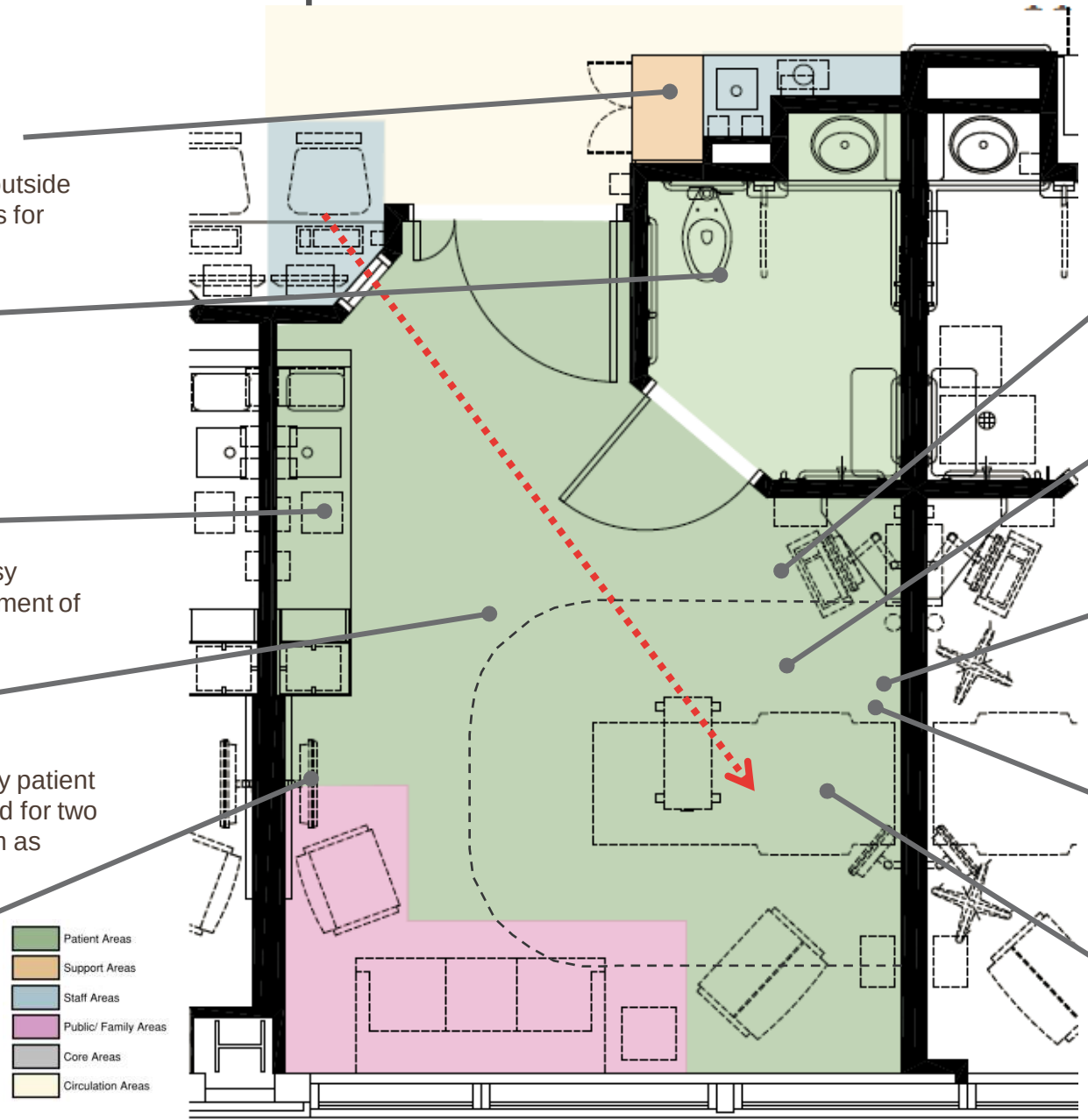
Ample counter space allowed for easy organization of care items and placement of a glucometer and label printer

