

Expected and unexpected: What we learn about neonatal intensive care unit design through behavioral observations of nurse activities

EUROPEAN
HEALTHCARE DESIGN
RESEARCH • POLICY • PRACTICE

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Introduction

Methodology

Result

Discussion

Conclusion

Introduction

Neonatal intensive care unit (NICU)

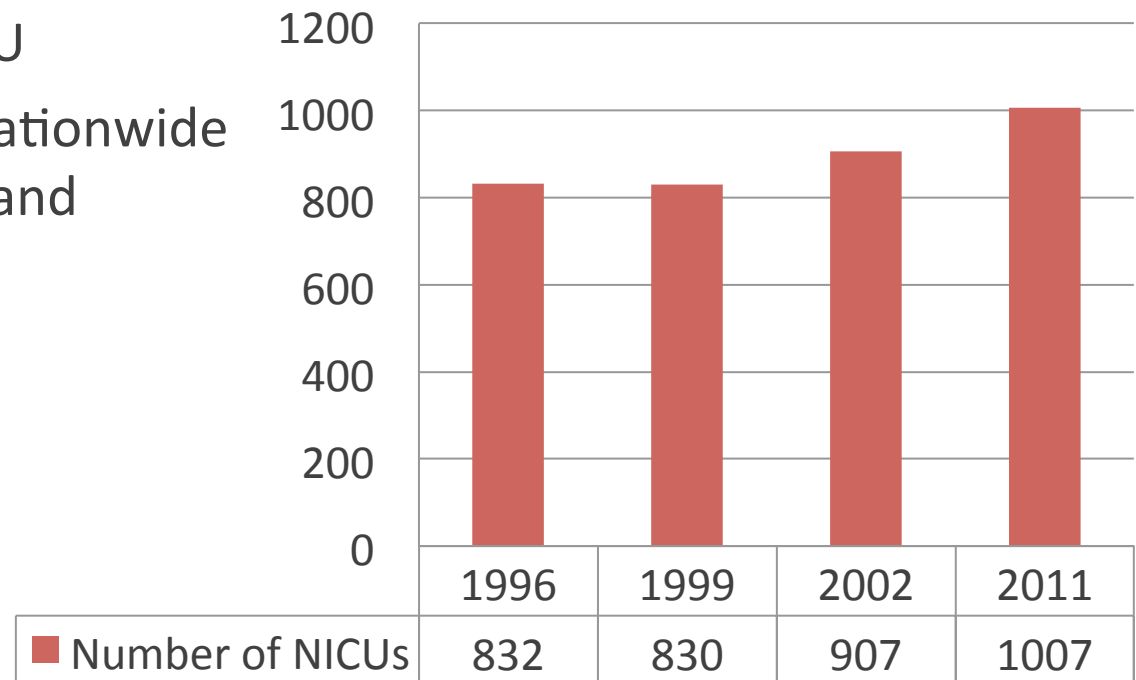
- Sophisticated mechanical devices and special equipment
- Premature and seriously ill newborns
- Neonatologists, specialized nurses, and technicians



Introduction

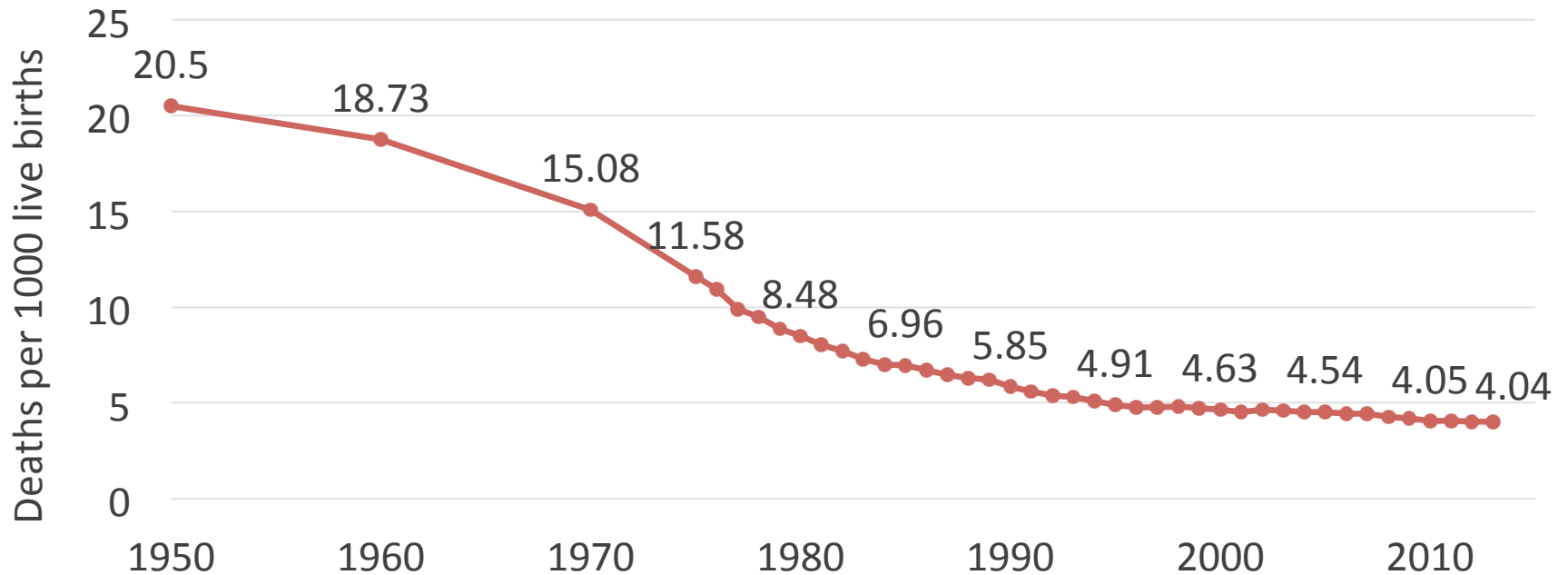
NICU development in the U.S.

