

# Academy of Architecture for Health On-line Professional Development

## Lean Inpatient Unit Design Strategies: New Research on Best Design for Effective Nursing

### Master Studio Series

Tuesday, April 11, 2017

2:00 pm – 3:00 pm ET

1:00 pm – 2:00 pm CT

12:00 am – 1:00 pm MT

11:00 am – 12:00 pm PT

#### Presenters

**Tom Clark, FAIA, EDAC**

Clark/Kjos Architects

**Scott Combs, AIA**

Clark/Kjos Architects

#### Moderator

**Rita Ho, Assoc AIA, LEED AP BD+C**

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# Master Studio Series

The Academy's multi-channel on-line approach provides emerging professionals, journeymen, and master professionals with convenient and economical opportunities to develop their chosen area of interest.

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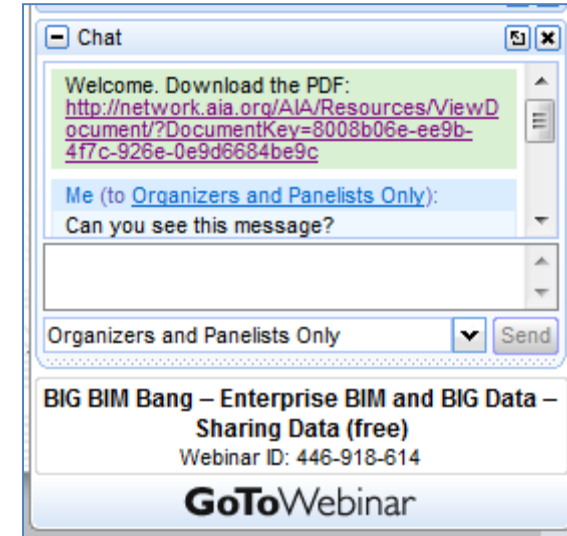
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# Lean Inpatient Unit Design Strategies: New Research on Best Design for Effective Nursing

## Presenters



**Tom Clark, FAIA, EDAC**  
Clark/Kjos Architects



**Scott Combs, AIA**  
Clark/Kjos Architects

# High Performance Environments



- Highly stressful
- Life & death conditions
- Precision
- Speed

# Caregiver Work Environments

## “5 Reason Nurses Want To Leave Your Hospital”\*

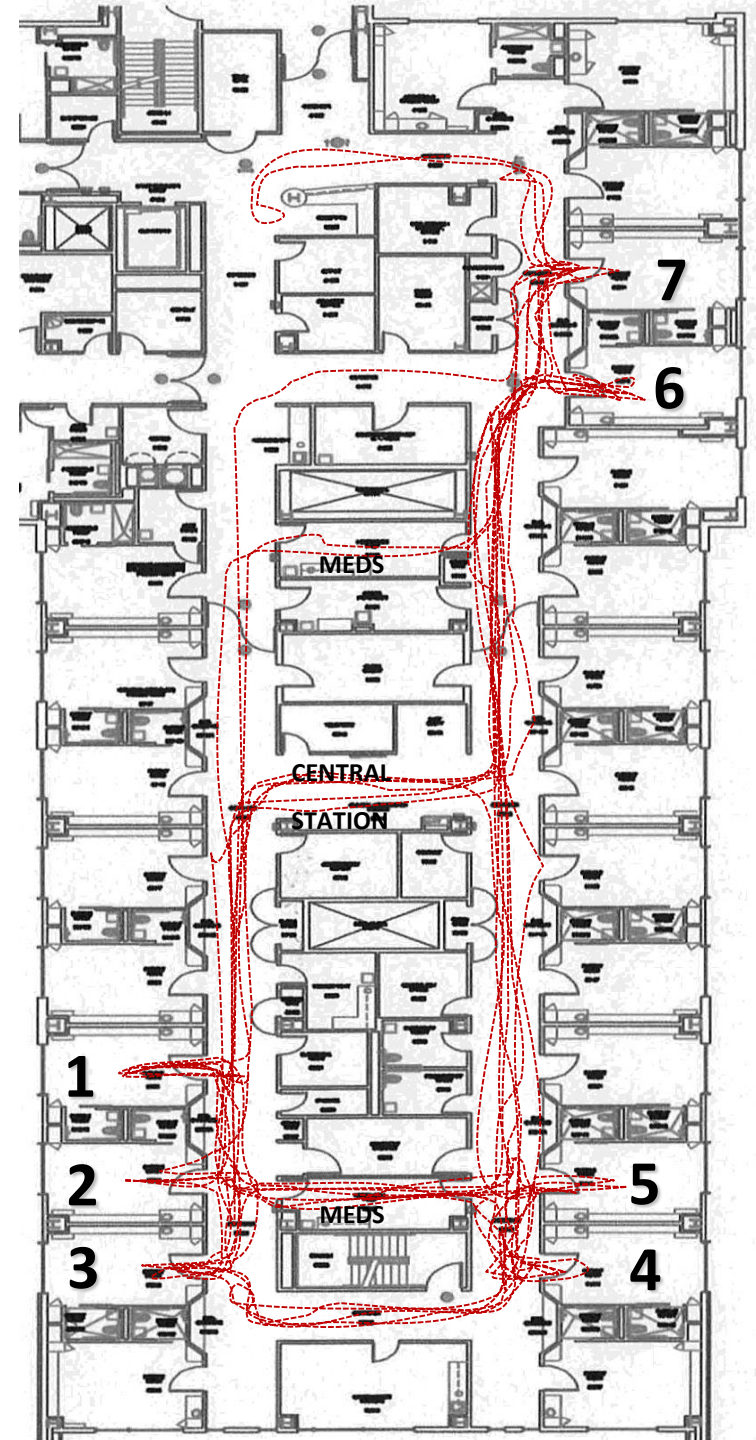
- Mandatory overtime
- Floating nurses to other units
- Bullying / toxic behavior
- Bad managers
- ***Non-nursing tasks & nursing interruptions***

*\*Source: HealthLeaders Media, August 9, 2011*

# Traditional Environments

**Waste:** Nurses walk average 3 miles/shift\*

*\*Impact of Work Environments on Nursing and Patient Care; Marilyn Chow & Ann Hendrich Study*



# Supplies

- 50% of nurses' work is gathering, transport & delay\*
- Hoarding



*\*Wisdom at Work: The Importance of the Older and Experienced Nurse in the Workplace;  
Robert Wood Johnson Foundation Study; June 2006*

# Medications

17% of nurses' time spent on medication administration\*

- Distractions = errors
- Waiting = waste

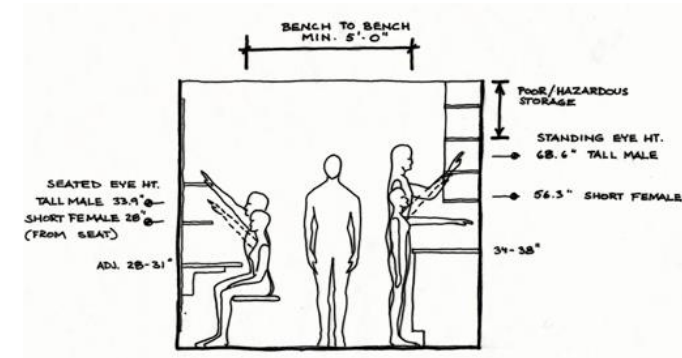
*\*Impact of Work Environments on Nursing & Patient Care; Ann Hendrich; Healthcare Design 2008*

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Academy of Architecture for Health