Room Size

The bed clearances allow for an easy patient transfer to a stretcher, or also allowed for two beds to be placed in the patient room as needed

Digital Technology

Digital patient information boards (thru EPIC) allowed for updates to be made for patient viewing without entering the room



Caregiver Zone

Ample space allowed for safe distances between caregiver and patient

Equipment Space

The bed clearances allowed for multiple large equipment pieces to be in the room at once

Call Light Features

Rauland System allowed staff and caregivers to communicate without being in the patient room, and was capable of being programmed for two patients in the room if needed.

Medical Gases on either side of the Patient Bed

Allowed for double occupancy

Ceiling Lifts

Allowed for patients to be easily rotated in bed for earlier Covid treatments

Patient Unit, Adaptable Features **Already Built-In**

24 bed unit

Mechanical Systems

The air handling units were able to segregate air intake from the rest of the hospital

ICU Level Care

The additional med gases built into the Med-Surg Unit allowed for ICU care without being transferred to the ICU

Decentralized Nurse Station

Care Team spread out across the entire unit as opposed to grouped together in a Central Nurse Station was safer for social distancing

Staff Shower

Shower available to staff for Covid exposures

Staff Respite

Respite space (break, locker, toilet) available for staff outside the unit

Support Spaces

Clean Supply, Nourishment, Meds, Soiled Holding and Equipment are easily accessible from patient rooms

Care of the Covid Patient

Patient Unit, Adaptable Features **Added for Covid**

24 bed unit

Equipment Storage

Additional space changed to equipment storage to handle the extra patient load on the unit

Additional Monitors

Monitors were added to handle the extra patient load on the unit, as well as the higher acuity patient

Windows in Patient Room Doors

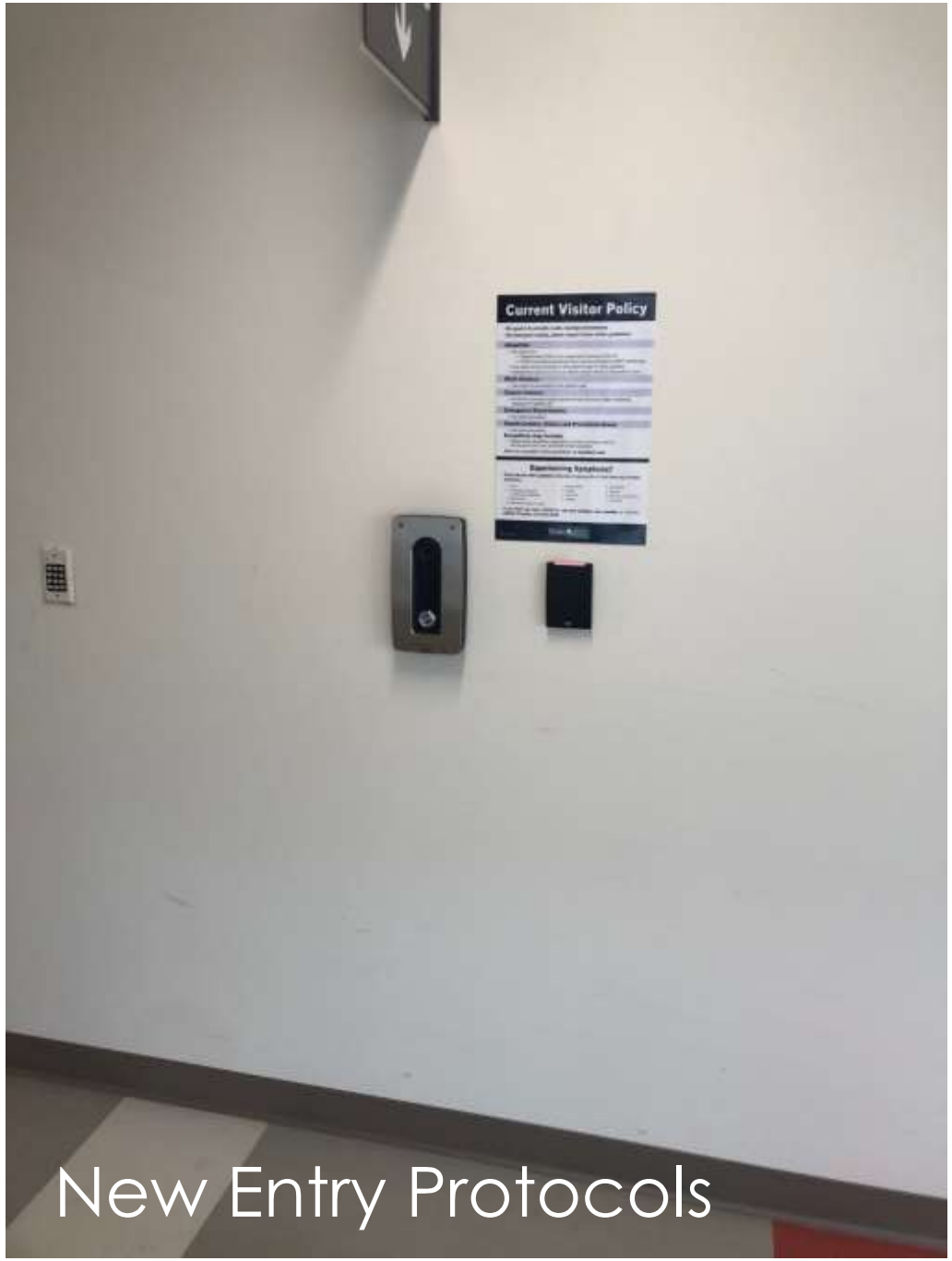
For visibility without entering the patient rooms, glass was added to entry doors. This was also a big component to conserving PPE when supplies were limited.

