Critical Care Design:
Design Competition Winners & Future Trends

SCCM 25 Years of Winning ICU Designs

Photo: D. Kirk Hamilton

The Swedish Medical Center
Englewood, Colorado, USA

1992 ICU Design Competition Winner

Photo: Courtesy of the Architect

University Medical Center Utrecht
The Netherlands

2011 ICU Design Competition Winner

SCCM: ICU Design Citation Award

The Society of Critical Care Medicine (SCCM)

The largest **multi-professional** organization dedicated to ensuring excellence and consistency in the practice of critical care.

With **16,000 members in 100 countries**, SCCM represents all professional components of the critical care team.

Now in its 25th year, the design competition is sponsored by:

- Society for Critical Care Medicine (SCCM)
- American Institute of Architects / Academy of Architecture for Health (AIA/AAH)
- American Association of Critical-Care Nurses (AACN)

www.sccm.org
http://www.sccm.org/Membership/Awards/Pages/default.aspx
http://www.sccm.org/Membership/Member_Demographics/Pages/default.aspx

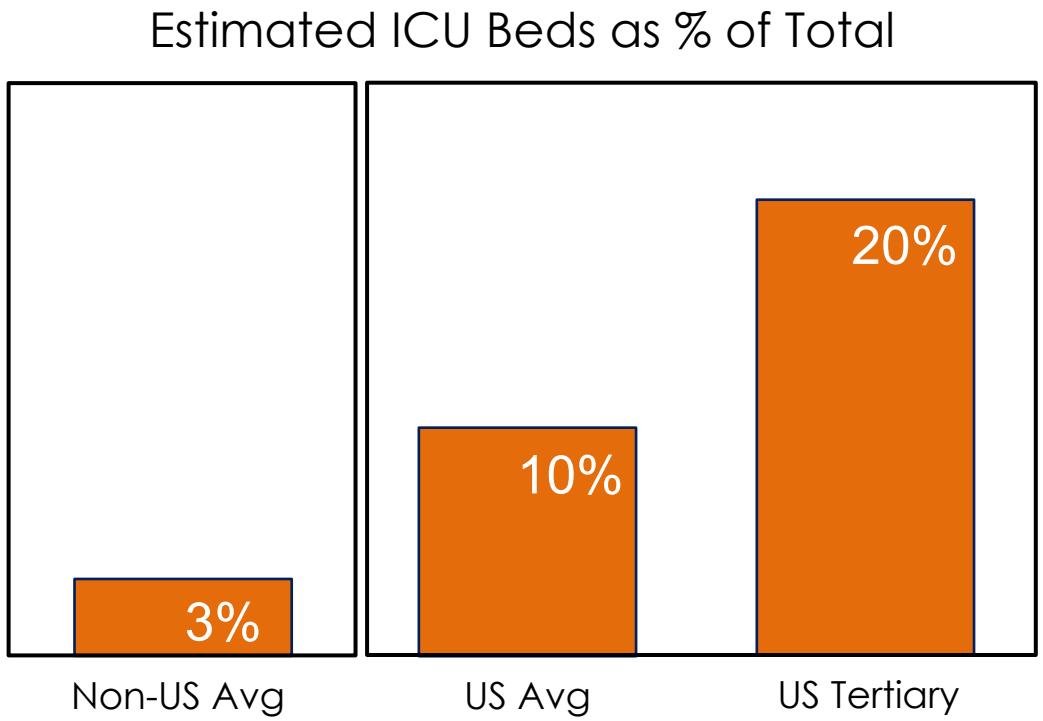
Why is this study important?

ICU Space Demand

In the United States, approximately **40 – 50%** of all hospital space is allocated to inpatient bed units. [1]

Of all US hospital beds, **10% to 20%** are ICU beds. [2]

In the US, an ICU bed unit occupies **30% to 40%** more space than an acute bed.



1 Uhlenhake, R. (2006). *Study of Critical Care Unit Projects*. WHR Architects, Inc.

2 Society of Critical Care Medicine Tele-ICU Committee. (2010) Telemedicine in the Intensive Care Unit. http://www.learnicu.org/SiteCollectionImages/Tele-ICU%20Paper.pdf. Accessed February 8, 2010.

Why is this study important?

ICU Associated Costs

- ICU beds make up **≤ 20%** of all beds but consume **33%** of operating budgets. [1, 2]
- ICU: **50%** more costly to build. [3]
- Cost/patient day **2-4 times** non-ICU patient day. [3]

"No other space has more impact on efficiency of care."

Paula Buick, RN; Joseph O'Leary; Michael Roughan, AIA

1 Buick, P, et al. Critical Care Tertiary Facility Design presentation. Design Symposium 2006.

2 Society of Critical Care Medicine Tele-ICU Committee. Telemedicine in the Intensive Care Unit. http://www.learnicu.org/SiteCollectionImages/Tele-ICU%20Paper.pdf. Accessed February 8, 2010.

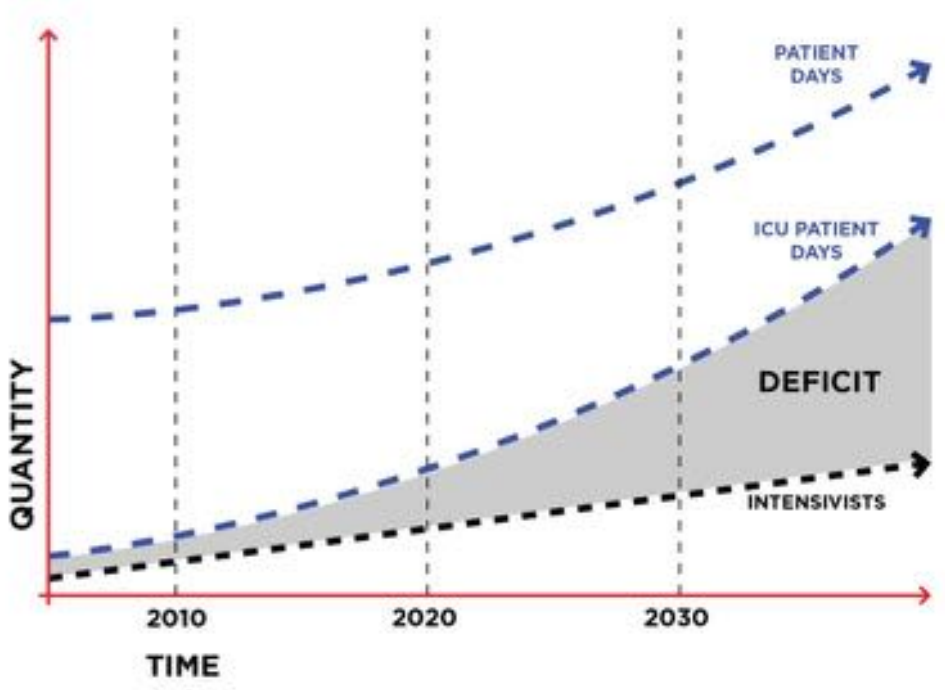
3 Advisory Board, 2006.

Why is this study important?

ICU Future Projections

- By 2020, there will be a possible **22%** deficit of intensivists to demand; by 2030, this deficit may increase to **35%.** [1, 2]

- ICU patient days are projected to grow up to **30%** more rapidly than non-ICU days. [3]

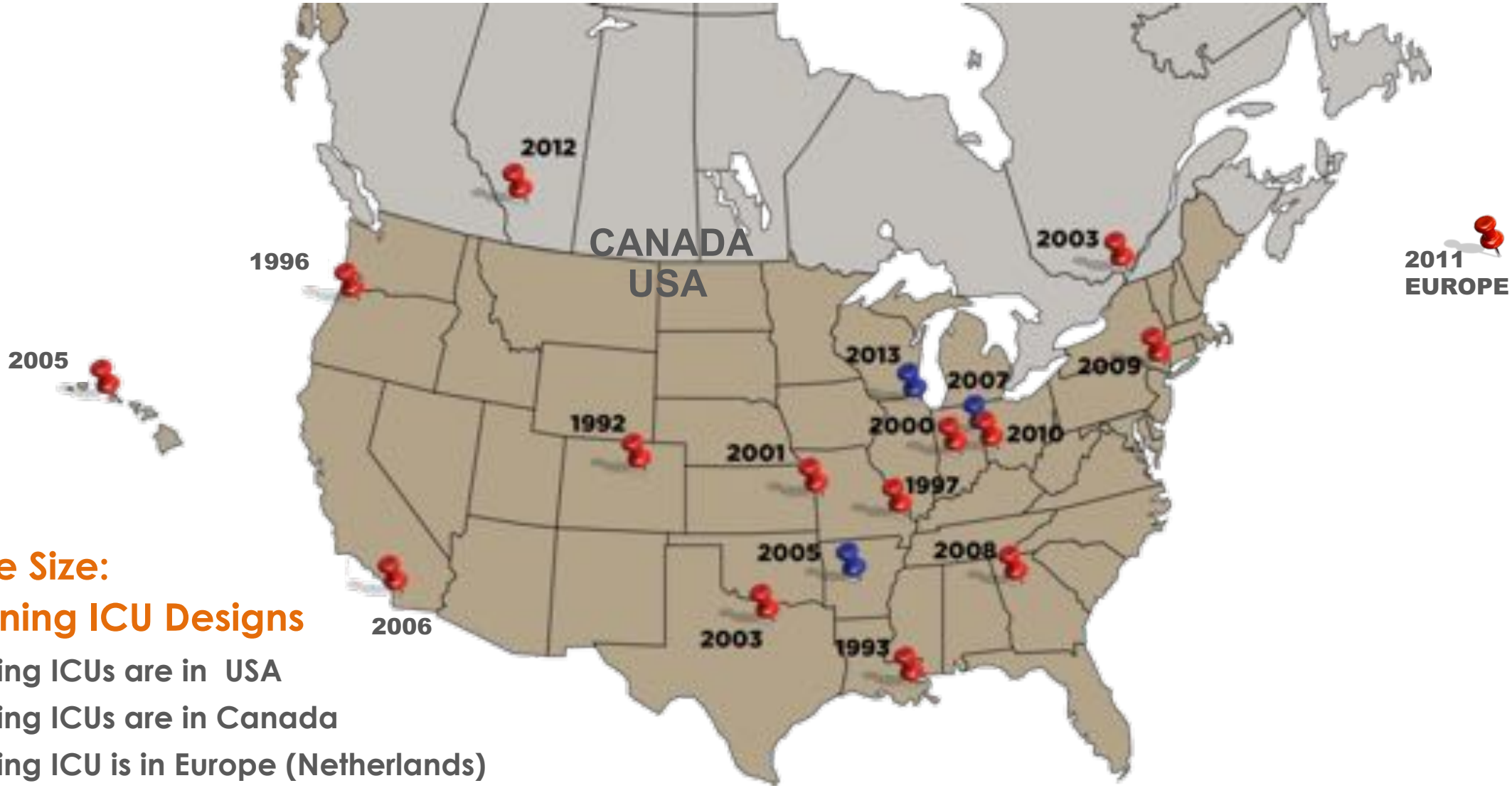


1 Katz, J., et al. (2006). *Cardiology and the Critical Care Crisis*. Journal of the American College of Cardiology.

2 Advisory Board (2009). *Hospitalist Programs with Regional Operations: Hospitalist and Intensivist Supply and Demand.* The Advisory Board Company, Washington, D.C.