# Medications

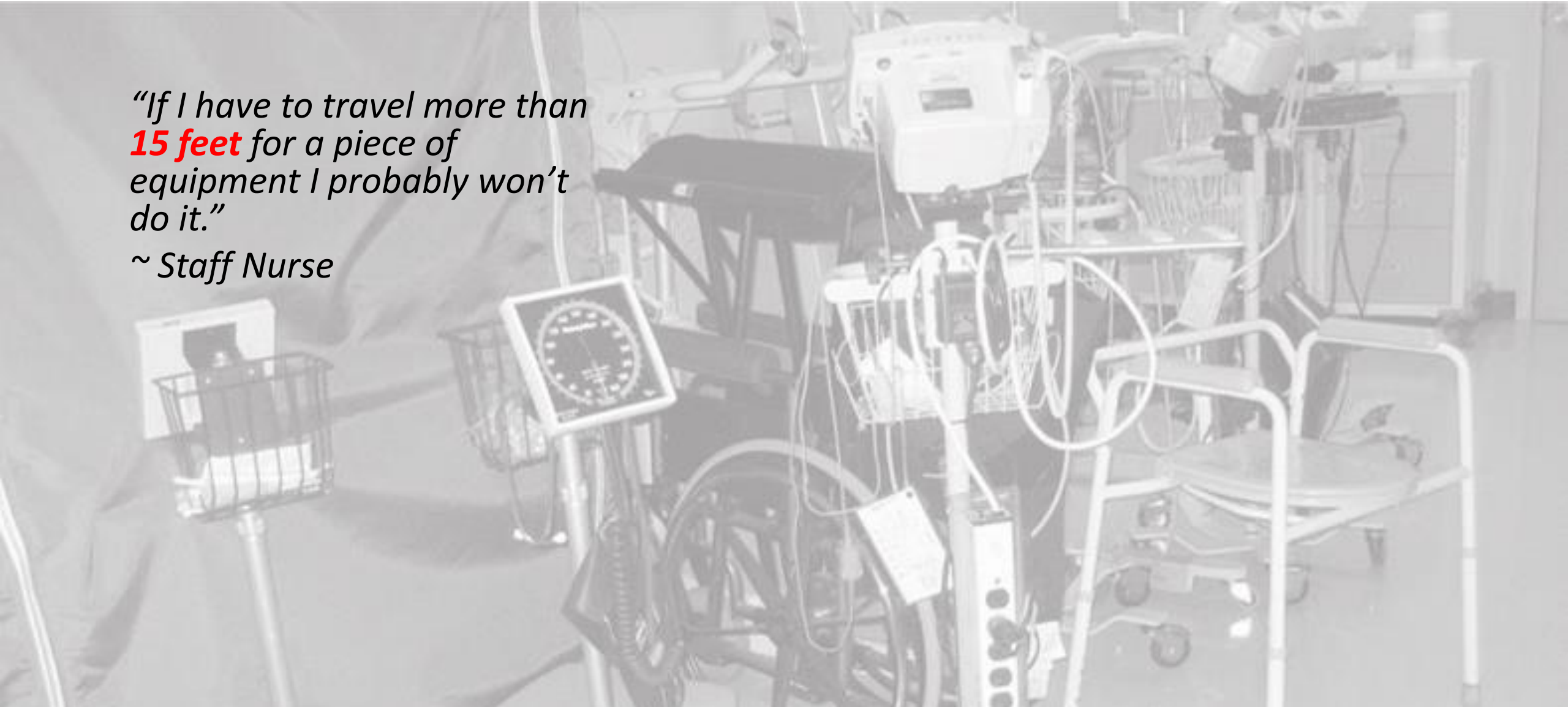
Undersized med rooms have problems...



# Equipment

*"If I have to travel more than  
**15 feet** for a piece of  
equipment I probably won't  
do it."*

*~ Staff Nurse*



# Documentation

- ...happens *anywhere* & *everywhere*



# THE RESEARCH

**Impacts of inpatient care unit design upon patient care goals:**

- **Time for direct patient care**
- **Time for documentation**
- **Patient safety**



# Research Questions



**Support resources**  
(Medications, supplies, linens,  
equipment, collaboration space, EMR)

Is there a correlation between their  
location and patient care time,  
documentation time, & safety?

# Methodology

- Literature review
- Enroll participants
- Floor plans
- Survey nurses
- Analysis



# Literature Review

## Direct patient care time

- Aiken, et al, 2002:
  - **More nurse direct patient care = lower mortality**
- Hendrich et.al., 2007, 2008:
  - **Only 19% of nurse time for direct patient care**

# Literature Review

## Decentralization

- Howard and Malloch, 2007:
  - **Nurses spent more time at bedside in decentralized units but only if support resources decentralized**

# Literature Review

## Documentation

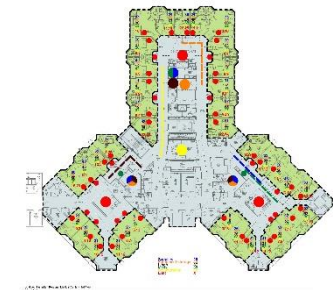
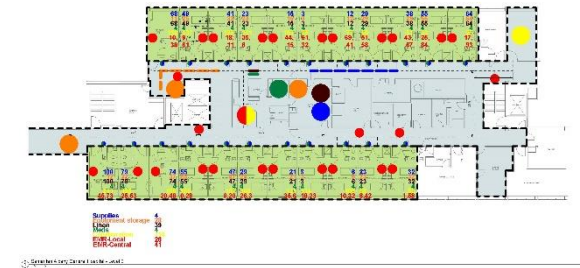
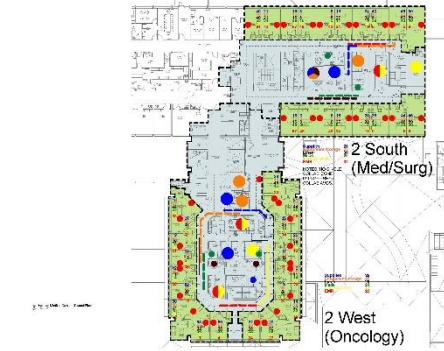
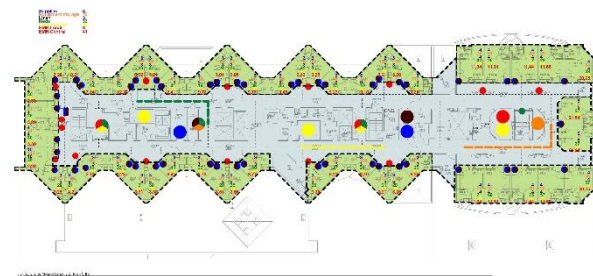
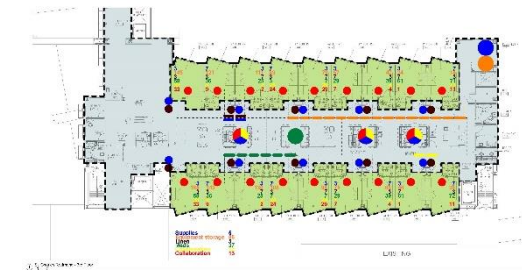
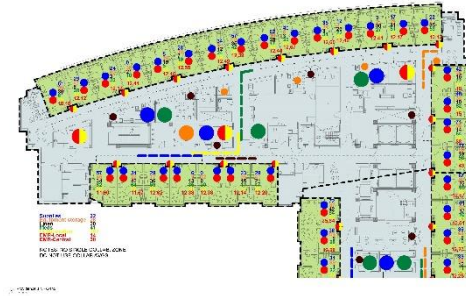
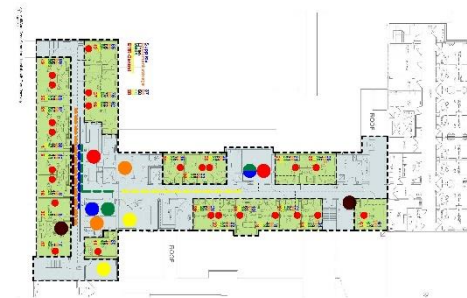
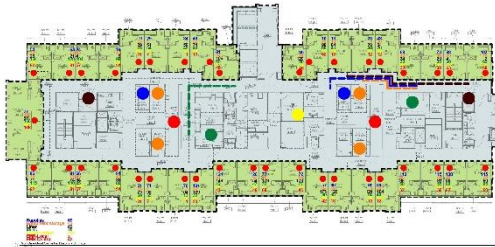
- Hendrich, 2008:
  - **Nurses spend 56% of time on documentation**