Secure Unit Entry

Secure unit entry to restrict visitors from entering the Covid unit

ICU Med Dispensers

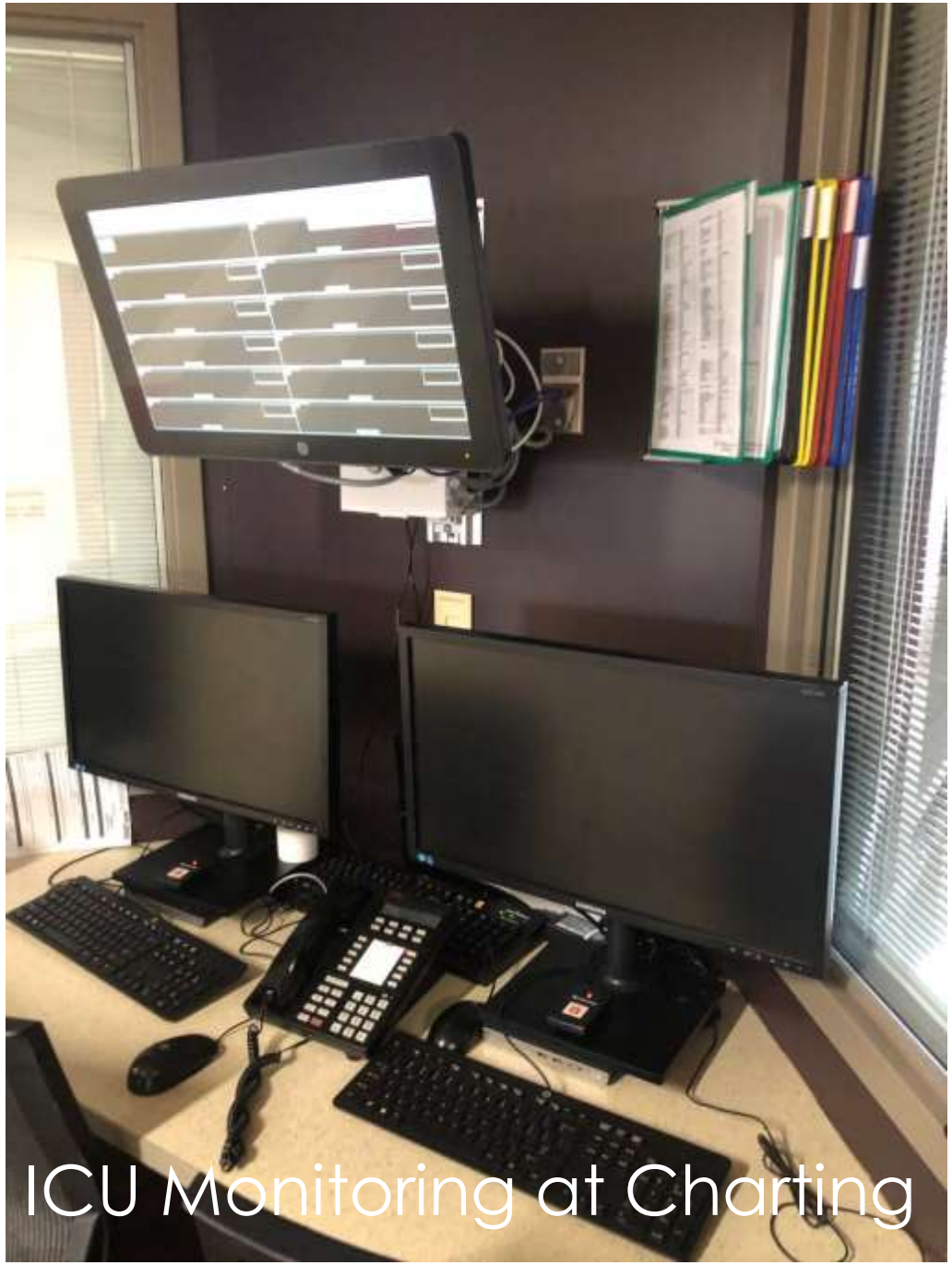
The size of the Medication Rooms allowed additional med storage capacity