3 Advisory Board, 2006.

SCCM: ICU Design Citation Award



Sample Size:

18 Winning ICU Designs

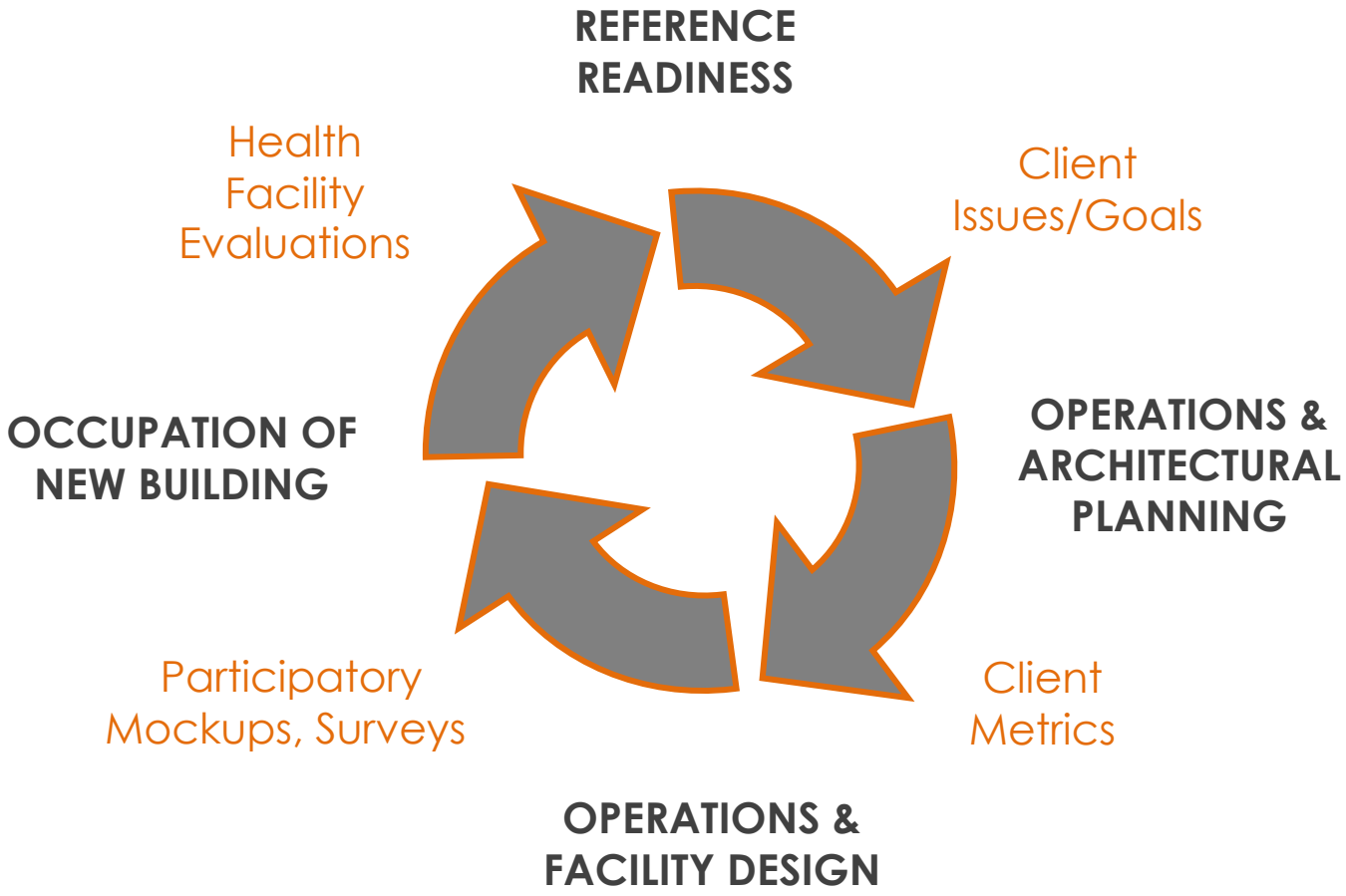
15 Winning ICUs are in USA

2 Winning ICUs are in Canada

1 Winning ICU is in Europe (Netherlands)

How Do We Use This Information

EBD Process & Practice Model – *For us, it is a continuum in learning*



Data Analysis: An Example Case Study

Data Collected on the Winners - -

Client: Emory University Hospital

Emory Healthcare
Atlanta, Georgia, USA

Medical Director: **Owen Samuels, MD**
Evidence-Based Design Consultant:
Craig Zimring, PhD, Georgia Tech University

Architect: HKS Architects

Atlanta, Georgia, USA

Completion Date: 2007

SCCM Award Date: 2008

Data Analysis: Case Study

Emory Neuro ICU, 20 Beds

Atlanta, Georgia, USA

Program Characteristics:

- Specialty ICU
- National & International Referrals
- Teaching & Research Programs

Project Characteristic:

- Vertical Expansion on Hospital

Data Analysis: Case Study

Exterior Perimeter Dimensions

A	+	B	+	C	+	D		
34.4m (113ft)	+	11.6m (125ft)	+	21.6m (71ft)	+	96.6m (317ft)	=	164.2m (625ft)

Data Analysis: Case Study

Roof Gardens (Area & Dimensions)

		width x height
A =	**257.3 SM (2770 SF)**	6.8m x 33.5m
B =	**69.4SM (748 SF)**	4.8m x 14.3m
C =	**116.7 SM (1795 SF)**	8.3m x 20.7m

Data Analysis: Case Study

Area Summary (20 Beds)

Floor Departmental Gross	=	2,384 SM (25,658 SF)	=	**115.4 SM/Bed (1,242 SF/Bed)**
Departmental Gross	=	2,053 SM (22,097 SF)	=	**102.6 SM/Bed (1,104 SF/Bed)**
Departmental Net	=	1,325 SM (14,269 SF)	=	**66.2 SM/Bed (713 SF/Bed)**

Data Analysis: Case Study

Area Groupings By Function

Patient Room Groupings:

A	= **14 Patient Rooms**	671 SM (7,222 SF)	**33% of DGSM**
B	= **6 Patient Rooms**	418 SM (4,499 SF)	**20% of DGSM**
Common Support: C	= **Admin, Family, Diag.**	964 SM (10,376 SF)	**47% of DGSM**

TOTAL = 20.53 DGSM (22,097 DGSF)

Data Analysis: Case Study

Patient Rooms

DNSM%

☐ Patient Room- Patient 452 SM (4,868 SF) **34%**

Data Analysis: Case Study

Patient Rooms - Family Accommodations

DNSM%

Patient Room- Patient 452 SM (4,868 SF) **34%**

Patient Room- Family 237 SM (2,550 SF) **18%**

Data Analysis: Case Study

Public, Family, & Visitor Spaces

DNSM%

Patient Room- Patient	452 SM (4,868 SF)	**34%**
Patient Room- Family	237 SM (2,550 SF)	**18%**
Public/Family/Visitor	126 SM (1,354 SF)	**9%**

Data Analysis: Case Study

Patient Care Support

DNSM%

Patient Room- Patient	452 SM (4,868 SF)	**34%**
Patient Room- Family	237 SM (2,550 SF)	**18%**
Public/Family/Visitor	126 SM (1,354 SF)	**9%**

DNSM%

Patient Care Support	286 SM (3,081 SF)	**21%**

Data Analysis: Case Study

Administrative Support

DNSM%

Patient Room- Patient	452 SM (4,868 SF)	**34%**
Patient Room- Family	237 SM (2,550 SF)	**18%**
Public/Family/Visitor	126 SM (1,354 SF)	**9%**

DNSM%

Patient Care Support	286 SM (3,081 SF)	**21%**
Admin. Support	187 SM (2,017 SF)	**14%**

Data Analysis: Case Study

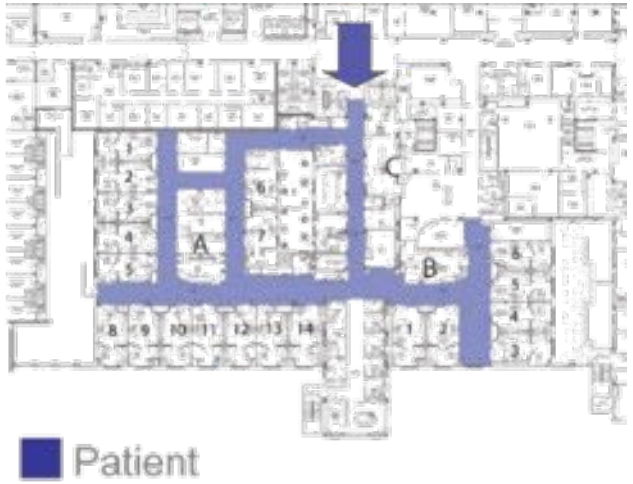
Diagnostic Imaging Spaces

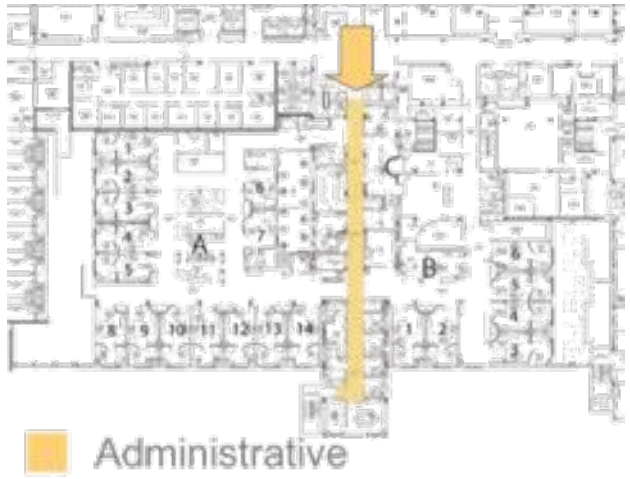
	DNSM%		
Patient Room- Patient	452 SM (4,868 SF)	**34%**	
Patient Room- Family	237 SM (2,550 SF)	**18%**	
Public/Family/Visitor	126 SM (1,354 SF)	**9%**	

	DNSM%	
Patient Care Support	286 SM (3,081 SF)	**21%**
Admin. Support	187 SM (2,017 SF)	**14%**
Diagnostic/Imaging	73 SM (783 SF)	**5%**