# Literature Review

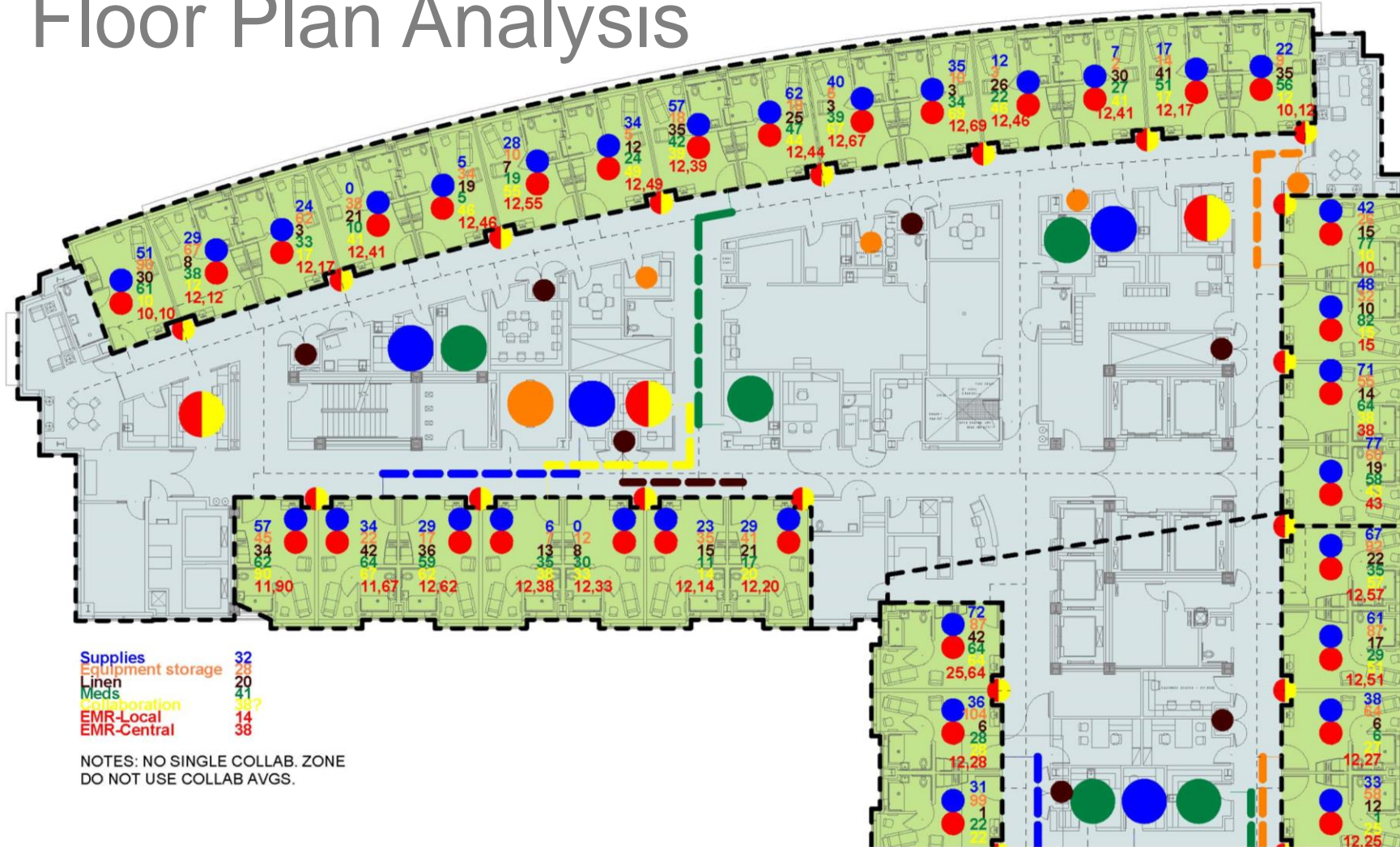
## Collaboration

- Becker, 2007:
  - **Community of practice—mentoring & communications**
- Tyson, et al., 2002:
  - **Decentralized units reduced communication**

# Floor Plan Analysis



# Floor Plan Analysis



1 Providence 8 N - Ortho  
 1/8" = 1'-0"

# Nurse Survey

## Medications, Supplies, Linens and Equipment

**11. On my unit, patient medications are kept: (If medications are stored in more than one location, please indicate the location closest to the patient.)**

- ☐ In the patient room
- ☐ In a corridor cabinet serving 1-4 patients
- ☐ At a decentralized location serving 5-10 patients
- ☐ At a decentralized location serving 11-20 patients
- ☐ At a centralized location serving 21 or more patients

Other (please specify)

**12. Please rate (on a scale of 1 to 5) how effective the location of patient medications is for your workflow in terms of:**

|                              | 1 - Not at all<br>Effective | 2 - Not very<br>Effective | 3 - Neutral           | 4 - Somewhat<br>Effective | 5 - Very Effective    |
|------------------------------|-----------------------------|---------------------------|-----------------------|---------------------------|-----------------------|
| Time for direct patient care | <input type="radio"/>       | <input type="radio"/>     | <input type="radio"/> | <input type="radio"/>     | <input type="radio"/> |
| Time for documentation       | <input type="radio"/>       | <input type="radio"/>     | <input type="radio"/> | <input type="radio"/>     | <input type="radio"/> |
| Patient safety               | <input type="radio"/>       | <input type="radio"/>     | <input type="radio"/> | <input type="radio"/>     | <input type="radio"/> |

# Supplies



# Analysis: Supplies

- Sorted by distance

|                              | Norton<br>Brownsboro | Good Sam<br>Puyallup 4 | Emory Johns<br>Creek Hosp. | Samaritan<br>Lebanon | St. Charles 3<br>Ortho Unit | St. Charles 4<br>Medical Unit | Samaritan Albany | Harrison 2S<br>( Med/Surg) | Harrison 2W<br>(Oncology) | Good Samaritan<br>Corvallis | Prov Portland 8S<br>(Neuro) | Prov Portland 8N<br>(Ortho) | Good Sam<br>Puyallup 6 | St. Charles<br>Redmond |
|------------------------------|----------------------|------------------------|----------------------------|----------------------|-----------------------------|-------------------------------|------------------|----------------------------|---------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|------------------------|
| ave dist to combined<br>locs | 82                   | 75                     | 40                         | 39                   | 38                          | 38                            | 34               | 29                         | 28                        | 26                          | 14                          | 13                          | 12                     | 7                      |
| Time for care                | 3                    | 1.7                    | 4                          | 3.4                  | 3.5                         | 3                             | 3.8              | 2.9                        | 2.8                       | 2.6                         | 3.7                         | 4.1                         | 3.7                    | 4                      |
| Time for<br>documentation    | 3.1                  | 2.2                    | 4                          | 3.4                  | 3.5                         | 3.3                           | 3.6              | 2.8                        | 2.9                       | 2.6                         | 3.7                         | 3.9                         | 3.6                    | 3.8                    |
| Patient Safety               | 3.6                  | 1.8                    | 4.1                        | 3.4                  | 3.4                         | 3.1                           | 3.8              | 2.9                        | 3                         | 2.7                         | 3.7                         | 4.1                         | 3.4                    | 4                      |