- 1898: first premature infant incubator station
- 1960/1965: first NICU
- 2011: 1,007 NICUs nationwide with increasing demand



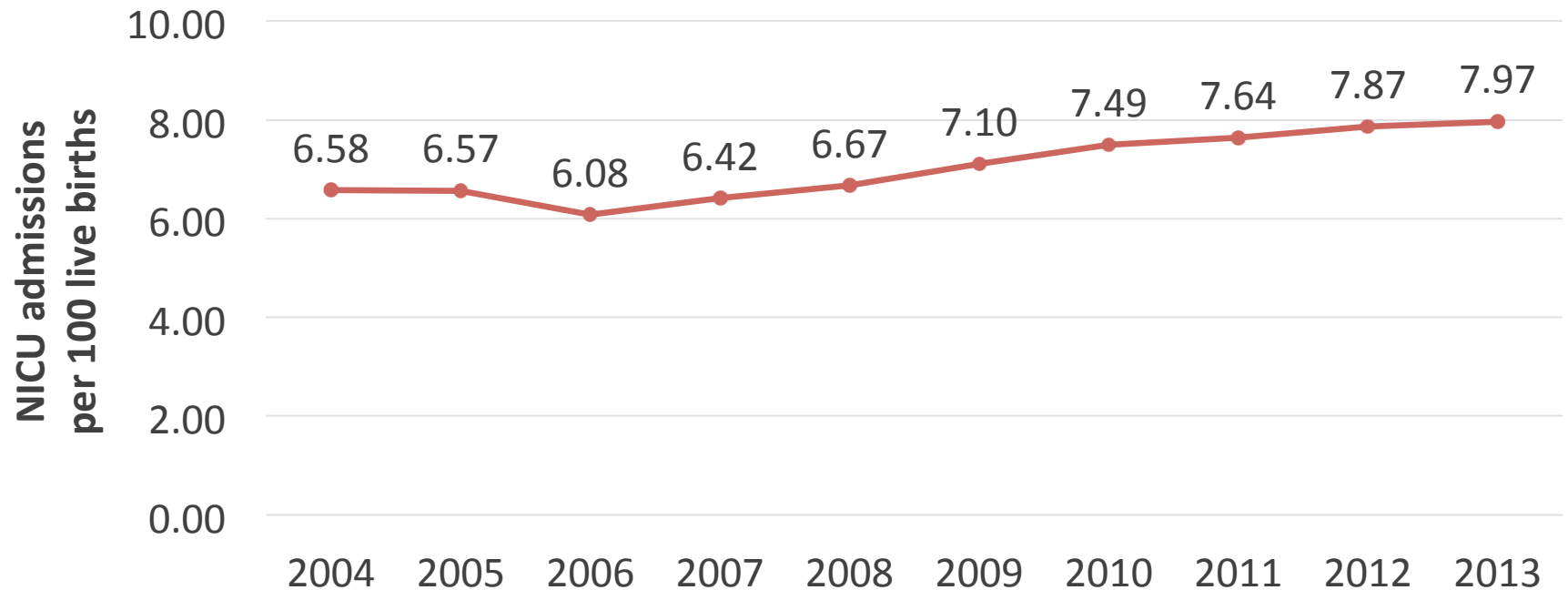
Introduction

- Neonatal mortality rates in the U.S.



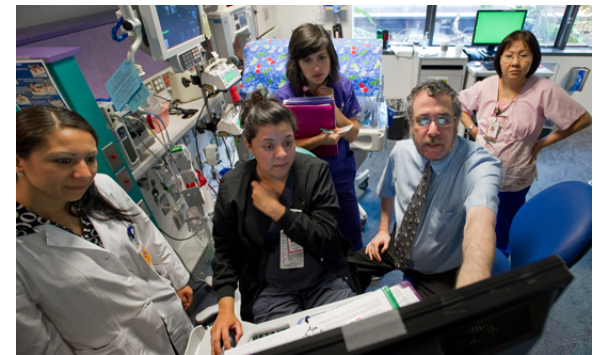
Introduction

- Percentages of NICU admissions among new births in the U.S.



Introduction

- Caring place
- Social place
- Work place



<http://hcahealthcare.com/util/images/rotator/shay-harper.jpg> <http://www.mobapbaby.org/MyMoBap/NICU/NICUStaff.aspx>
<http://www.texaschildrensblog.org/2012/08/what-is-a-neonatologist-part-2-what-we-do/>

Introduction

Care models

- Family-centered care
- Developmental care



<https://mdmercy.com>
<https://s-media-cache-ak0.pinimg.com>

Introduction

Gap of knowledge

- Impact of NICU **physical environment**
- Limited studies in NICUs, especially from the **perspective of nurses' behaviors and needs**