Data Analysis: Case Study

Circulation Paths, By User





Patient Rooms

Emory University Hospital
Neurosciences ICU

Unit Configuration & Geometry

Winning ICU Designs 1992-2013

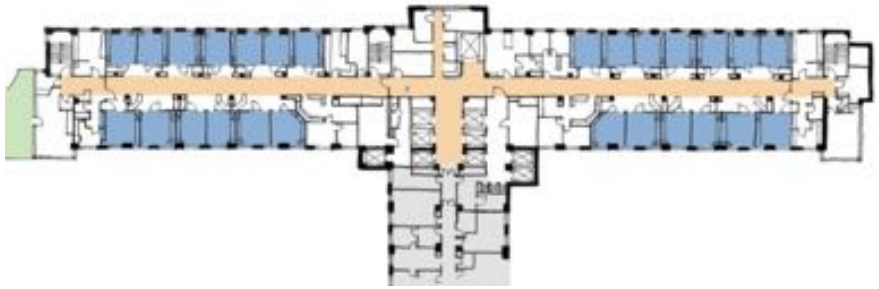
Color Legend: ADULT / PEDS

1992 1993 1996 1997 2000 2001 2003 2003 2005 2005

2006 2007 2008 2009 2010 2011 2012 2013

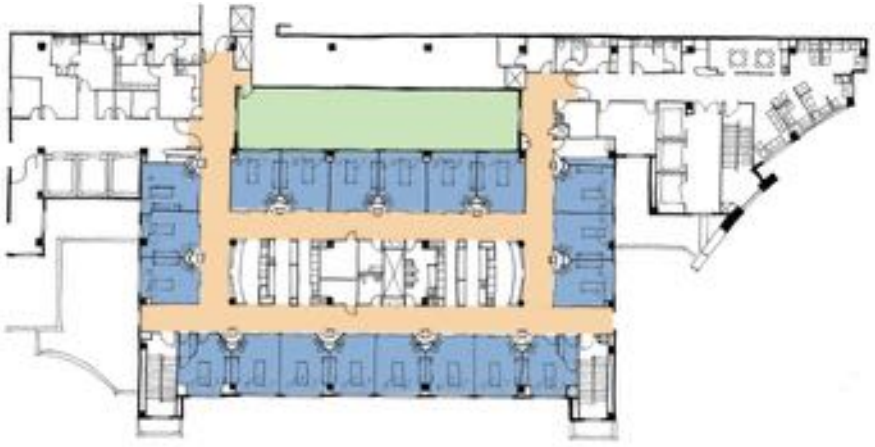
Unit Configuration & Geometry

Unit Configurations By Type



Linear

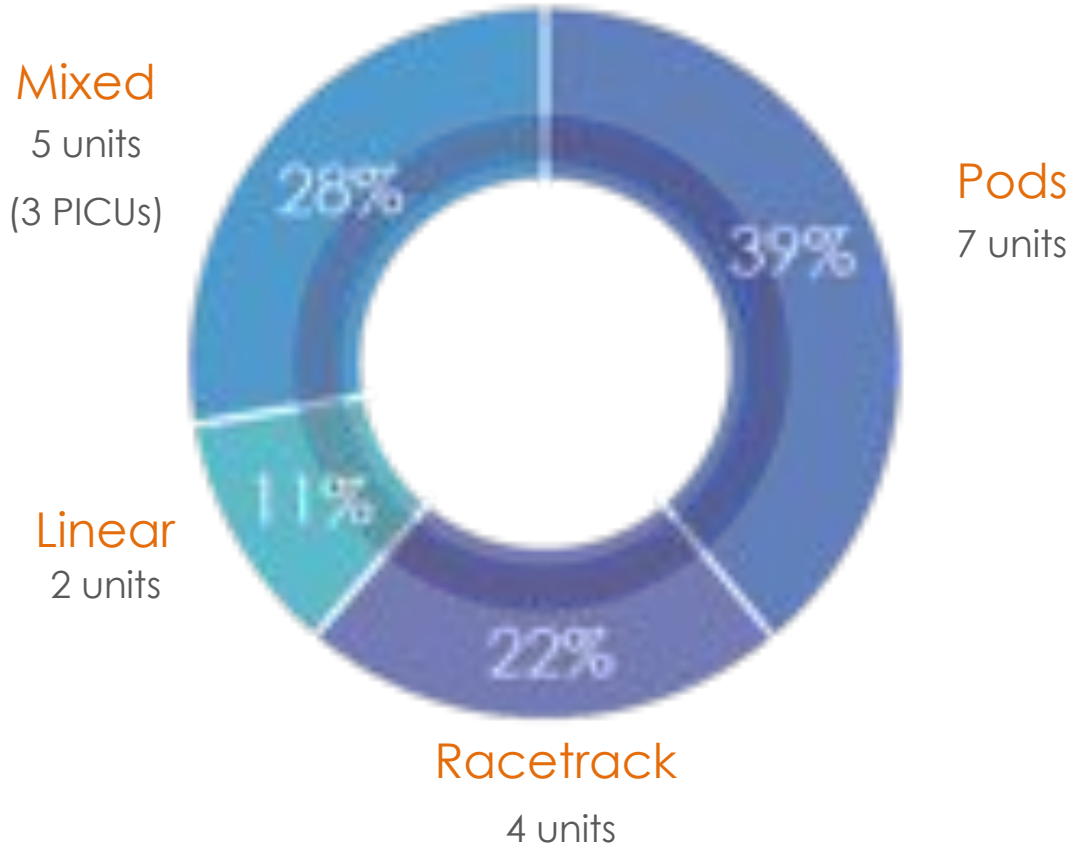
Pod



Racetrack

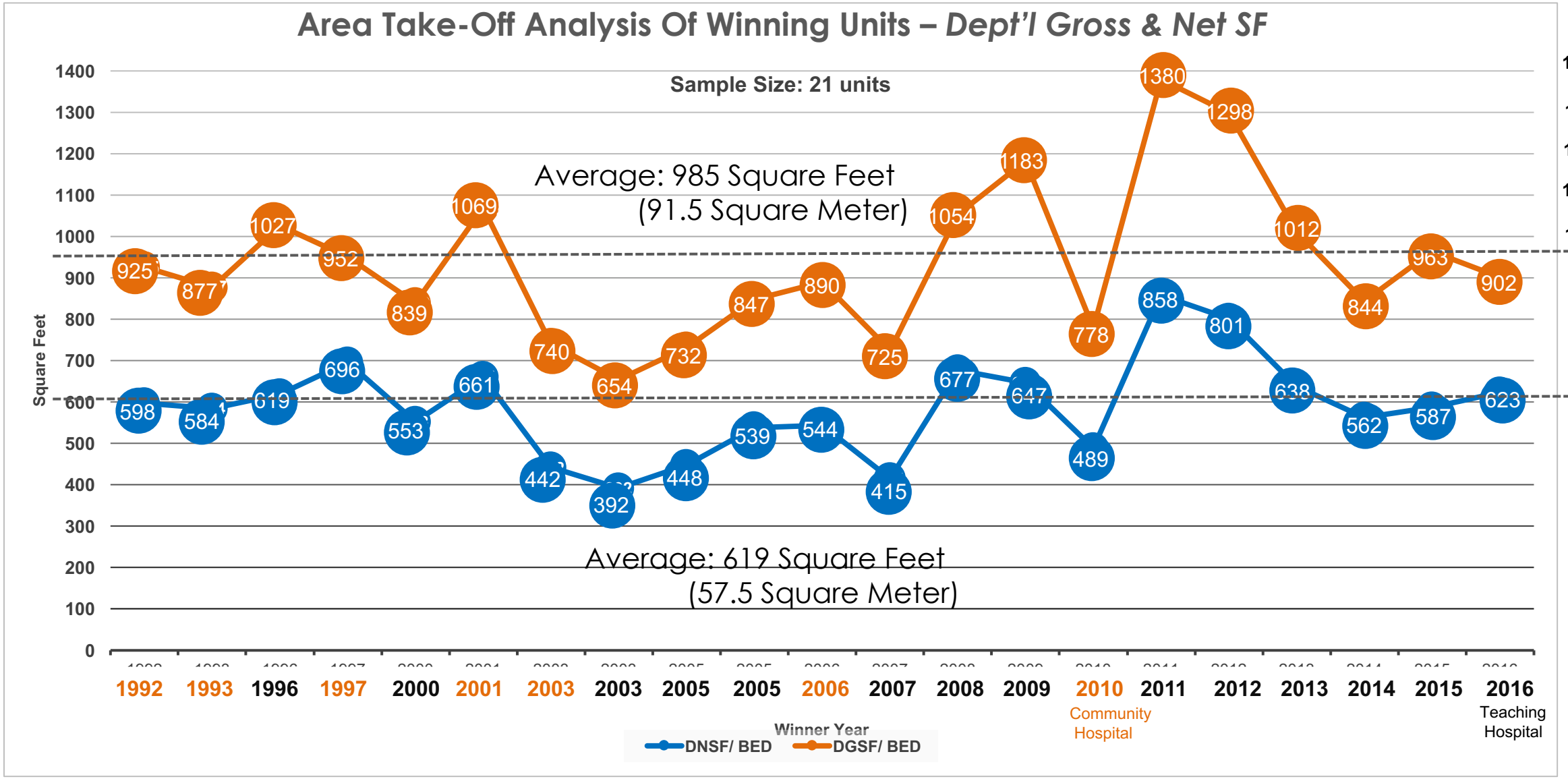
Mixed

Unit Configurations By Type

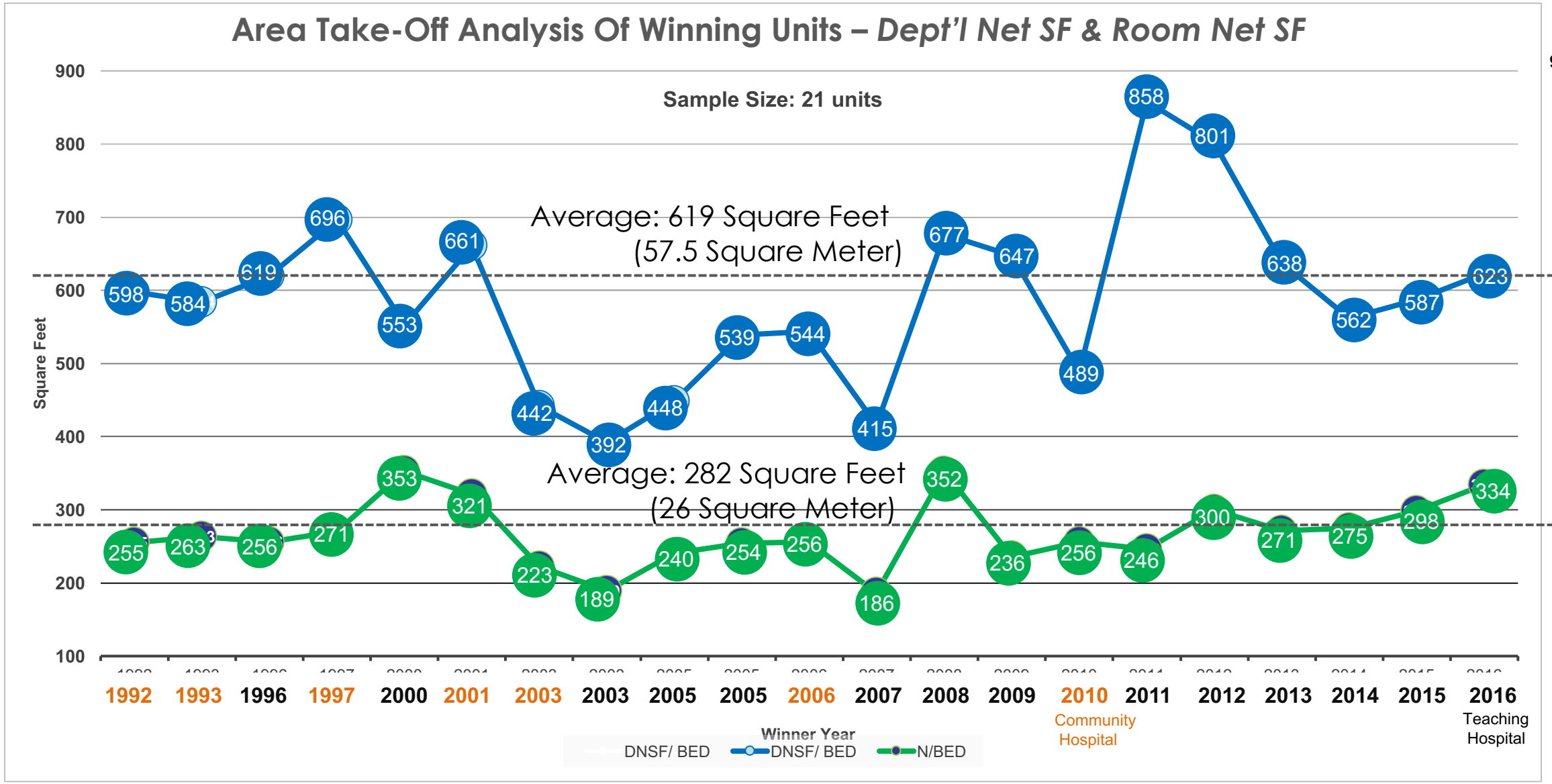


Categorization of ICUs on the basis of unit configuration

SCCM ICU Winners



SCCM ICU Winners



Area Take-Off Analysis of Winning Units – Dept'l Net:Gross SF Factors

Unit Departmental Area per Bed and Average Grossing Factors

Construction Type	Average Dept Area / Bed		Avg Net to Dept'l Gross Factors
	DGSF / Bed	DGSM / Bed	
New Construction	990	92	1.57
New & Reno. Construction (Mixed)	1027	95	1.66
Renovation Construction	814	76	1.69