# Analysis: Supplies

- Sorted by decentralization type

|                        | CENTRALIZED<br>Serving 21 or more patients |                      |                            |                             |                               | DECENTRALIZED<br>Serving 11-20 patients |                           |                             |                            | DECENTRALIZED<br>5-10 patients |                             | NURSE SERVERS          |                        |                  |
|------------------------|--|----------------------|----------------------------|-----------------------------|-------------------------------|---|---------------------------|-----------------------------|----------------------------|--------------------------------|-----------------------------|------------------------|------------------------|------------------|
|                        | Good Sam<br>Puyallup 4                     | Norton<br>Brownsboro | Harrison 2S<br>( Med/Surg) | St. Charles 3<br>Ortho Unit | St. Charles 4<br>Medical Unit | Samaritan<br>Lebanon                    | Harrison 2W<br>(Oncology) | Good Samaritan<br>Corvallis | Emory Johns<br>Creek Hosp. | Prov Portland 8N<br>(Ortho)    | Prov Portland 8S<br>(Neuro) | Good Sam<br>Puyallup 6 | St. Charles<br>Redmond | Samaritan Albany |
| type central vs decent | 4  | 4                    | 4                          | 4                           | 4                             | 3                                       | 3                         | 3                           | 3                          | 2                              | 2                           | 1                      | 1                      | 1                |
|                        |  |                      |                            |                             |                               |   |                           |                             |                            |                                |                             |                        |                        |                  |
| Time for care          | 1.7  | 3                    | 2.9                        | 3.5                         | 3                             | 3.4                                     | 2.8                       | 2.6                         | 4                          | 4.1                            | 3.7                         | 3.7                    | 4                      | 3.8              |
| Time for documentation | 2.2  | 3.1                  | 2.8                        | 3.5                         | 3.3                           | 3.4                                     | 2.9                       | 2.6                         | 4                          | 3.9                            | 3.7                         | 3.6                    | 3.8                    | 3.6              |
| Patient Safety         | 1.8  | 3.6                  | 2.9                        | 3.4                         | 3.1                           | 3.4                                     | 3                         | 2.7                         | 4.1                        | 4.1                            | 3.7                         | 3.4                    | 4                      | 3.8              |

# Analysis: Supplies

- Some correlation: **distance**
- Strong correlation: **decentralization type**



# Variables: Supplies

- Some nurse servers too small
- Inconsistent stock



# Medications



# Analysis: Medications

- Sorted by distance

|                              | Norton<br>Brownsboro | Harrison 2S<br>( Med/Surg) | Harrison 2W<br>(Oncology) | Good Sam<br>Puyallup 6 | St. Charles<br>3 Ortho Unit | St. Charles<br>4 Medical Unit | Good Sam<br>Puyallup 4 | Prov Portland<br>8N (Ortho) | Emory Johns<br>Creek Hosp. | St. Charles<br>Redmond | Good Samaritan<br>Corvallis | Samaritan<br>Lebanon | Prov Portland<br>8S (Neuro) | Samaritan<br>Albany |
|------------------------------|----------------------|----------------------------|---------------------------|------------------------|-----------------------------|-------------------------------|------------------------|-----------------------------|----------------------------|------------------------|-----------------------------|----------------------|-----------------------------|---------------------|
| Ave dist to<br>combined locs | 78                   | 71                         | 70                        | 70                     | 55                          | 45                            | 44                     | 41                          | 38                         | 37                     | 35                          | 34                   | 28                          | 10                  |
| Time for care                | 3                    | 2.4                        | 3.3                       | 4                      | 3.6                         | 3                             | 3.3                    | 3.9                         | 3.9                        | 3.8                    | 2.9                         | 4.3                  | 4.1                         | 3.5                 |
| Time for documentation       | 3.5                  | 2.8                        | 3.1                       | 3.9                    | 3.9                         | 3.1                           | 3.2                    | 4                           | 3.9                        | 3.8                    | 2.8                         | 4                    | 4.1                         | 3.4                 |
| Patient Safety               | 3.9                  | 3.5                        | 3.3                       | 3.9                    | 3.9                         | 3.1                           | 2.8                    | 4.1                         | 4.1                        | 4.2                    | 2.9                         | 3.7                  | 4.4                         | 4.2                 |

# Analysis: Medications

- Sorted by number of beds per meds room

|                           | Norton<br>Brownsboro | Good Sam<br>Puyallup 6 | St. Charles<br>Redmond | Harrison 2S<br>( Med/Surg) | St. Charles<br>3 Ortho Unit | St. Charles<br>4 Medical Unit | Good Sam<br>Puyallup 4 | Emory Johns<br>Creek Hosp. | Good Samaritan<br>Corvallis | Harrison 2W<br>(Oncology) | Prov Portland<br>8N (Ortho) | Prov Portland 8S<br>(Neuro) | Samaritan<br>Lebanon | Samaritan<br>Albany |
|---------------------------|----------------------|------------------------|------------------------|----------------------------|-----------------------------|-------------------------------|------------------------|----------------------------|-----------------------------|---------------------------|-----------------------------|-----------------------------|----------------------|---------------------|
| Beds per med rlocation    | 24                   | 20                     | 18                     | 18                         | 13                          | 13                            | 12                     | 12                         | 12                          | 12                        | 9                           | 7                           | 5                    | 1                   |
| Time for care             | 3                    | 4                      | 3.8                    | 2.4                        | 3.6                         | 3                             | 3.3                    | 3.9                        | 2.9                         | 3.3                       | 3.9                         | 4.1                         | 4.3                  | 3.9                 |
| Time for<br>documentation | 3.5                  | 3.9                    | 3.8                    | 2.8                        | 3.9                         | 3.1                           | 3.2                    | 3.9                        | 2.8                         | 3.1                       | 4                           | 4.1                         | 4                    | 3.6                 |
| Patient Safety            | 3.9                  | 3.9                    | 4.2                    | 3.5                        | 3.9                         | 3.1                           | 2.8                    | 4.1                        | 2.9                         | 3.3                       | 4.1                         | 4.4                         | 3.7                  | 4.4                 |

Sorted for beds per med room

# Analysis: Medications

- Size of meds room, as area per bed

| Unit                      | Tot size of all med rooms as sf/bed | Ave. Safety score |
|---------------------------|-------------------------------------|-------------------|
| Providence 8S             | 14.1                                | 4.4               |
| Providence 8N             | 12.6                                | 4.1               |
| Good Samaritan Puyallup 6 | 10.4                                | 3.9               |
| St Charles Bend 3         | 8.4                                 | 3.9               |
| Emory Johns Creek         | 8.0                                 | 4.1               |
| St Charles Redmond        | 7.8                                 | 4.2               |
| St Charles Bend 4         | 7.1                                 | 3.1               |
| Good Samaritan Corvallis  | 6.0                                 | 2.9               |
| Good Samaritan Puyallup 4 | 5.9                                 | 2.8               |
| Norton Brownsboro         | 5.8                                 | 3.9               |
| Harrison West             | 3.3                                 | 3.3               |
| Harrison South            | 2.1                                 | 3.5               |