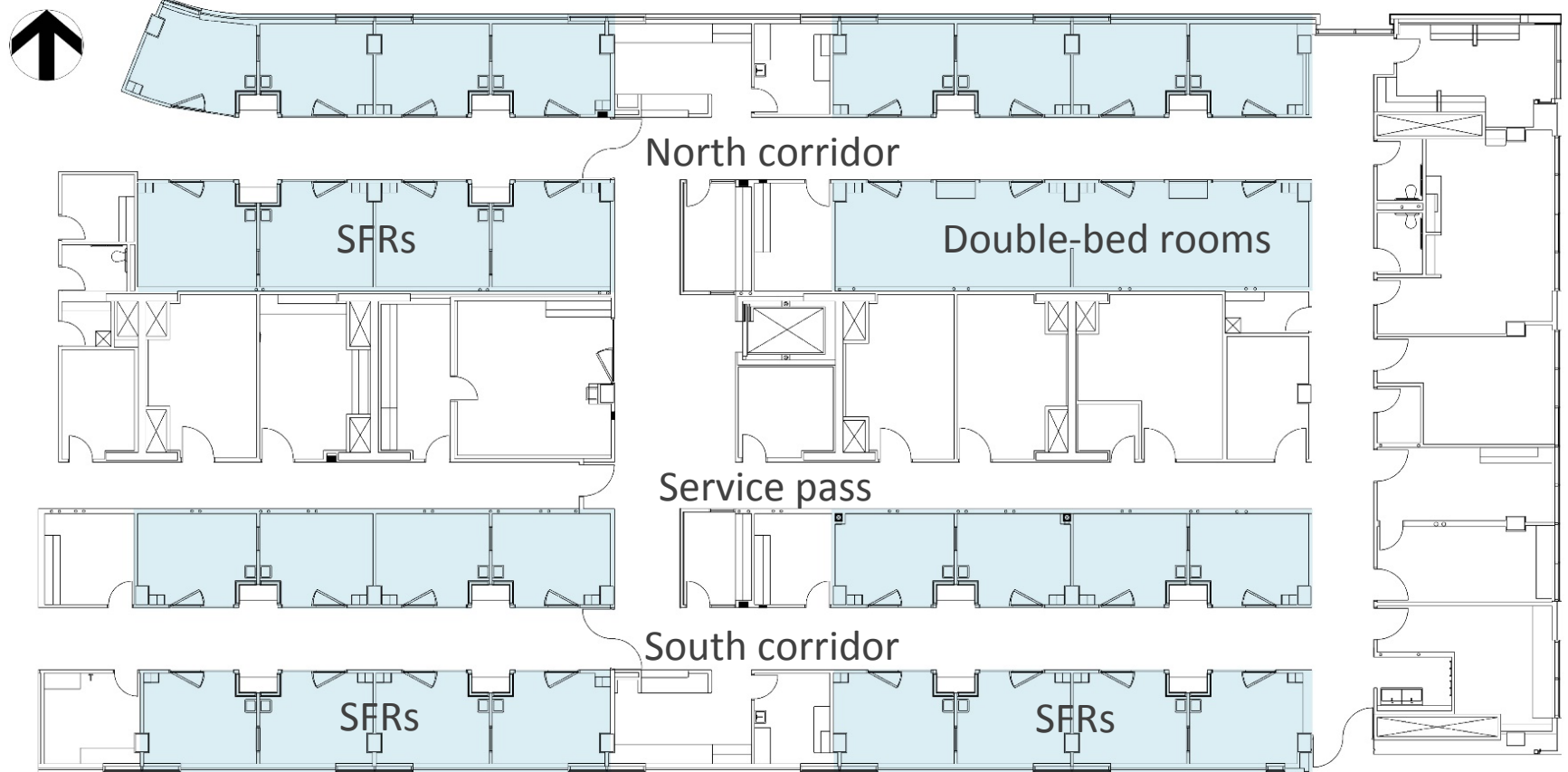
Methodology: Behavioral Observation



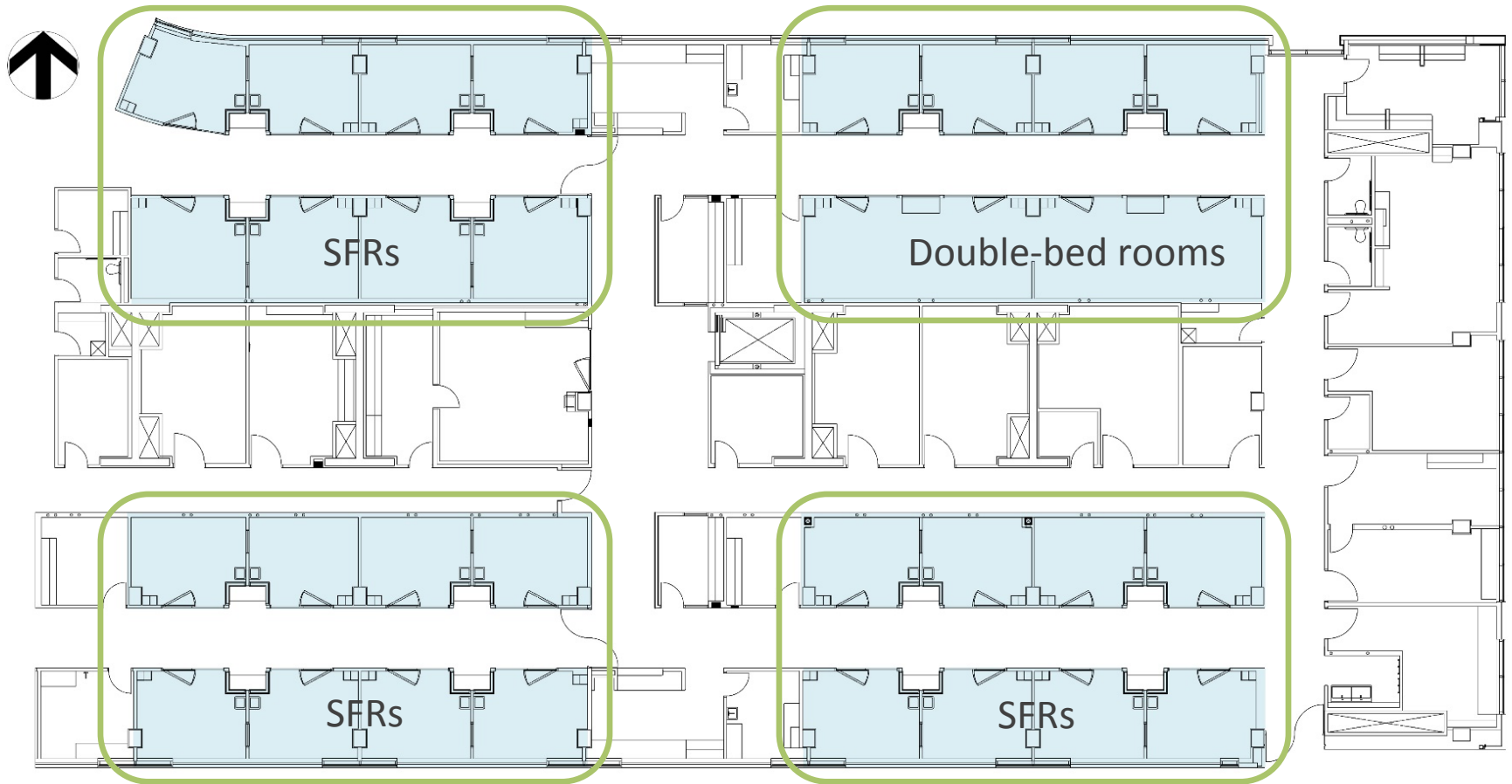
Site description

- A general hospital in the southeast U.S.
- New level III NICU
- 30 rooms, 28 are single family rooms (SFRs)