Average unit departmental area per patient bed & average net to departmental area grossing factors by construction type

Sample Size: 18 Units
12 New Construction
1 Mixed (New & Reno.)
5 Renovation

Area Take-Off Analysis of Winning Units

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12% Loss in Usable Area (New vs. Reno)

Average unit departmental area per patient bed & average net to departmental area grossing factors by construction type

Sample Size: 18 Units
12 New Construction
1 Mixed (New & Reno.)
5 Renovation

Area Take-Off Analysis of Winning Units

		Percentage Values of Net Areas	Range	% of Net Area Recommended
1	**Patient Care** Includes patient room & toilet	20.2% - 43.0%	22.8%	30 to 35%
2	**Staff & Material Support** Includes centralized & decent. charting, clean & soiled, etc.	9.9% - 20.7%	10.7%	15%
3	**Staff Facilities** Includes staff lounge, lockers, toilets, on-call rooms, etc.	1.8% - 6.3%	4.5%	4%
4	**Diagnostic & Treatment** Includes imaging suites, dialysis, pharmacy, lab, etc.	0.0% - 4.9%	4.9%	2 to 4%
5	**Administration & Education** Includes classrooms, conference spaces, offices etc.	1.9% - 14.1%	12.2%	7%
6	**Public & Family** Includes waiting areas, family sleep rooms, amenities, etc.	3.0% - 18.5%	15.5%	10%

Program categories used during area take-off analysis of ICU designs & percentages of total department area

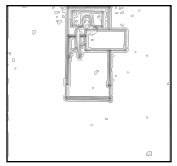
10 Best-Practice Critical Care Design Trends

1. Larger, Consolidated Units
2. Stabilized Patient Room Size
3. Defined In-Room Family Space
4. Remote Technology & Support Systems
5. Continued Design for Interdisciplinary Teams
6. Integration of Diag. & Treatment Facilities
7. Integration of Admin. & Support Spaces
8. Variable Unit Geometry
9. Segregated Circulation
10. Visual & Physical Access to Nature

(1) Larger Units – Beds & Areas

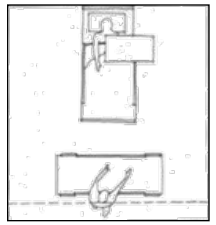
More units, and larger units, will likely be needed in the future as demand grows. Area for **support spaces** will likely increase.

1970



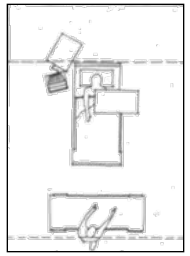
450 DGSF/bed

1980



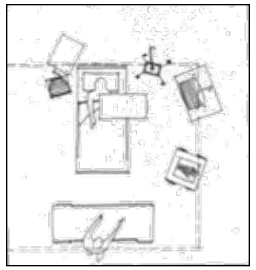
550 DGSF/bed

1990



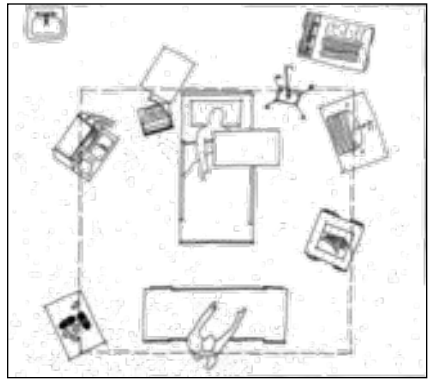
650 DGSF/bed

2000



750 DGSF/bed

2013



950 DGSF/bed

UNIT AREA PER BED

Wider, Flexible Corridors…

Rounding & Collaboration

Emory

Rounding & Computers

MS-KCC

… and Ambulation in the ICU

MS-KCC

(2) The Patient Room

All-private rooms in critical care will become the design standard, with a stable clear patient room area of 250 to 300 SF (23 SM);

family space is in addition to this (sitting, sleep)

.

The Patient Room

Private toilet facility within acuity adaptable room and flat headwall

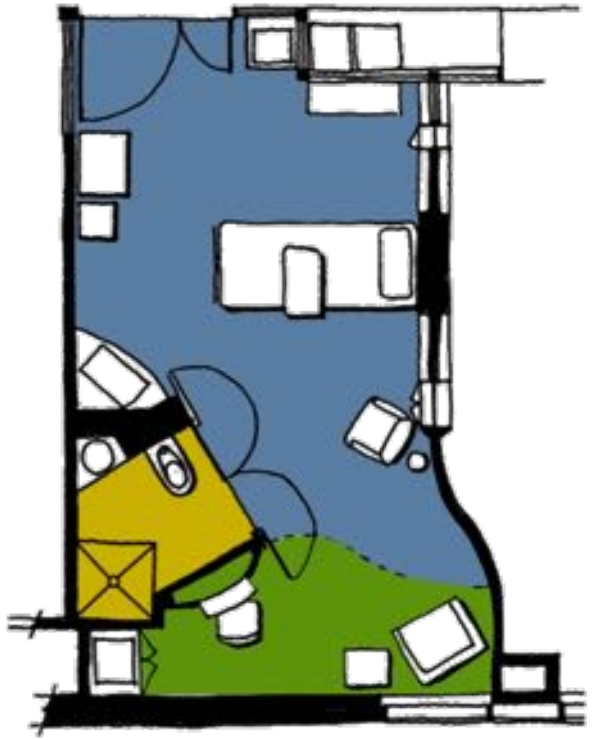


Photo: BSA LifeStructures

Clarian Health Group Methodist Hospital
Indianapolis, Indiana
2000 Winner
Architects: BSA Lifestructures

Patient Room as Procedure Room

Example of the ICU Room as a Procedure Suite *– a potential case for additional clearances*

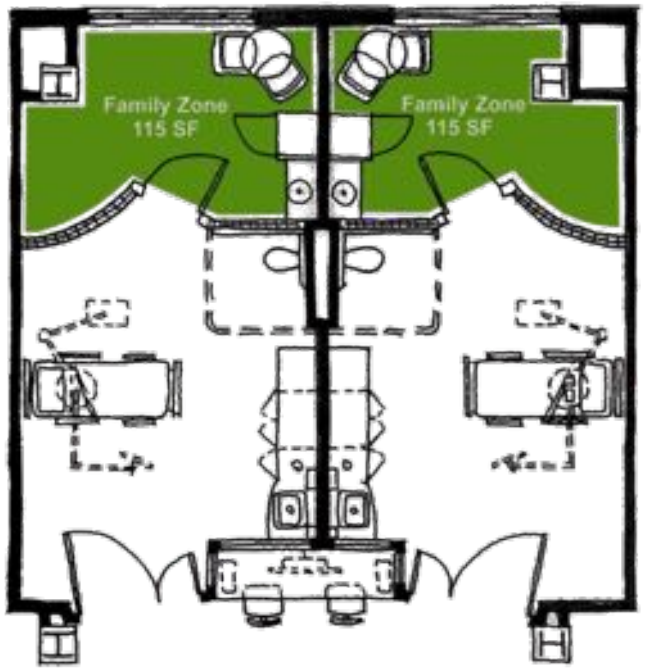
Emory University Neurosciences ICU

(3) The Family Zone

Recent units, where possible, incorporate designated **family and visitor space** and amenities into the unit or within the patient room itself.

10 Best-Practice Critical Care Design Trends

The Family Zone
115 NSF



Emory University Hospital ICU
Atlanta, Georgia
2008 winner

University Medical Center Utrecht

- **36 Bed ICU**
- **Teaching Program**
- **Large Regional Referral Hospital**

Green areas are family spaces.

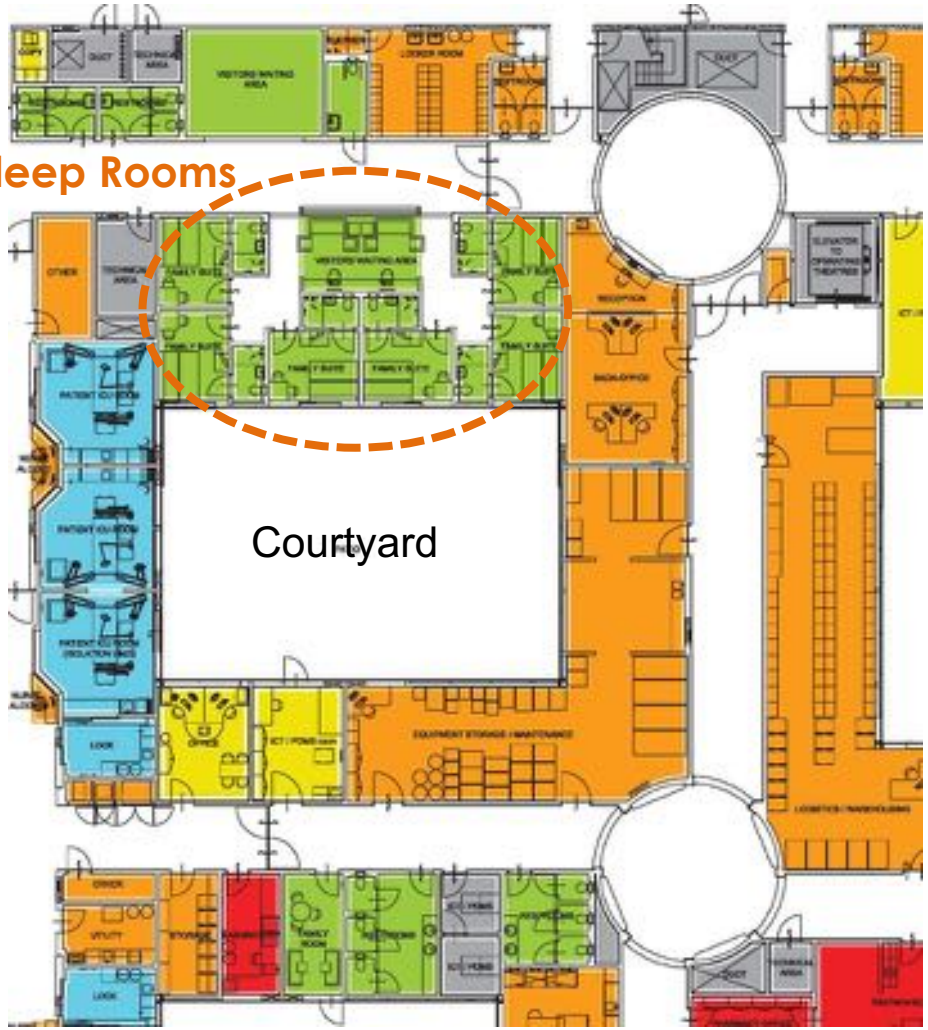
CT = Courtyard

2010 SCCM ICU DESIGN COMPETITION WINNER
University Medical Center Utrecht, Division of Intensive Care Medicine, The Netherlands

University Medical Center Utrecht

Family Space Design:

- Family Sleep Accommodations (6) are Separate from Patient Rooms
- Decentralized Consultation Rooms (3)
- Primary Waiting Room Near Sleep Rooms



(4) Technology & Life Support Systems

The majority of units, notably recent ones, employed **ceiling mounted booms** rather than the traditional headwall unit within the patient room design.