# Analysis: Medications

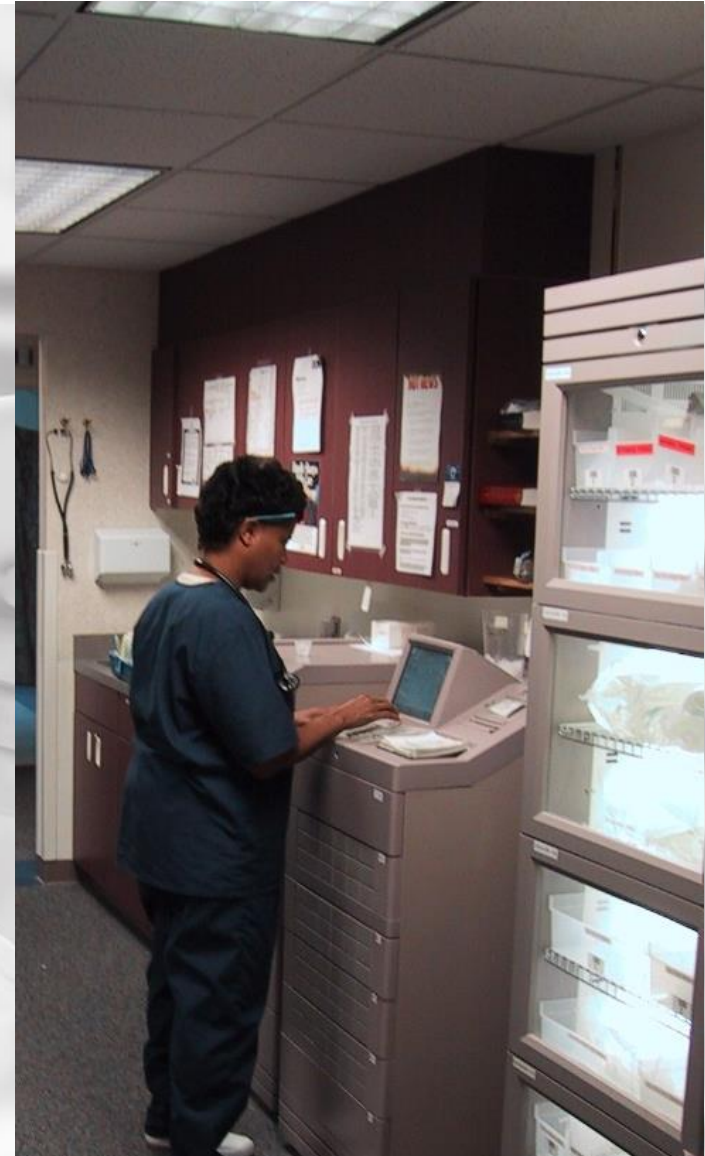
- Size of med room

| Unit                      | Ave. med<br>room size | Ave.<br>Safety<br>score |
|---------------------------|-----------------------|-------------------------|
| Good Samaritan Puyallup 6 | 219                   | 3.9                     |
| St Charles Redmond        | 140                   | 4.2                     |
| Norton Brownsboro         | 140                   | 3.9                     |
| Providence 8N             | 109                   | 4.1                     |
| Providence 8S             | 103                   | 4.4                     |
| Emory Johns Creek         | 96                    | 4.1                     |
| St Charles Bend 3         | 82                    | 3.9                     |
| Good Samaritan Corvallis  | 80                    | 2.9                     |
| Good Samaritan Puyallup 4 | 71                    | 2.8                     |
| St Charles Bend 4         | 57                    | 3.1                     |
| Harrison West             | 36                    | 3.3                     |
| Harrison South            | 36                    | 3.5                     |



# Analysis: Medications

- Some correlation: walking distance
- Some correlation: # patients/med room
- Safety correlation: med room SF/patient
- Safety correlation: med room size



# Variables: Medications

- Incomplete stock
- Pharmacy staff not keeping up
- 9-1-5-9-1-5 = waiting



# Analysis: Equipment



# Analysis: Equipment

## Summary of findings:

- No compelling correlation

# Variables: Equipment

- Rooms often too small
- When decentralized, equipment can be anywhere.



# Electronic Medical Record

A hand is shown interacting with a tablet displaying an e-health Medical Record interface. The interface includes a search bar, a list of patient categories (A-F, G-L, M-R, T-Z), a form for patient information (Date, Patient name, D.O.B./Age, GP Name, Address, Tel, Blood Group, Weight, Height), and sections for Previous medical history and Medication. The bottom navigation bar includes Home, Schedule, Health plan, and Appointment.

**e-health Medical Record**

**Search** **HN** **First admission date**

**A-F**  
**G-L**  
**M-R**  
**T-Z**  
Type a character

Date :  
Patient name :  
D.O.B./Age :  
GP Name :  
Address :  
Tel :  
Blood Group :  
Weight :  
Height :

**Previous medical history**

**Medication**

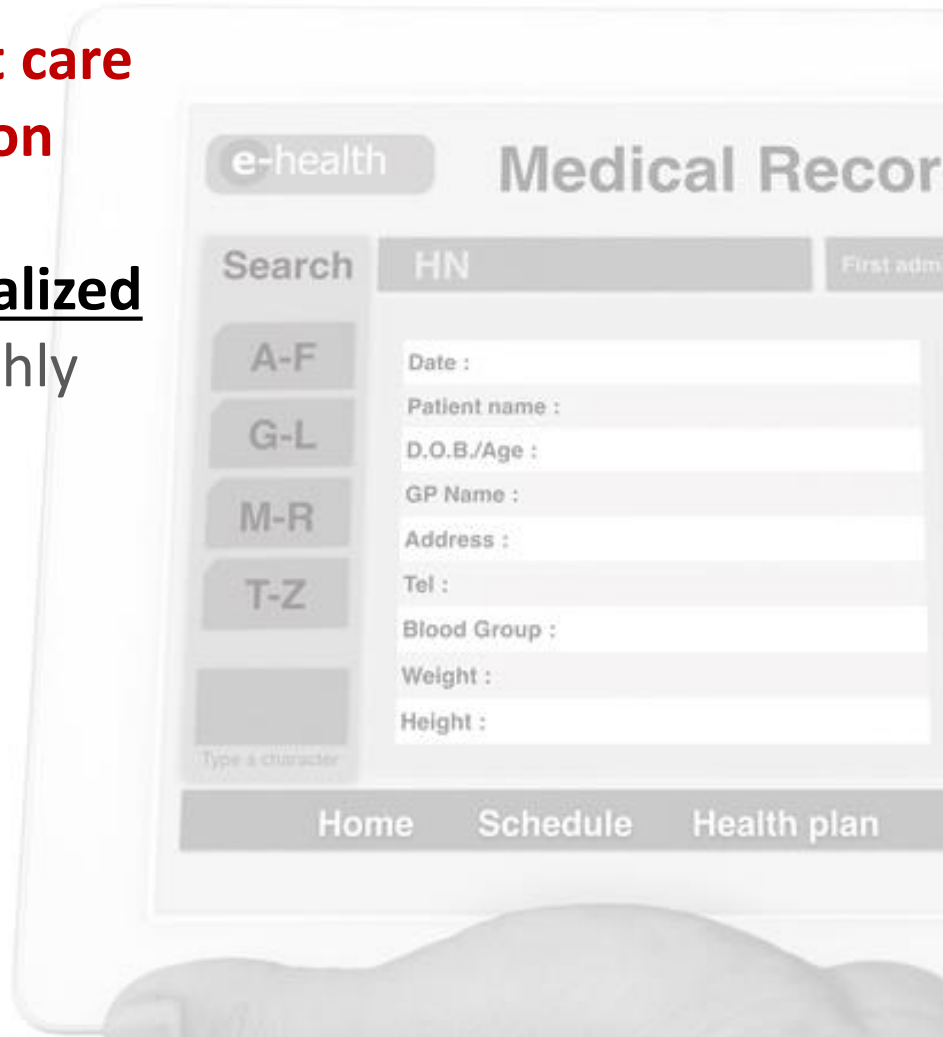
**Home Schedule Health plan Appointment**