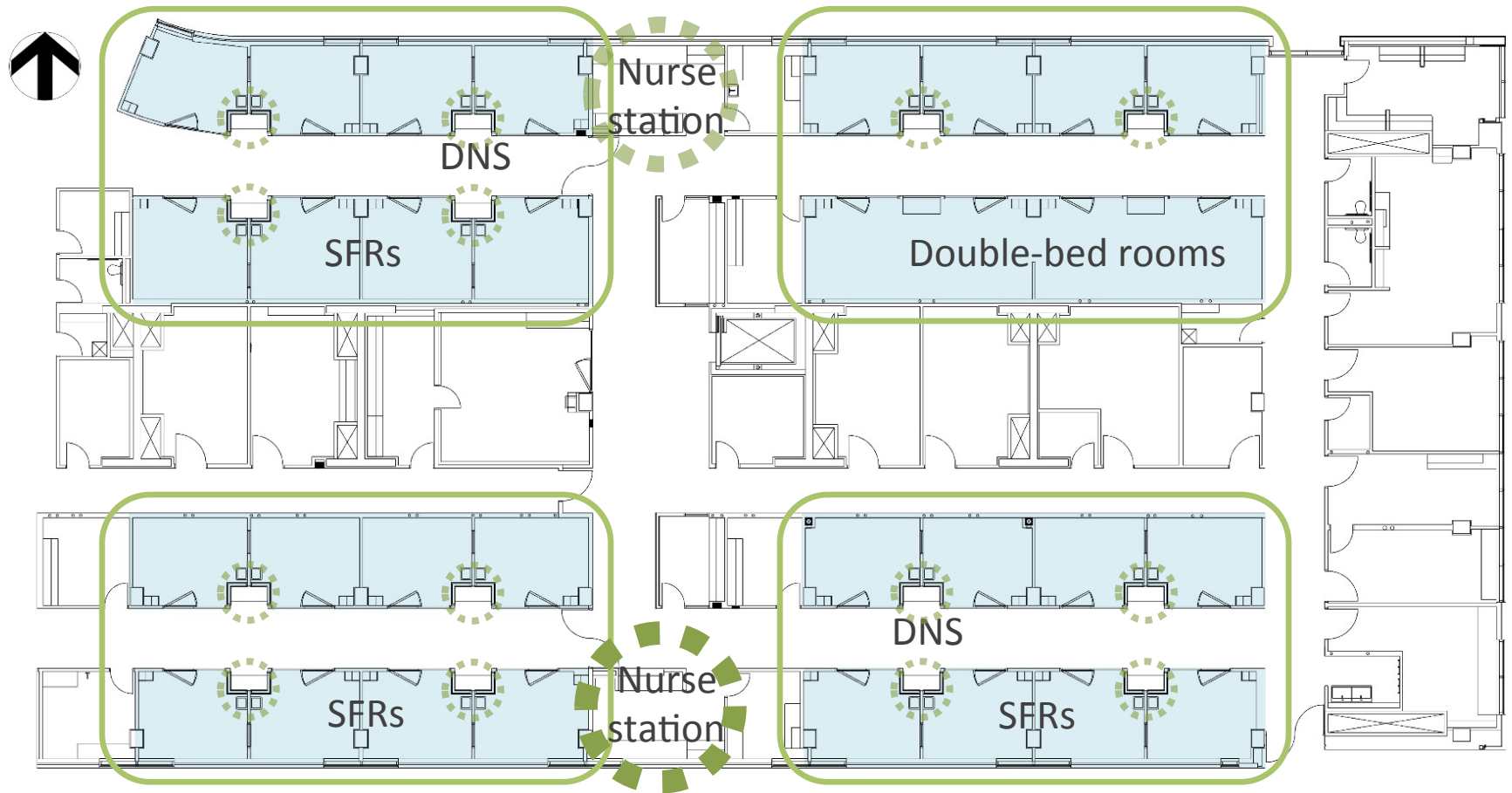
Methodology: Behavioral Observation



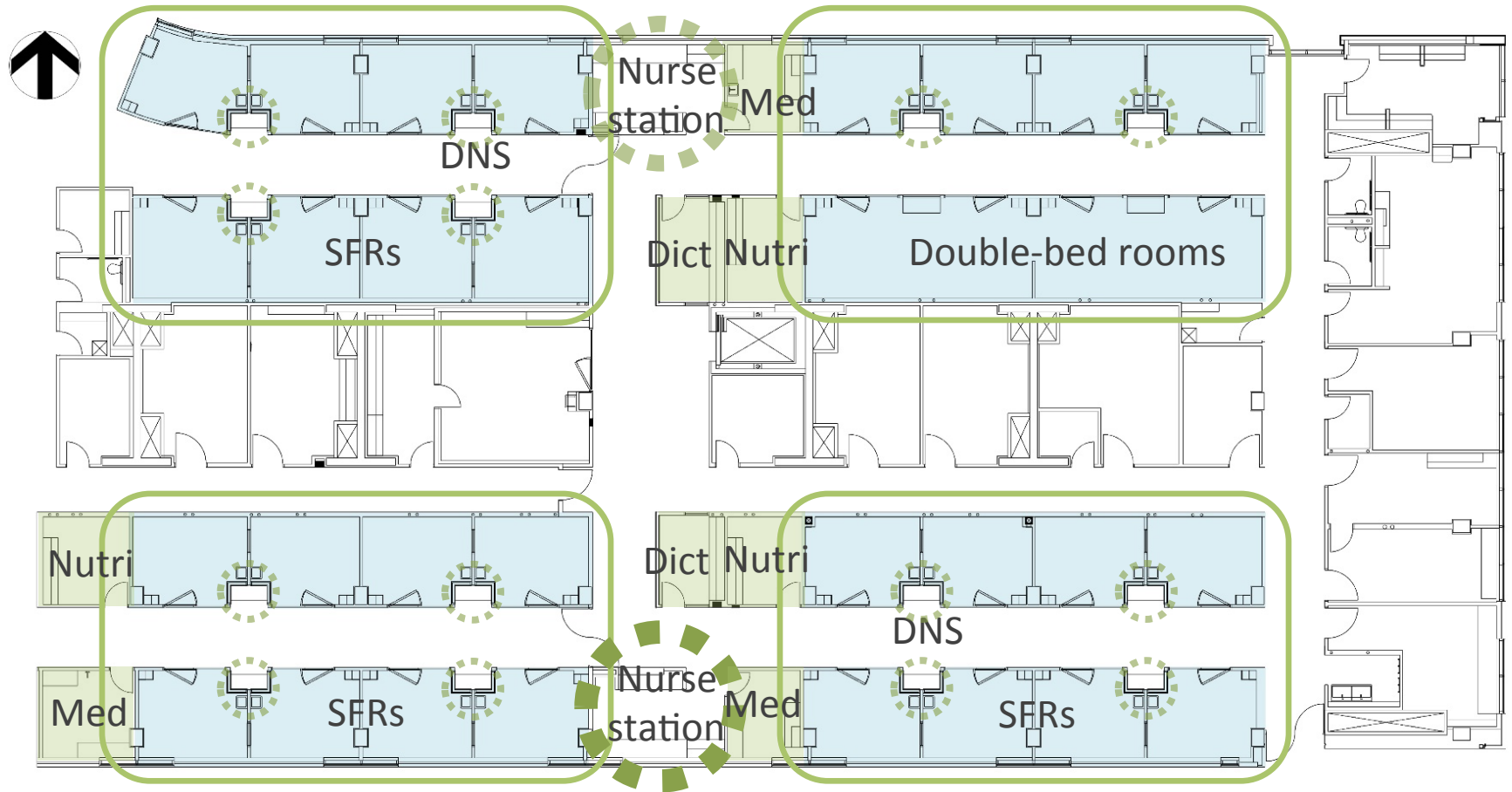
Methodology: Behavioral Observation