- E-Glass
- Dedicated Lab Label Printers
- Ceiling Booms
- Wireless IR Transmitter
- Web cam
- Remote monitoring
- E – ICU
- Robots

10 Best-Practice Critical Care Design Trends

Technology & Life Support Systems

Photo: Memorial Sloan-Kettering Cancer Center, Neil Halpern, M.D., ICU Medical Director

1 Nurse server
2 E-glass slide, break away doors
3 Inside opening of nurse server
4 Wireless clock
5 Storage cabinets
6 Computer & double monitor
7 Lab label printer
8 Twin BOOMS
9 Wireless IR transmitter
10 Web cam
11 Patient closet & DVD player
12 Flat screen TV
13 Toilet
14 Nursing work area

10 Best-Practice Critical Care Design Trends

E- Glass (For Privacy)

E- Glass Off

E- Glass On

MS-KCC

Technology – IT in Many Forms…

- Hospitals with an eICU had a lower mortality rate (Critical Care Medicine, 2004 32:31-38)
- Technology enables physicians to respond any time, any where to patient needs
- Knowledge-sharing is faster
  - Research → education → care

(5) Design for Interdisciplinary Teams

All units showed some **combination of centralized & decentralized** layouts for staff work stations, while only one design was fully decentralized.

10 Best-Practice Critical Care Design Trends

Design for Interdisciplinary Teams

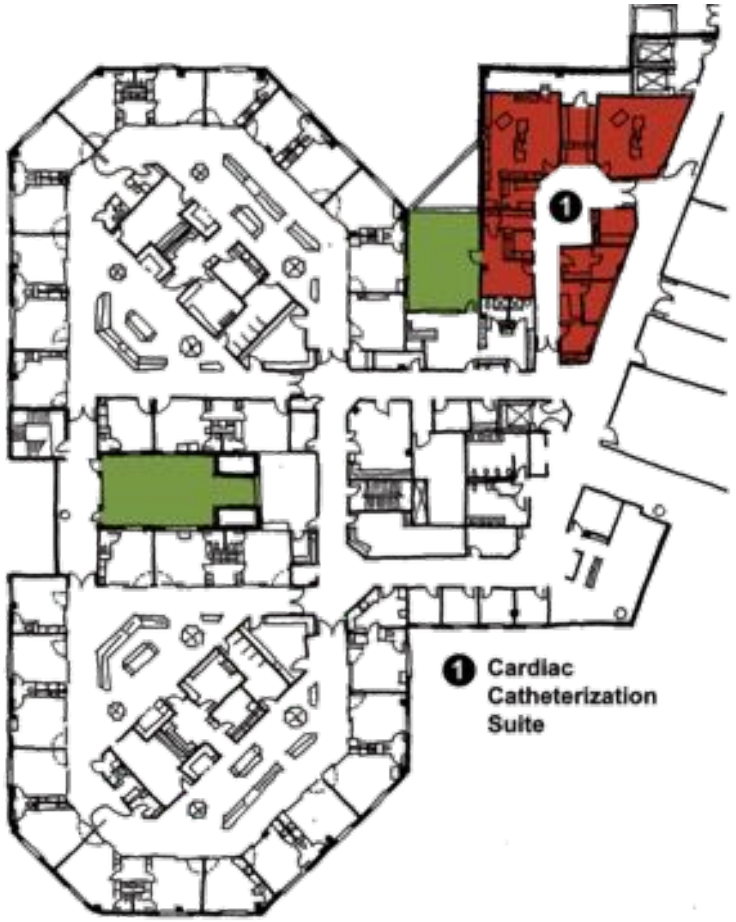
St. Joseph's Health Center
Kansas City, Missouri
2001 winner
Architects: Hart Freeland Roberts, Inc

Emory University Hospital
Atlanta, Georgia, USA
2008 winner
Architects: HKS

(6) Proximity to Diagnostic & Treatment

Winning units are **incorporating diagnostic and treatment modalities** into their designs, when possible, often as shared services with the entire hospital.

Proximity to Diagnostic & Treatment



Proximity of ICU to cardiac catheterization suite

Swedish Medical Center ICU
Englewood, Colorado, 1992 winner
Architects: WHR Architects & H+L Architects

(7) Administrative & Support Space

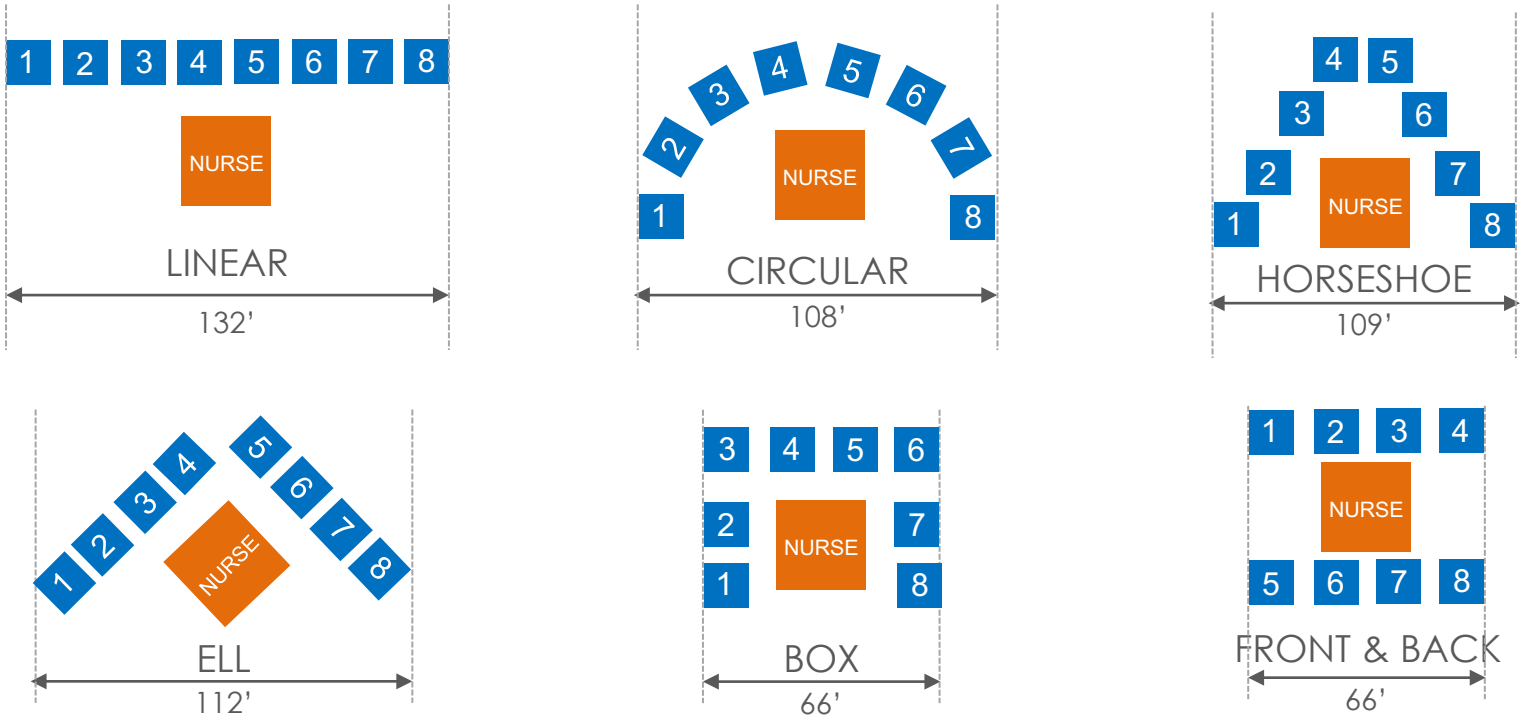
An increase in **administrative and education** space within the unit has been noted over the last several years, particularly within teaching hospitals.

Administrative & Support Spaces

Memorial Sloan-Kettering Cancer Center
New York City, New York, 2009 winner
Architects: daSILVA Architects

(8) Variable Unit Geometry

No single ICU geometry has been noted as superior to another; **the pod concept** is seen in recent years, along with a combination of different **configurations.**

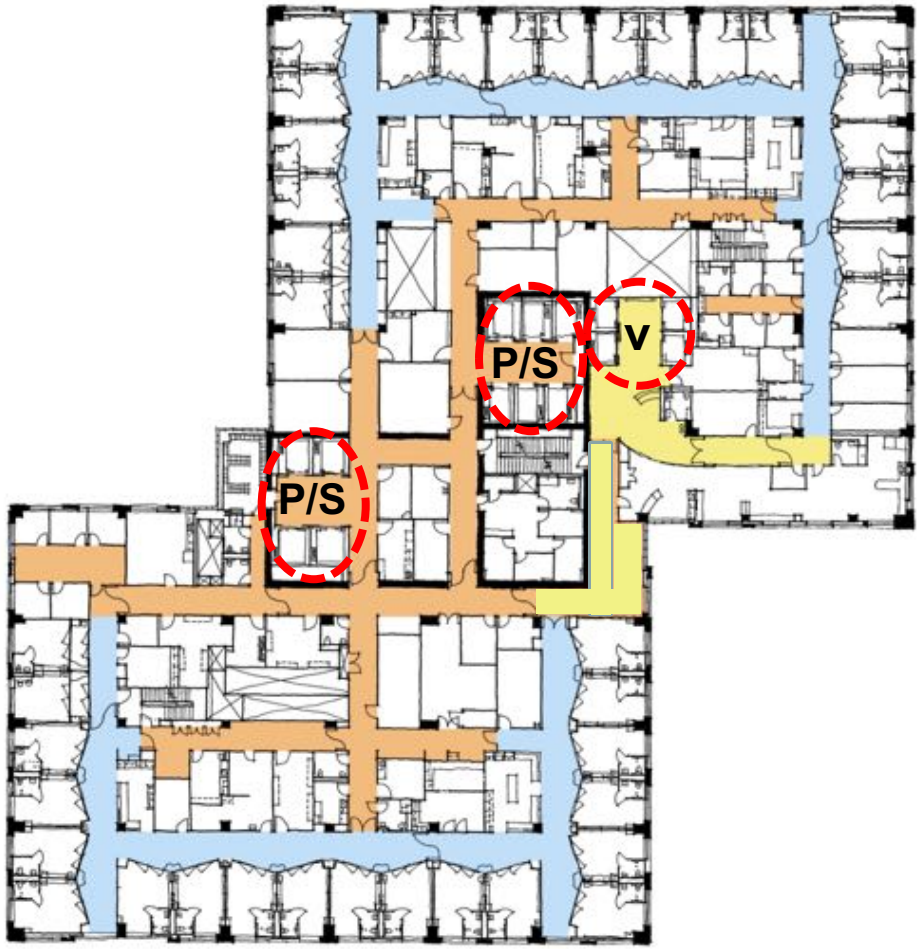


(9) Segregated Circulation

Distinction of circulation regarding **on-stage** and **off-stage** separations are becoming more common and will likely continue to be seen in future designs.