# Analysis: Electronic Medical Record

Time for direct patient care

Time for documentation

- All types of decentralized locations scored highly

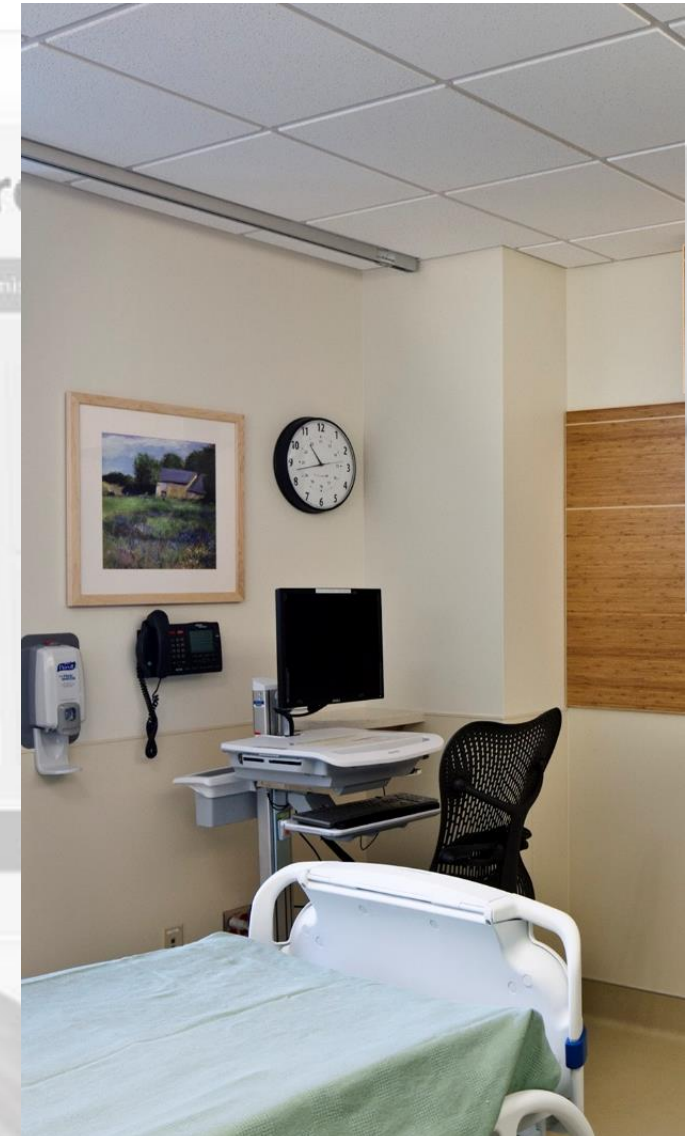


# Analysis: Electronic Medical Record

## Safety

- Patient room best
- Corridor alcove second best
- Satellite third best

| Location                    | Average judgment | Positive judgments | % positive |
|-----------------------------|------------------|--------------------|------------|
| In patient room             | 4.1 of 5         | 13 of 14           | 93%        |
| Corridor alcove for 1-2 pts | 3.5 of 5         | 5 of 6             | 83%        |
| Satellite for several pts   | 3.4 of 5         | 7 of 9             | 78%        |
| Central to entire unit      | 2.9 of 5         | 1 of 3             | 33%        |

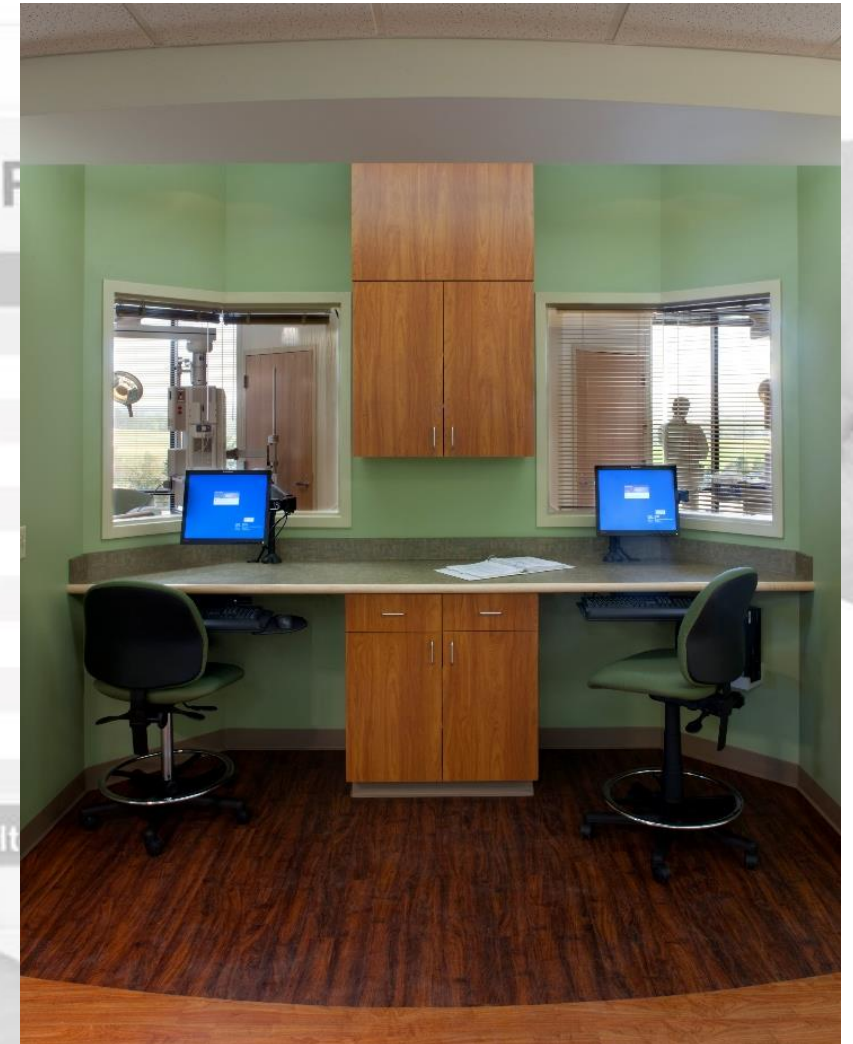


# Analysis: Electronic Medical Record

## Noise and distractions

- Patient room and corridor alcove best

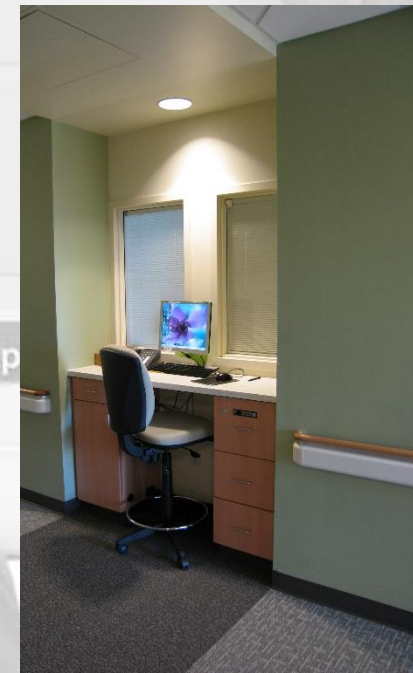
| Location                    | Average judgment | Positive judgments | % positive |
|-----------------------------|------------------|--------------------|------------|
| In patient room             | 3.4 of 5         | 11 of 14           | 84%        |
| Corridor alcove for 1-2 pts | 3.4 of 5         | 5 of 6             | 83%        |
| Satellite for several pts   | 3.4 of 5         | 6 of 9             | 67%        |
| Central to entire unit      | 2.7 of 5         | 1 of 3             | 33%        |



# Analysis: Electronic Medical Record

## Corridor view and safety:

- Satellites: When open to view corridor, 5 of 6 scored positively
- Alcoves: When open to view corridor, 5 of 6 scored positively