New Entry Protocols

New Secure Entry

ICU Monitoring - Patient



ICU Monitoring at Charting

Visibility Thru Door

Visibility of Headwall

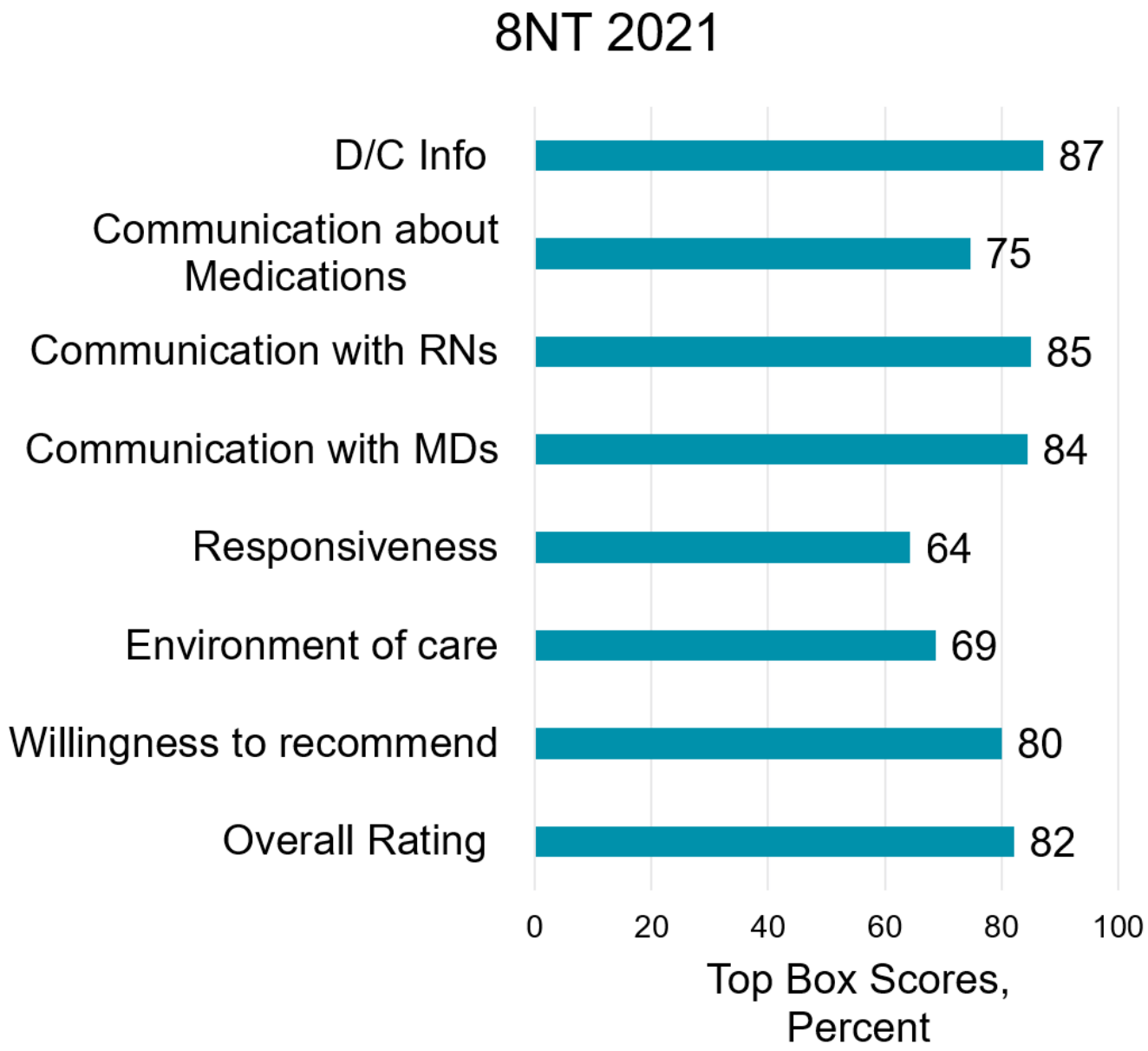
How Well Froedtert Performed
(July 2020-June 2021)

HCAHPs

- Overall rating of all ICUs:

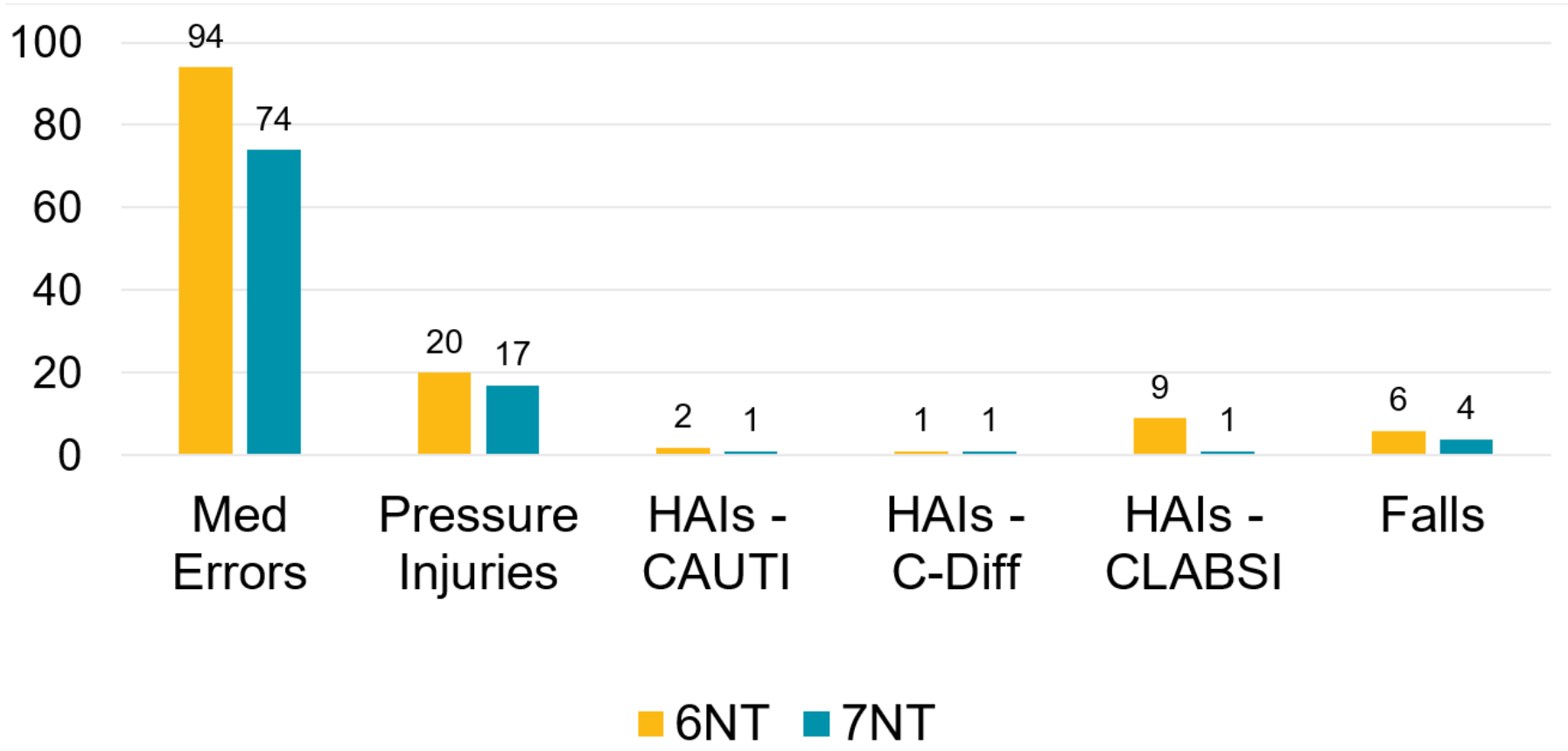
  FY20 = 78.6

  FY21 = 80.5



How Well Froedtert Performed

(July 2020-June 2021)



How Well Froedtert Performed

**as of October 2020*

Total COVID-19 cases

Froedtert Hospital

	Hospital	COVID-19 cases	% cases w/COVID-19	Mean LOS (Obs)	LOS index	Mean ICU days	% ICU cases	% early deaths	% deaths (Obs)	Mortality index
Overall	FH_FROEDTERT	556	4.4%	8.6	1.01	7.9	22.7%	1.1%	11.2%	0.65
	AMCs	70,607	7.0%	10.4	1.22	10.8	24.3%	2.0%	14.5%	0.87
	Midwest Region	32,672	4.9%	8.9	1.05	8.9	27.0%	1.4%	12.1%	0.75
	All CDB	163,569	7.1%	9.3	1.11	9.7	23.4%	2.1%	14.3%	0.88

Lessons Learned / What if there was a 10NT?

Design

- Secure Unit
- Decontamination Room
- Ante Room
- Shared Room VIP
- Video Monitoring
  - (Virtual ICU & Virtual Visitation)

Operations

- What else can be done to increase efficiency/productivity?
- Available beds vs. available resources