10 Best-Practice Critical Care Design Trends

Unit Geometry & Circulation



Tall building geometry and off-set vertical cores allow onstage/off-stage access and circulation

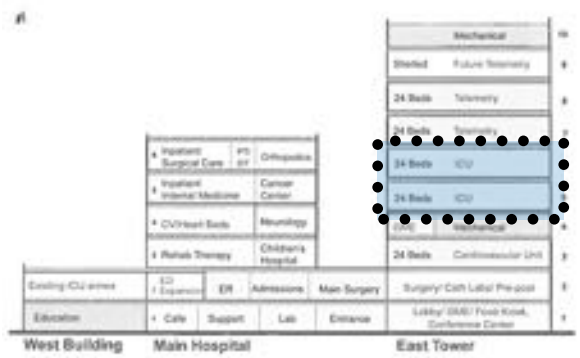
Patient

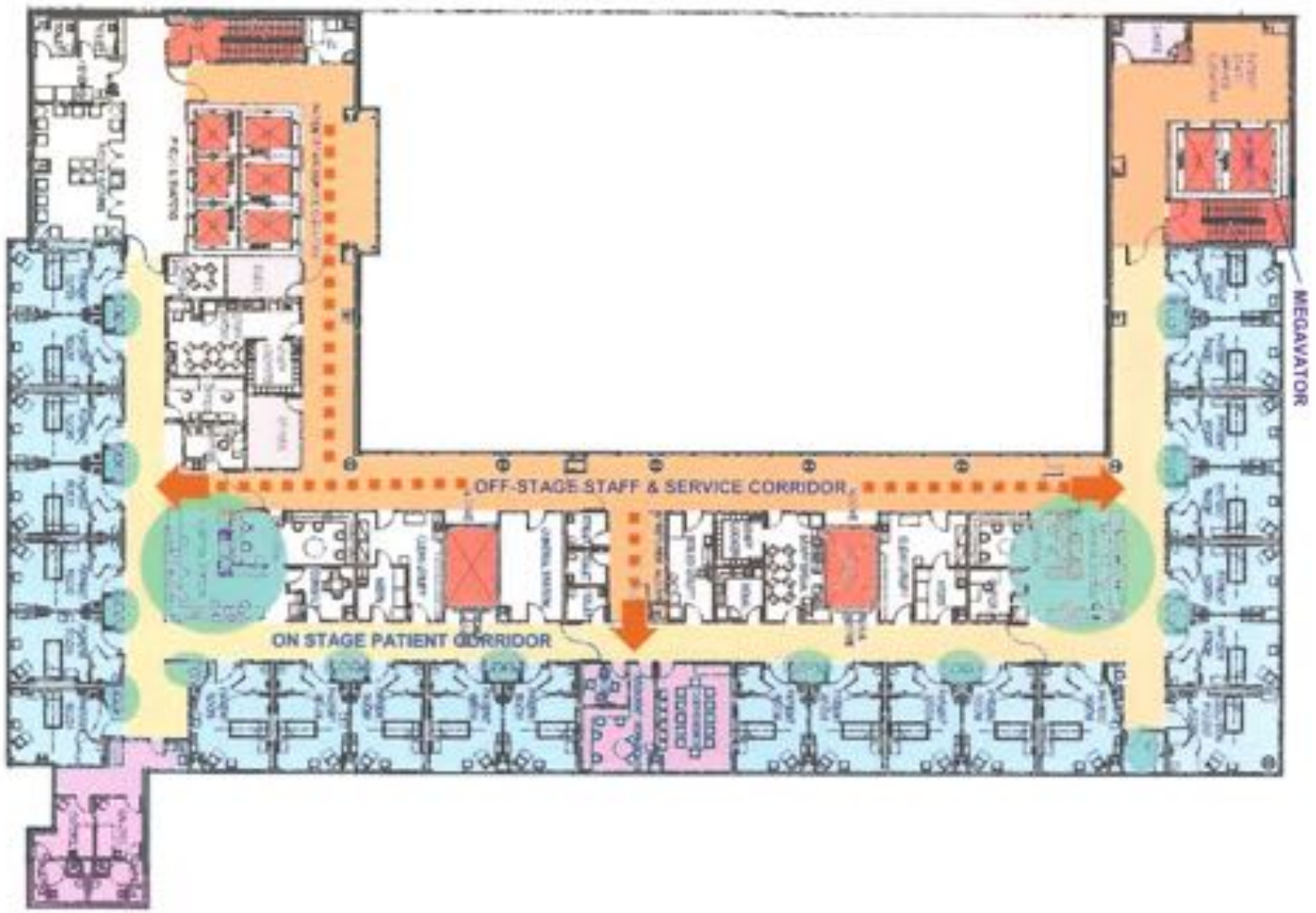
Visitor

Service

Ann & Robert H. Lurie Children's Hospital PICU, Chicago, Illinois, 2013 winner
Architects: ZGF

ENTRY 01
ICCU – A Cardiac ICU





(10) Visual and Physical Access to Nature

The importance of **nature for patients, families and staff** is increasingly recognized and incorporated into critical care units where possible.

"Nature serves as a positive distraction that reduces stress and diverts patients from focusing on their pain or distress."

– Ulrich, 2008

10 Best-Practice Critical Care Design Trends

Access to Nature

Legacy Good Samaritan
Multidisciplinary ICU
Portland, Oregon, USA
1996 winner
Architects: Tom Sagerser Architects

Photo: Kirk Hamilton, FAIA, FACHA

Stamford Hospital

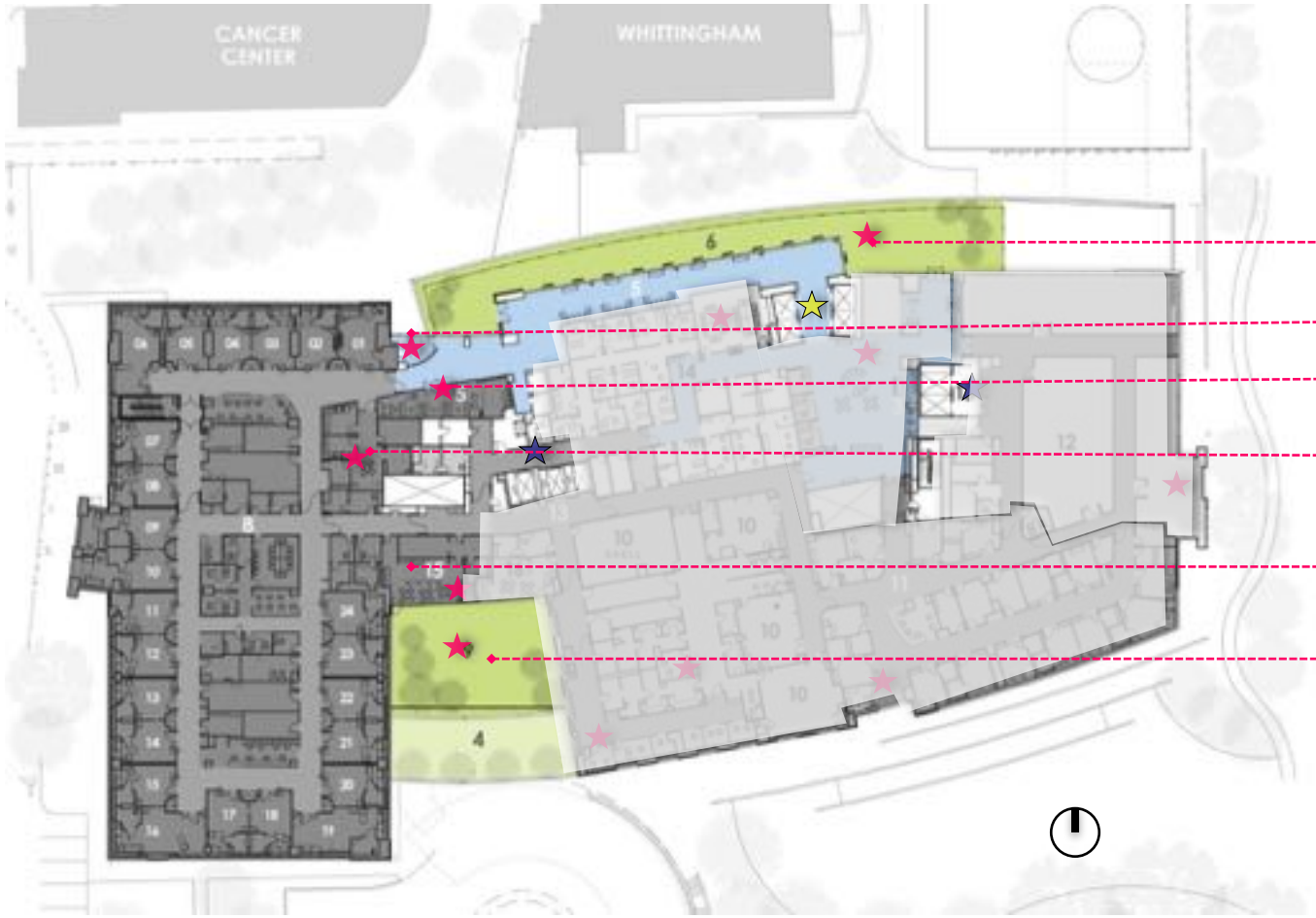
WHR Architects

Stamford Hospital, CT

(Under Construction)

A Planetree Hospital

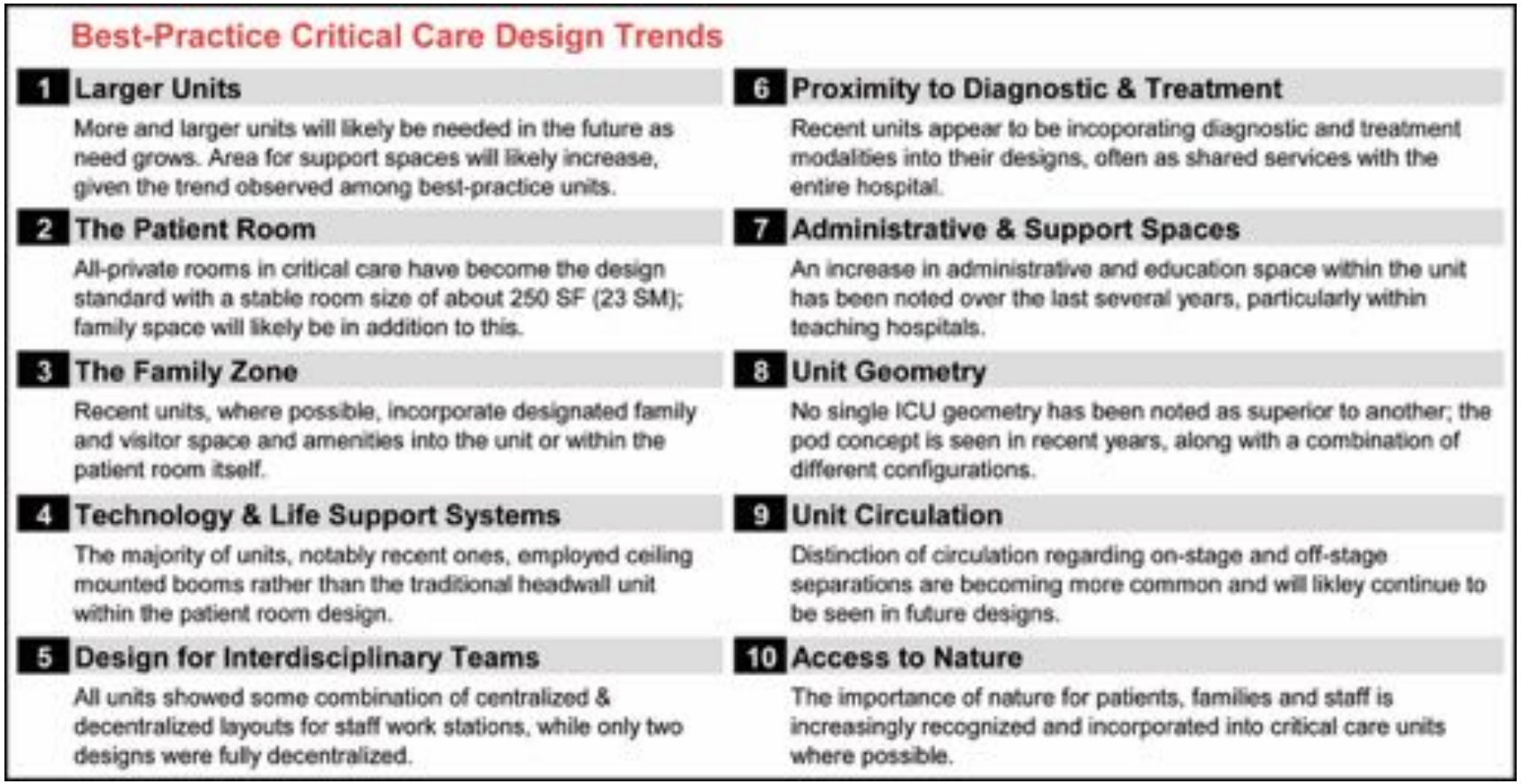
Example of Green Terraces for Families & Staff



SECOND FLOOR PLAN

Example of Green Terraces for Patients and Families

10 Best-Practice Critical Care Design Trends



Best-Practice Critical Care Design Trends

1 Larger Units

More and larger units will likely be needed in the future as need grows. Area for support spaces will likely increase, given the trend observed among best-practice units.