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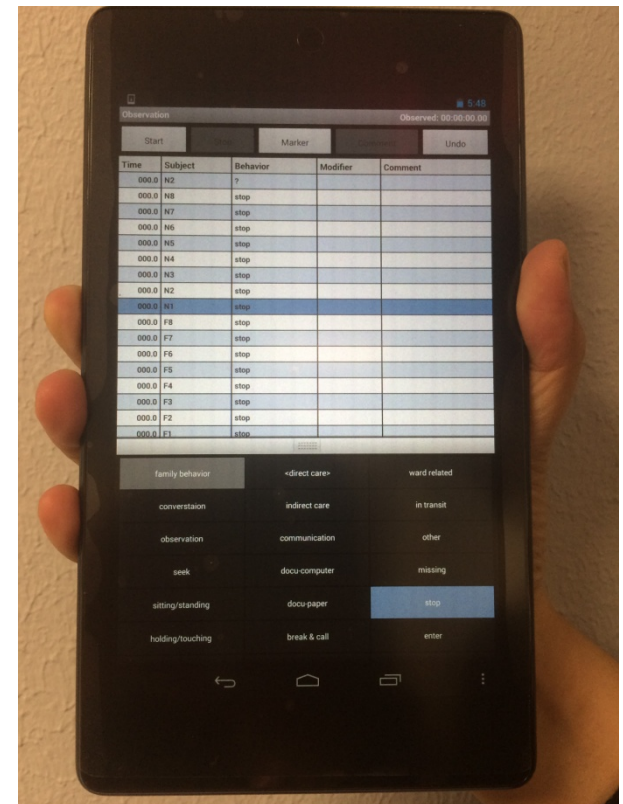
Methodology: Behavioral Observation