Thank you

Froedtert & Medical College of Wisconsin

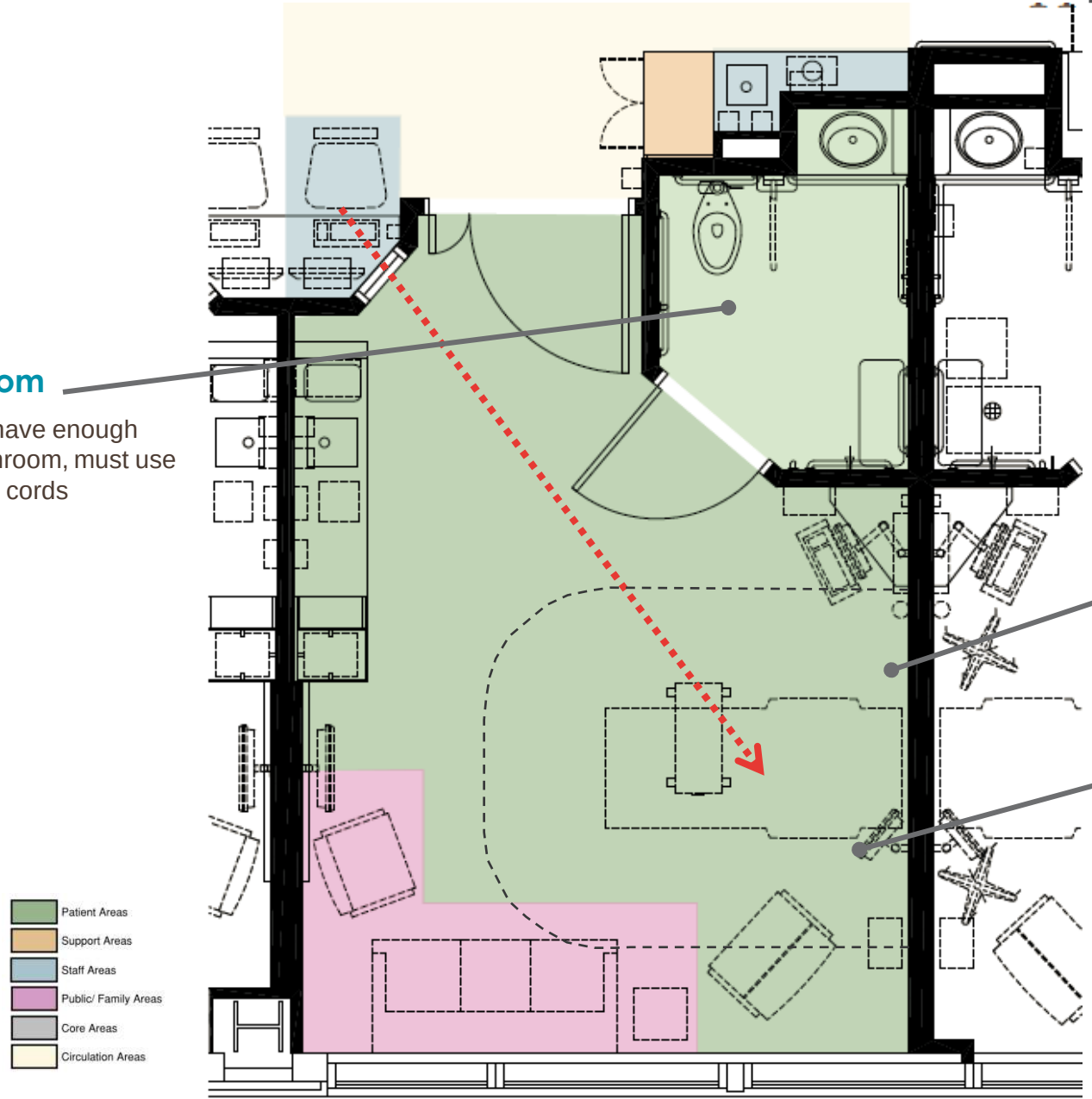
HGA

WISCONSIN HEALTHCARE ENGINEERING ASSOCIATION

Patient Room, Additional Features Requested

Distance to Toilet Room

Patients on Optiflow do not have enough cord length to reach the bathroom, must use the commode without longer cords



Electrical Outlet

An additional outlet on the headwall would be ideal

Med Gas Access

The larger ICU monitors installed make access to the oxygen and med-air a bit difficult, request mounting brackets higher