2 The Patient Room

All-private rooms in critical care have become the design standard with a stable room size of about 250 SF (23 SM); family space will likely be in addition to this.

3 The Family Zone

Recent units, where possible, incorporate designated family and visitor space and amenities into the unit or within the patient room itself.

4 Technology & Life Support Systems

The majority of units, notably recent ones, employed ceiling mounted booms rather than the traditional headwall unit within the patient room design.

5 Design for Interdisciplinary Teams

All units showed some combination of centralized & decentralized layouts for staff work stations, while only two designs were fully decentralized.

6 Proximity to Diagnostic & Treatment

Recent units appear to be incoporating diagnostic and treatment modalities into their designs, often as shared services with the entire hospital.

7 Administrative & Support Spaces

An increase in administrative and education space within the unit has been noted over the last several years, particularly within teaching hospitals.

8 Unit Geometry

No single ICU geometry has been noted as superior to another; the pod concept is seen in recent years, along with a combination of different configurations.

9 Unit Circulation

Distinction of circulation regarding on-stage and off-stage separations are becoming more common and will likley continue to be seen in future designs.

10 Access to Nature

The importance of nature for patients, families and staff is increasingly recognized and incorporated into critical care units where possible.

THANK YOU!

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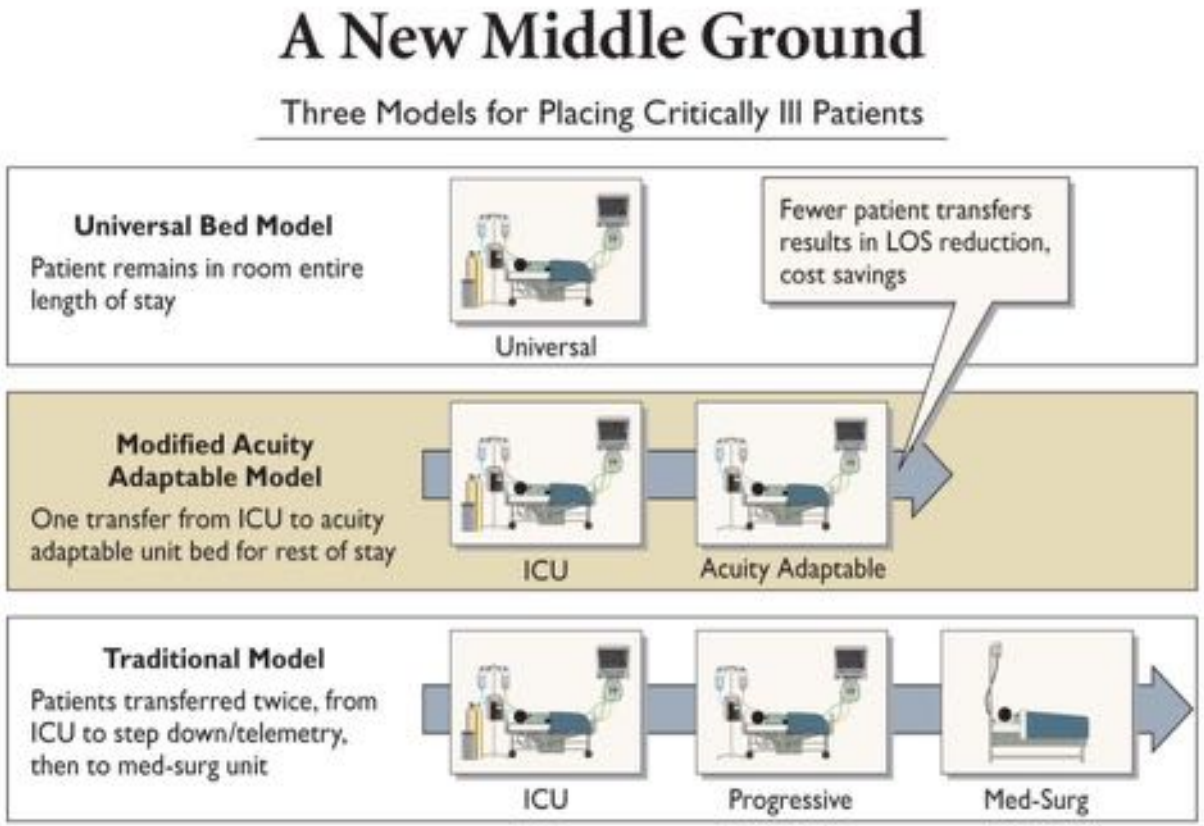
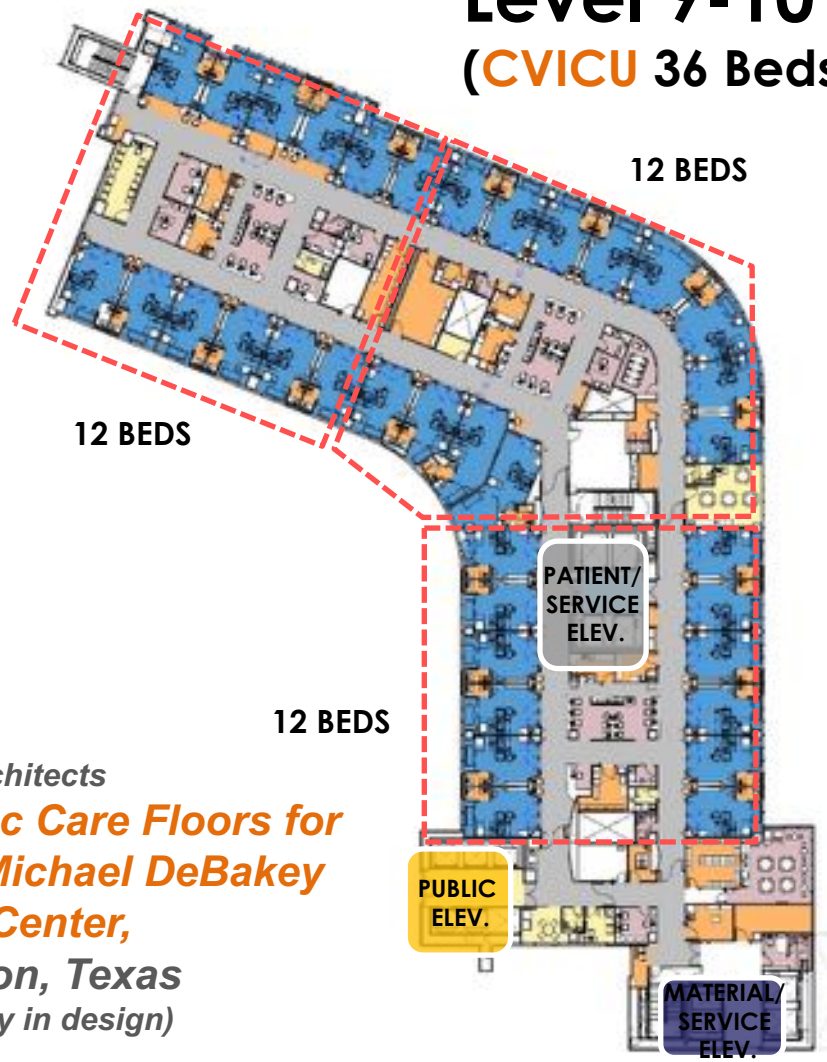
Acuity-Adaptable Rooms



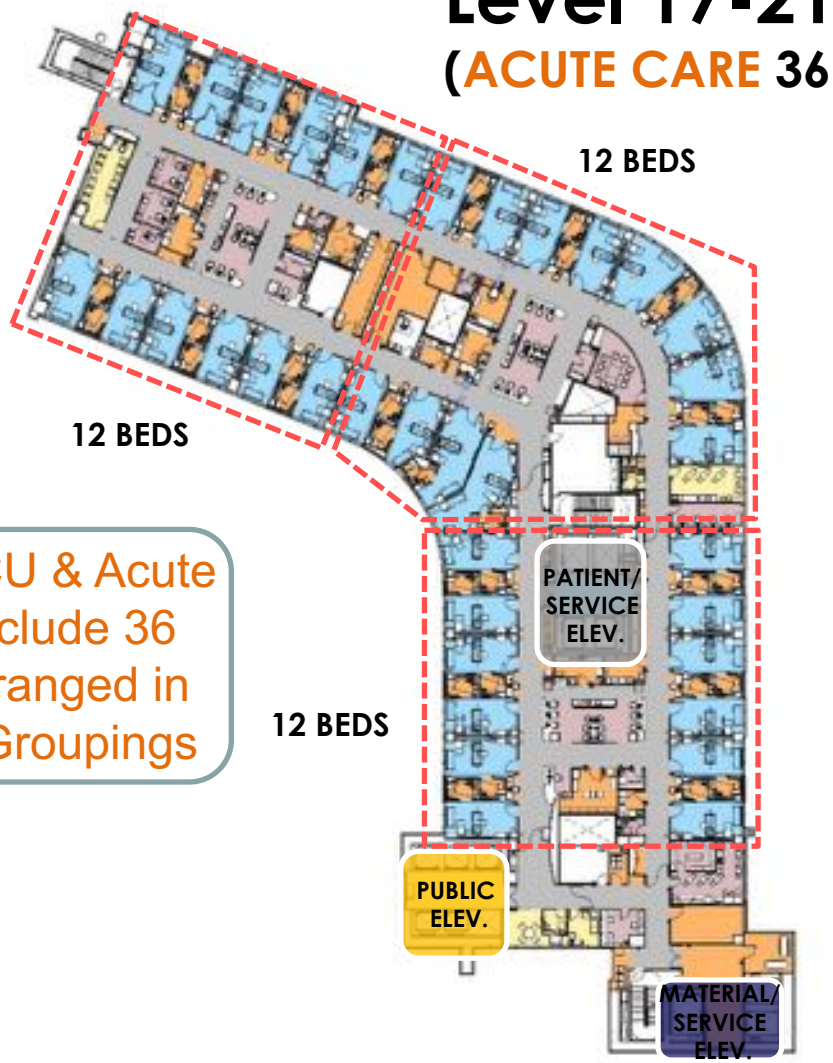
Source: Advisory Board Company

HMH Michael DeBakey Heart Center

Level 9-10
(CVICU 36 Beds)



Level 17-21
(ACUTE CARE 36 Beds)



Both ICCU & Acute Floors Include 36 Beds, Arranged in 12-Bed Groupings

WHR Architects

Cardiac Care Floors for HMH Michael DeBakey Heart Center,

Houston, Texas

(currently in design)