Methodology: Behavioral Observation

Equipment

- Noldus software at Nexus 7 tablet
- Nurse behaviors

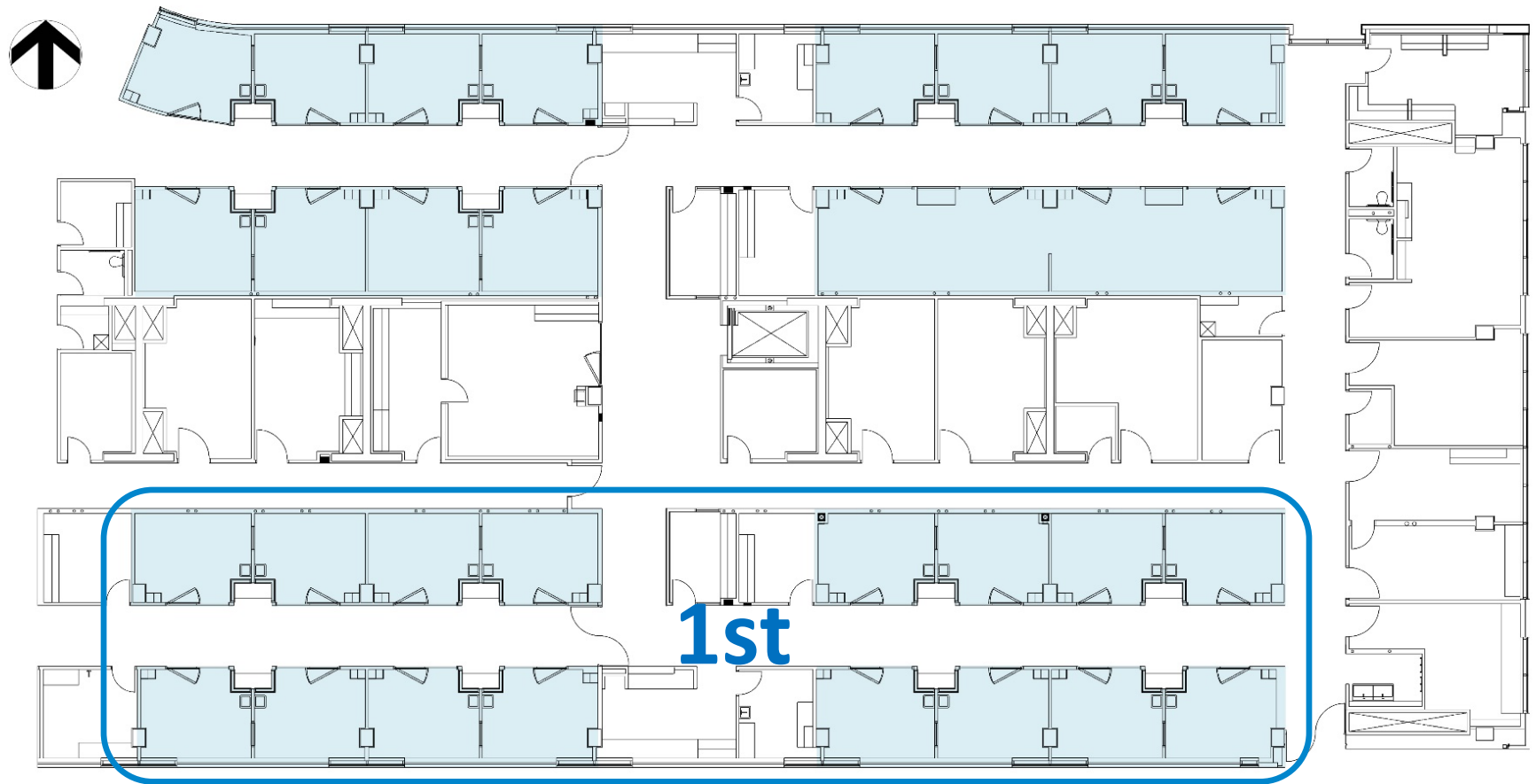


Result

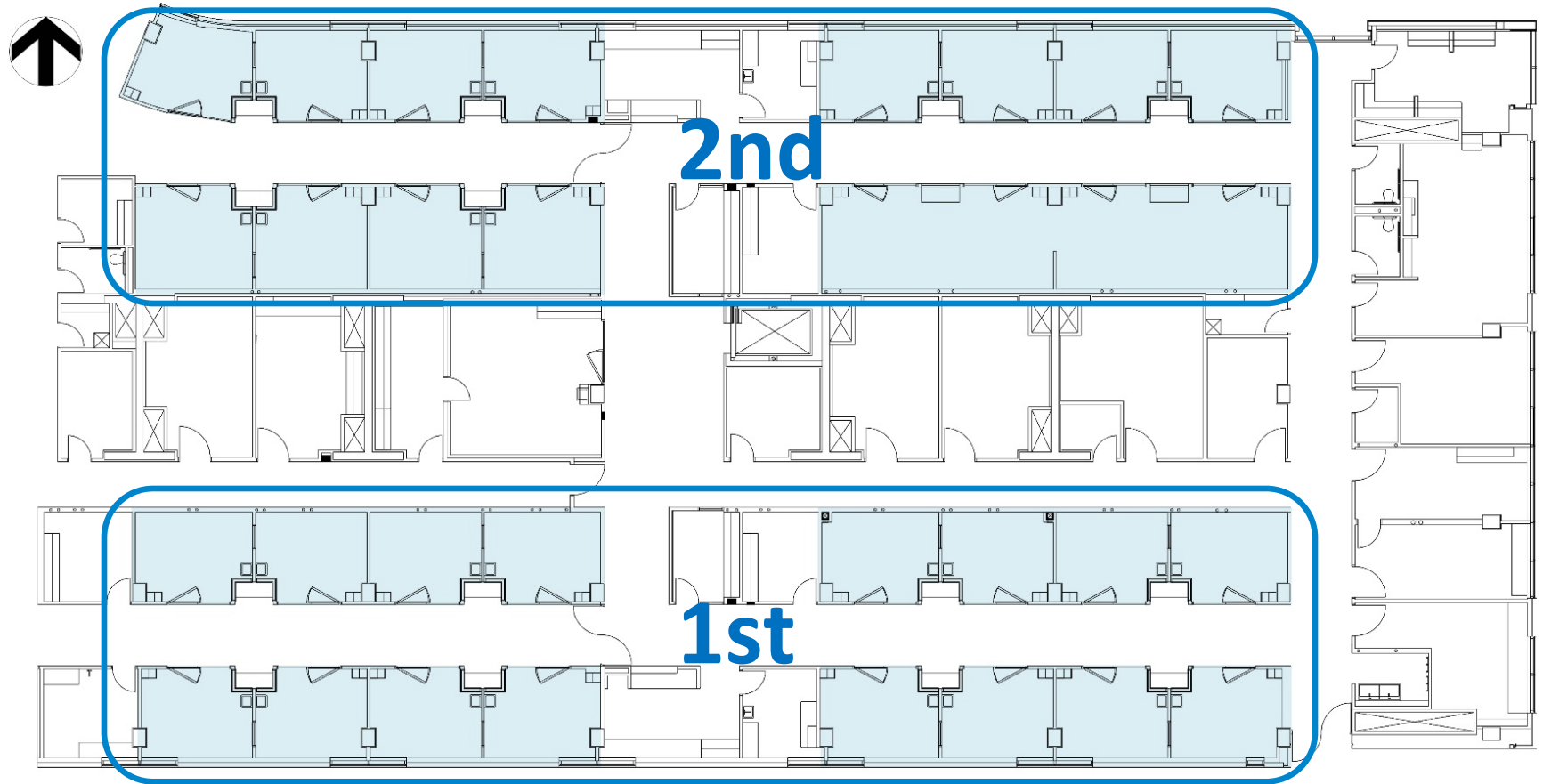


- Between 8am to 6pm over nine days
- 15 out of 25 nurses were observed
- 50.85 hrs behavioral observation (time, location, behavior)
- Lighting levels in the patient rooms and along the corridor