# Collaboration Spaces



# Analysis: Collaboration Spaces

## Summary of findings:

- All high scoring
- No correlation to distance

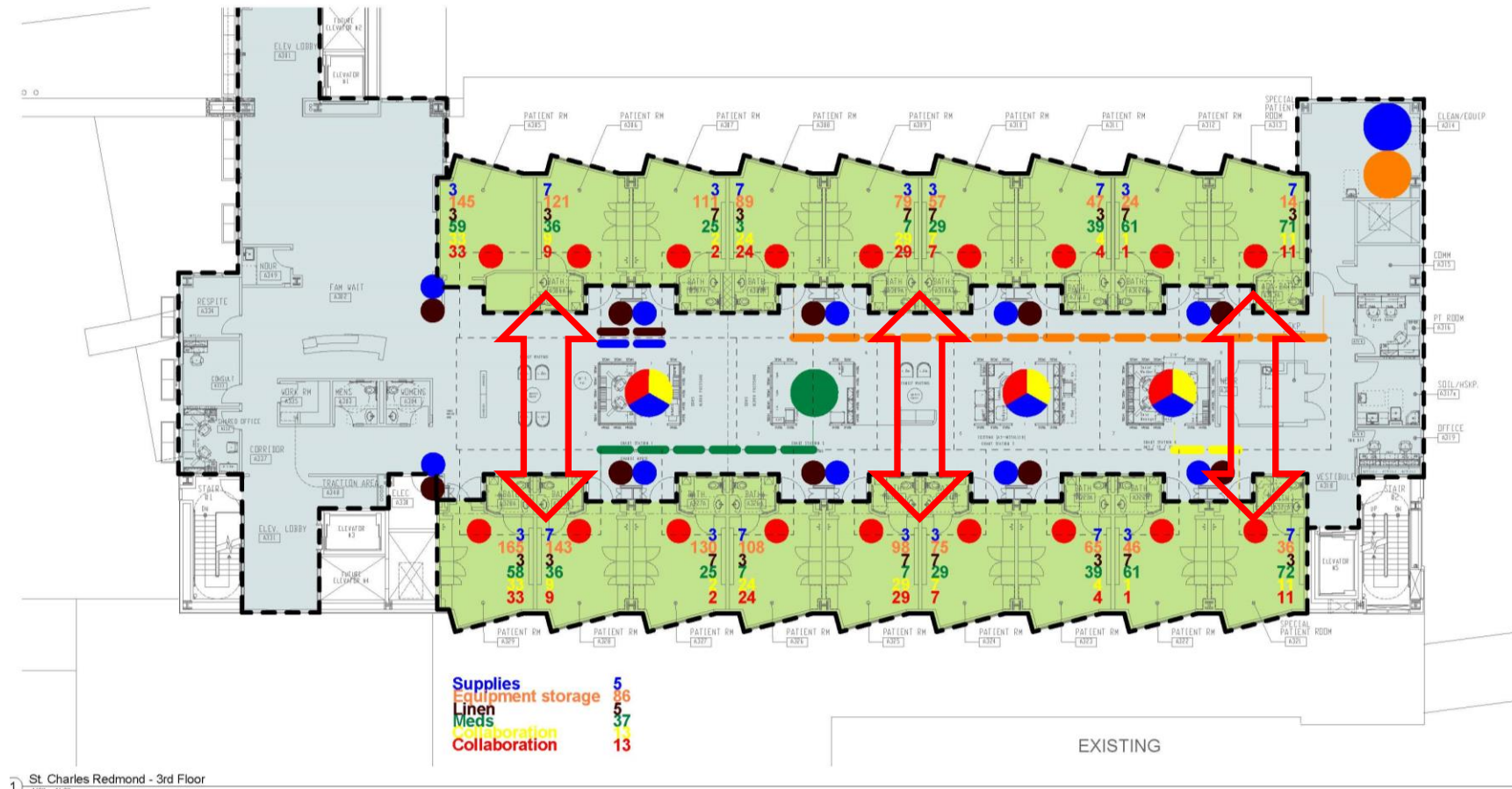


# 3 Typologies Effective for Support Resources



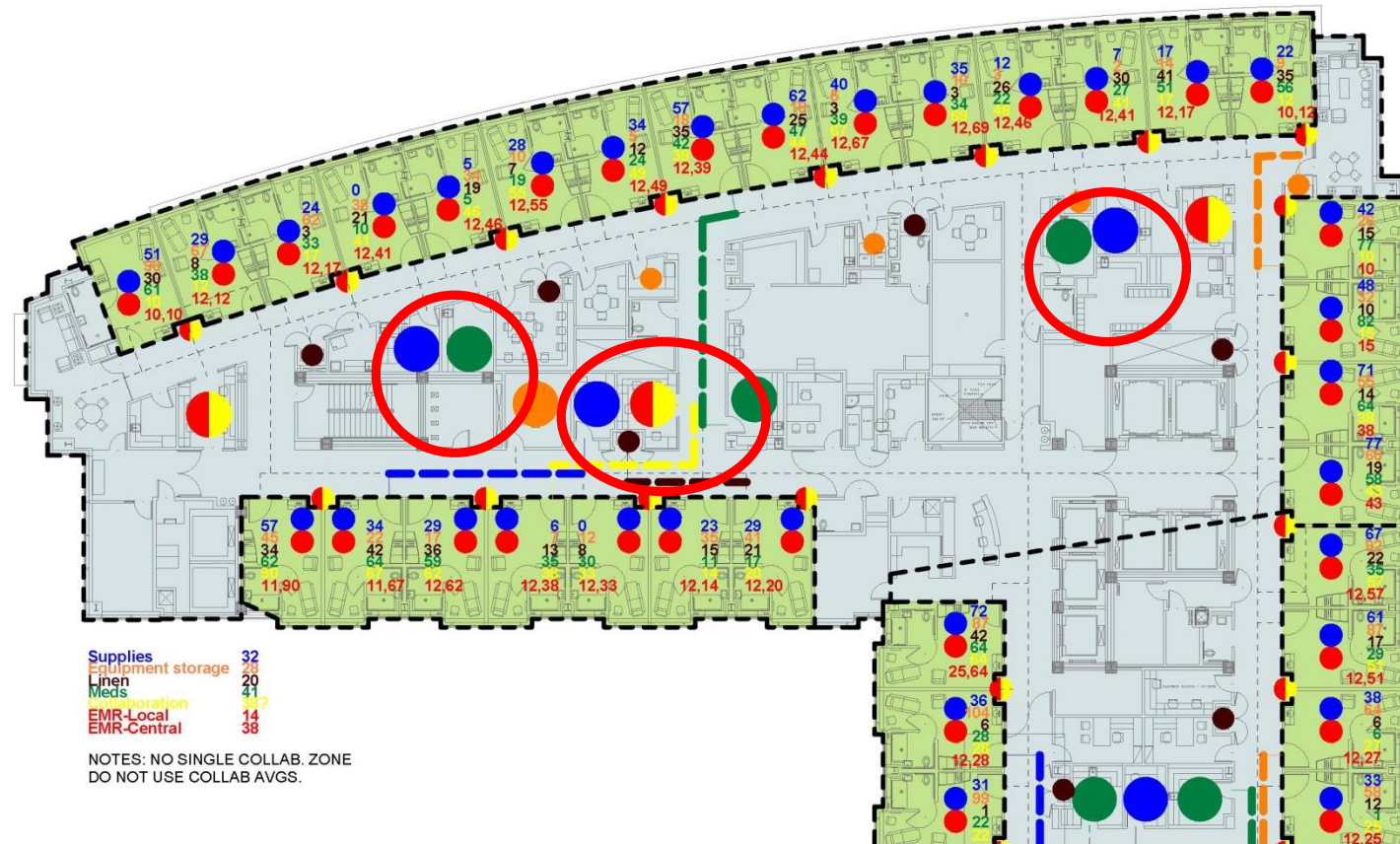
# 12-bed 'separate' module concept

- High scores: Meds, supplies, linen



# Open, flexible core

- High scores: Meds, supplies, linen



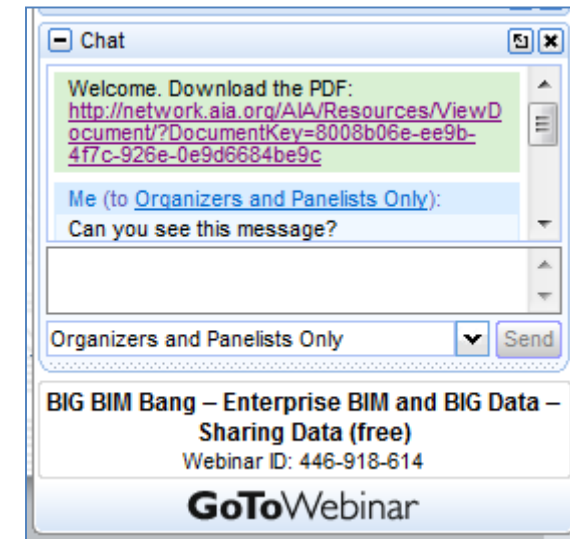
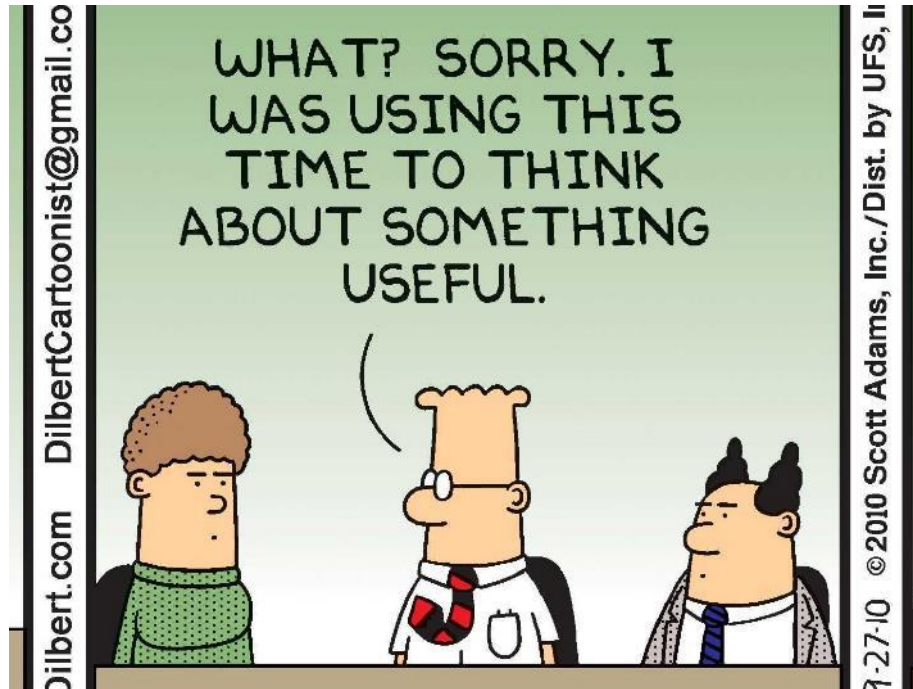
Providence 8 N - Ortho

# Highly decentralized

- High scores: Meds, supplies

Lean Inpatient Units 7-25-2013

# Upcoming Break for Questions and Comments

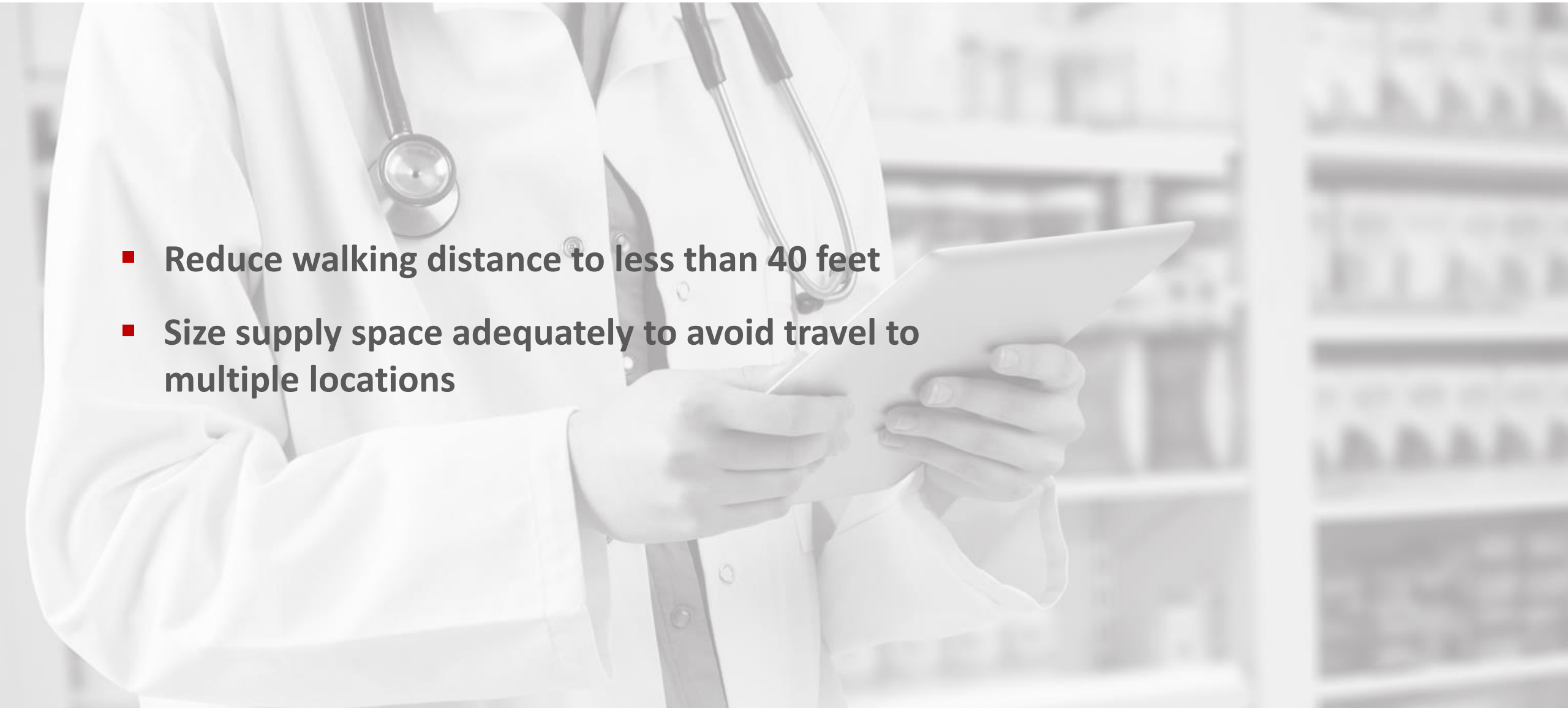


## Take-aways: Best IPU Practices



# Best Practices: Supplies

- **Reduce walking distance to less than 40 feet**
- **Size supply space adequately to avoid travel to multiple locations**



# Best Practices: Medications

- Reduce walking distance to less than 40 feet
- Med rooms over 80 SF, or 8 SF/bed increase safety



# Best Practices: Equipment

- 
- Decentralization not proven helpful
  - Consistent equipment location most important

# Best Practices: Electronic Medical Records

- All decentralized locations work well
- Open visualization at corridor alcoves or satellites
- Corridor alcoves—need space for 2



# Best Practices: Collaboration Spaces

- **Informal: accommodate at all EMR locations**
- **Shift change: most at patient bedside**
- **Formal care planning meetings: don't use valuable real estate**



Get Creative!



# Time for Questions and Comments



<http://www.businessinsider.com> , Courtesy of Scott Adams

**Moderator**

**Rita Ho, Assoc AIA, LEED AP BD+C**

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# Upcoming Webinars\*

| Date | Series                         | Topic  |
|------|--------------------------------|--|
| 5/9  | HC 101 Series                  | Building Enclosure Fundamentals – Air Barriers for Hospitals     |
| 6/13 | Design Award Case Study Series | Kaiser Permanente Kraemer Radiation Oncology Center              |
| 7/11 | Master Series                  | <i>To be Announced Soon! – check the AAH website for details</i> |

\*Dates and topics are subject to change

Visit [www.aia.org/aah](http://www.aia.org/aah) for more information and to register.