HMH Michael DeBakey Heart Center

12 Bed Nursing Pod (CVICU)

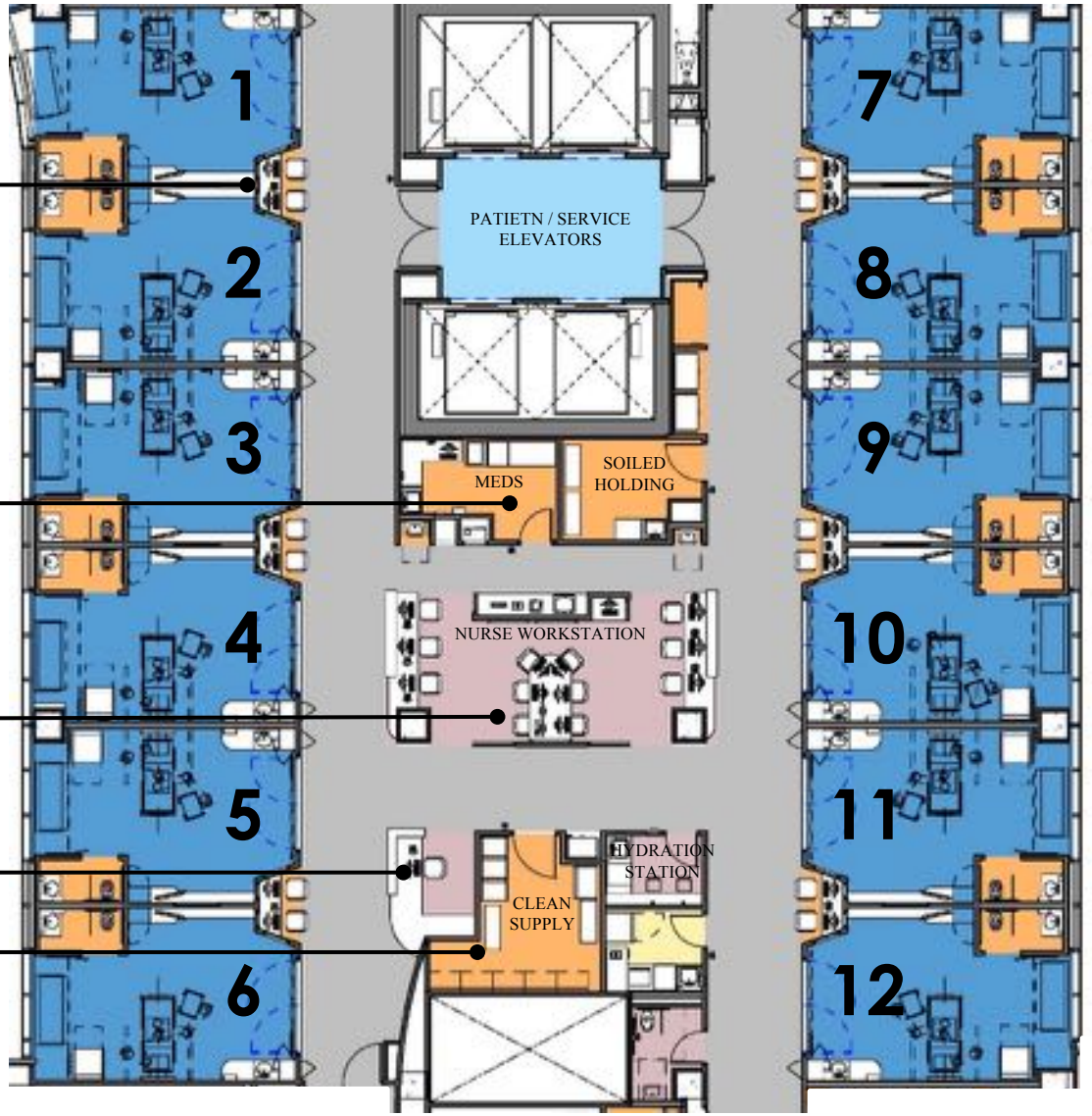
CHARTING STATION

MEDICATION / SOILED

NURSE WORKSTATION / PHYSICIAN WORKROOM

UNIT SECRETARY

CLEAN SUPPLY



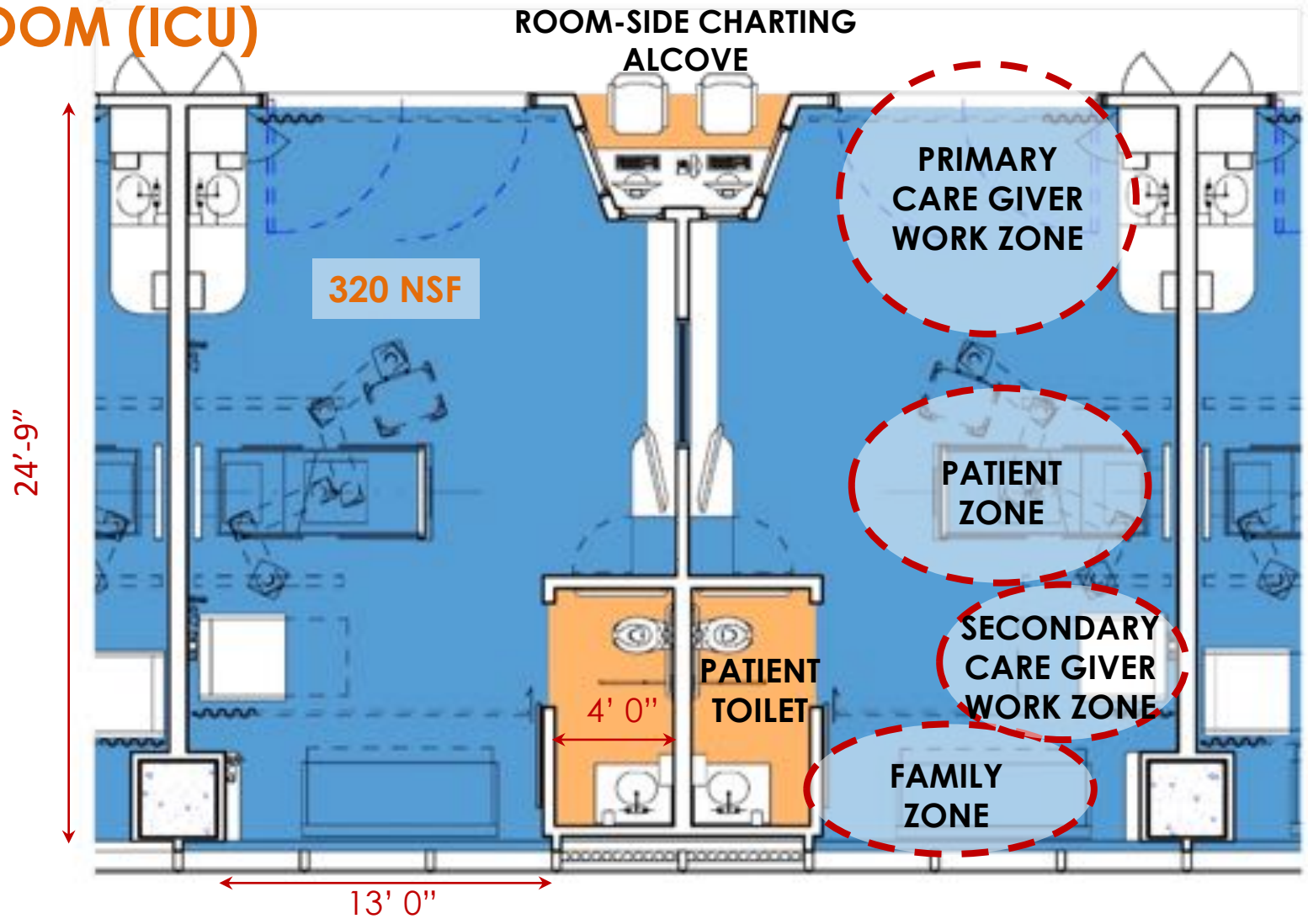
WHR Architects

Cardiac Care Floors for HMH Michael DeBakey Heart Center,

Houston, Texas

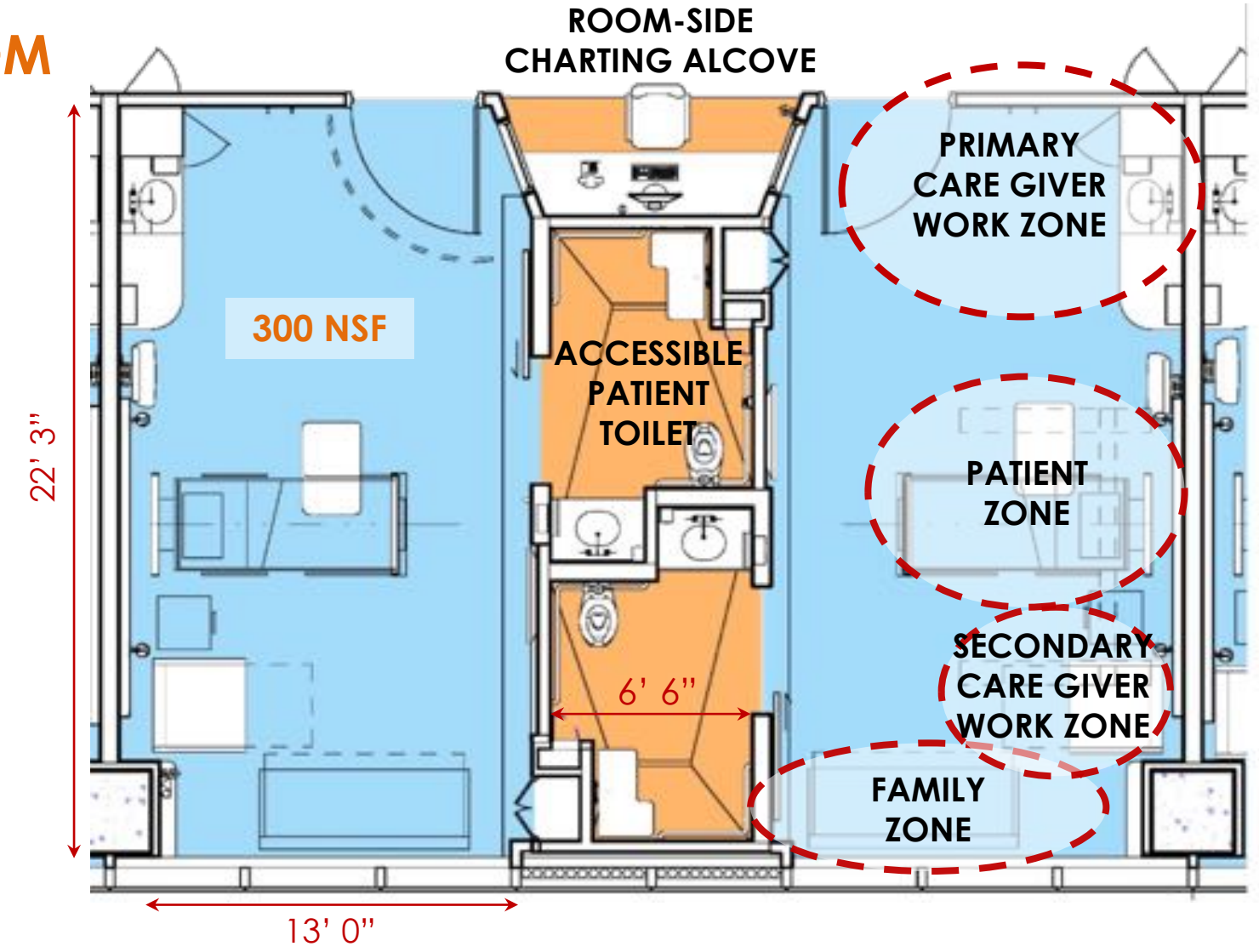
(currently in design)

PATIENT ROOM (ICU)



Private ICCU Room: 30 SM, *Including Toilet (no Shower)*

PATIENT ROOM (Typical Acute Care)



Private Acute Room (Stepdown):
32 SM,
Including Toilet & Shower