Result: Behavioral Observation



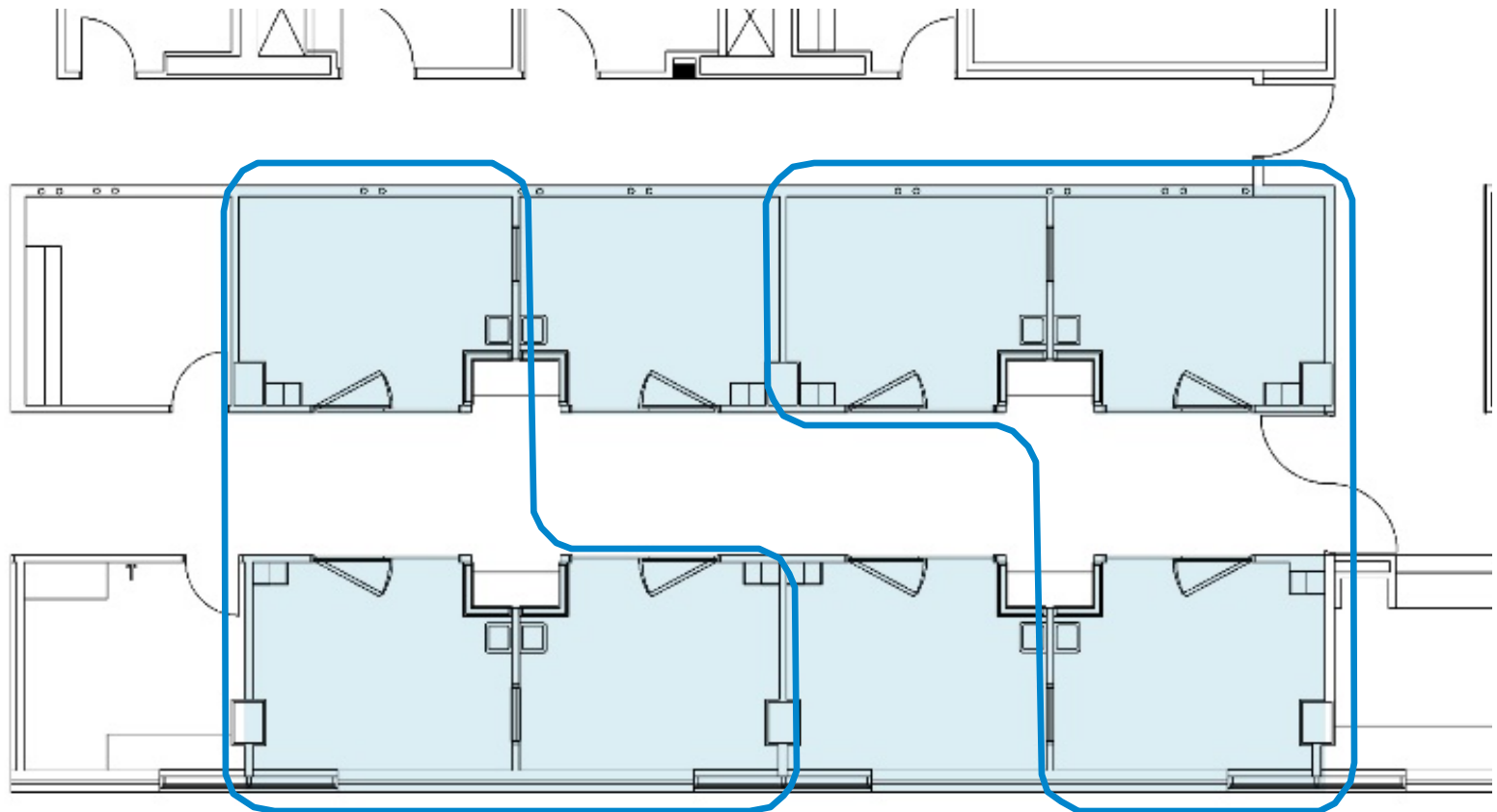
Result: Behavioral Observation



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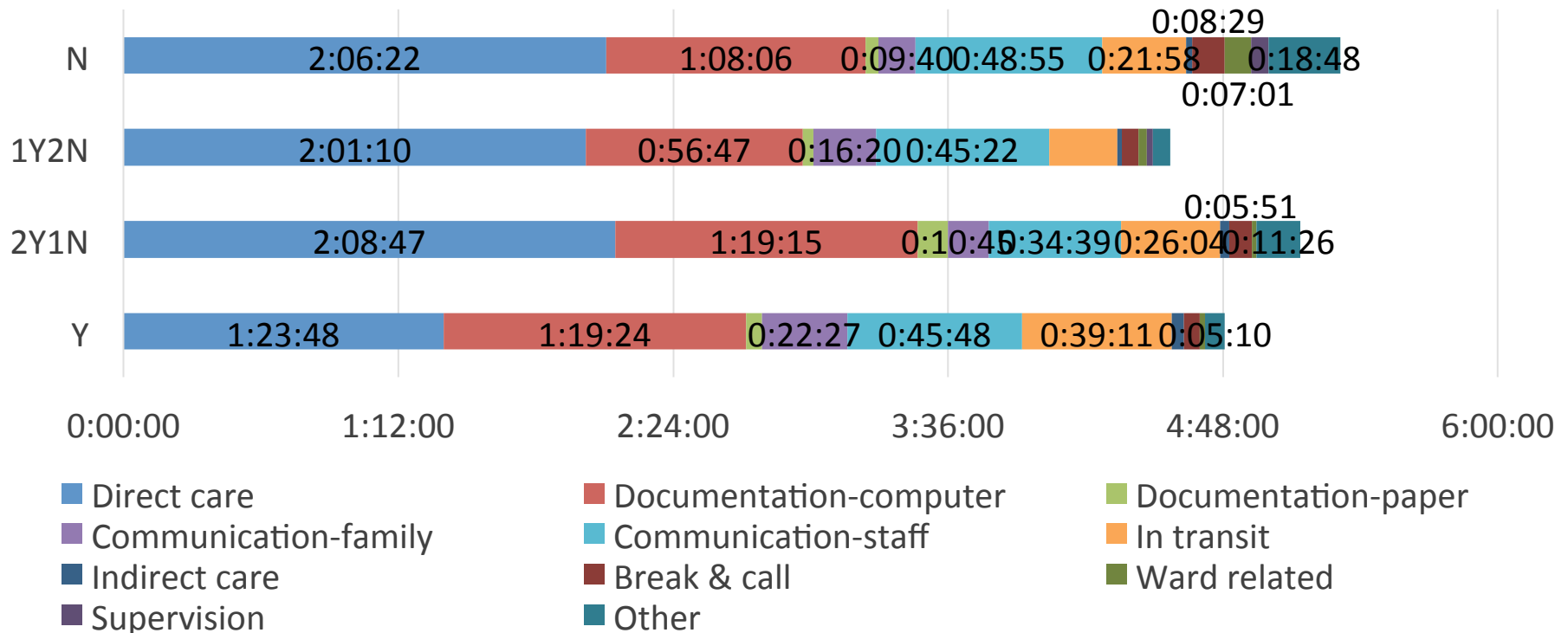
Result: Behavioral Observation



Result:

Behavioral Observation

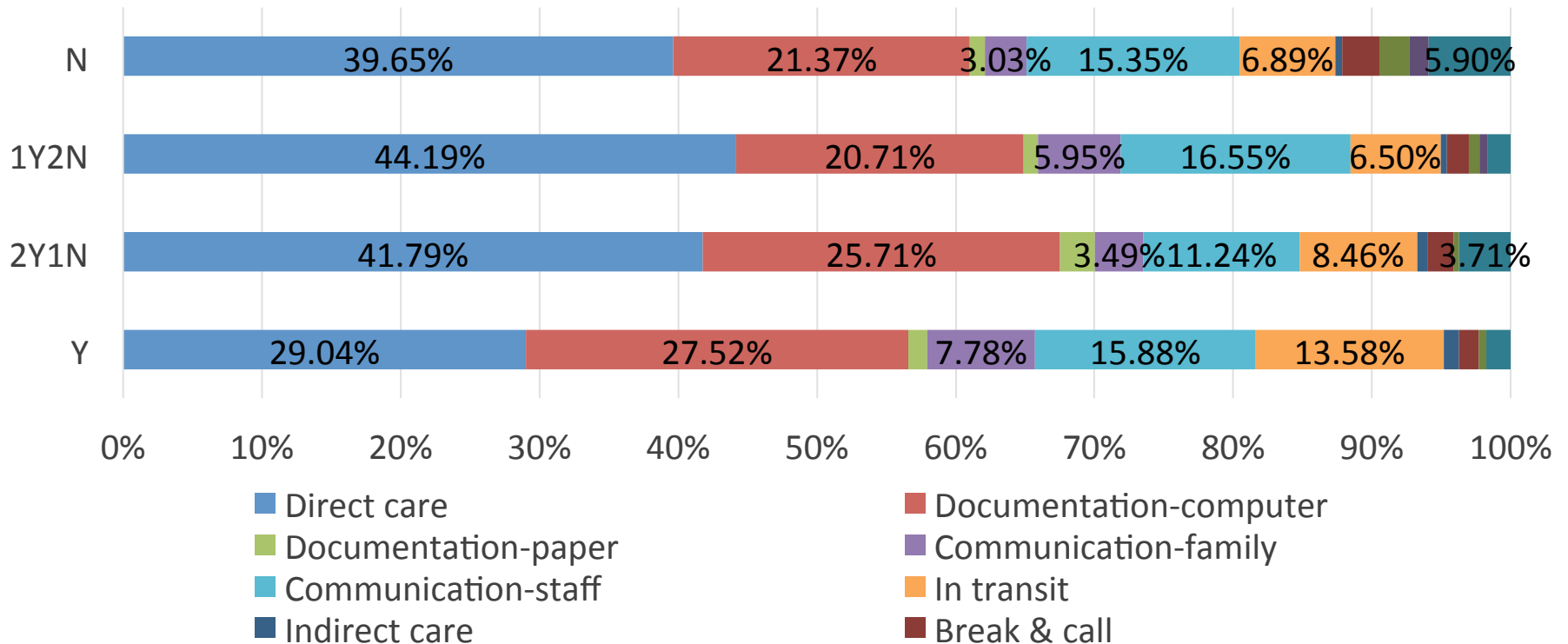
- Comparison of average task time per observation day among nurses assigned to rooms with different lighting conditions (h:mm:ss)



Result:

Behavioral Observation

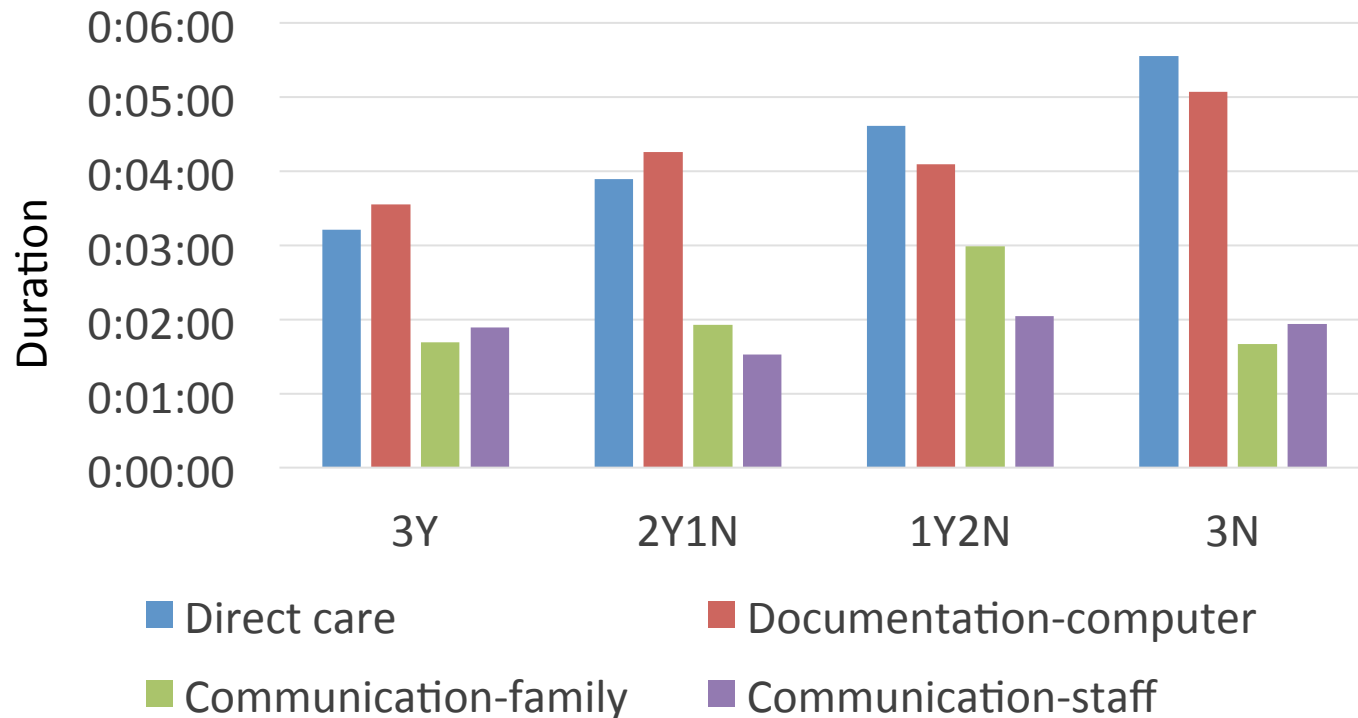
- Comparison of average task time per observation day among nurses assigned to rooms with different lighting conditions (percentage of total time)



Result:

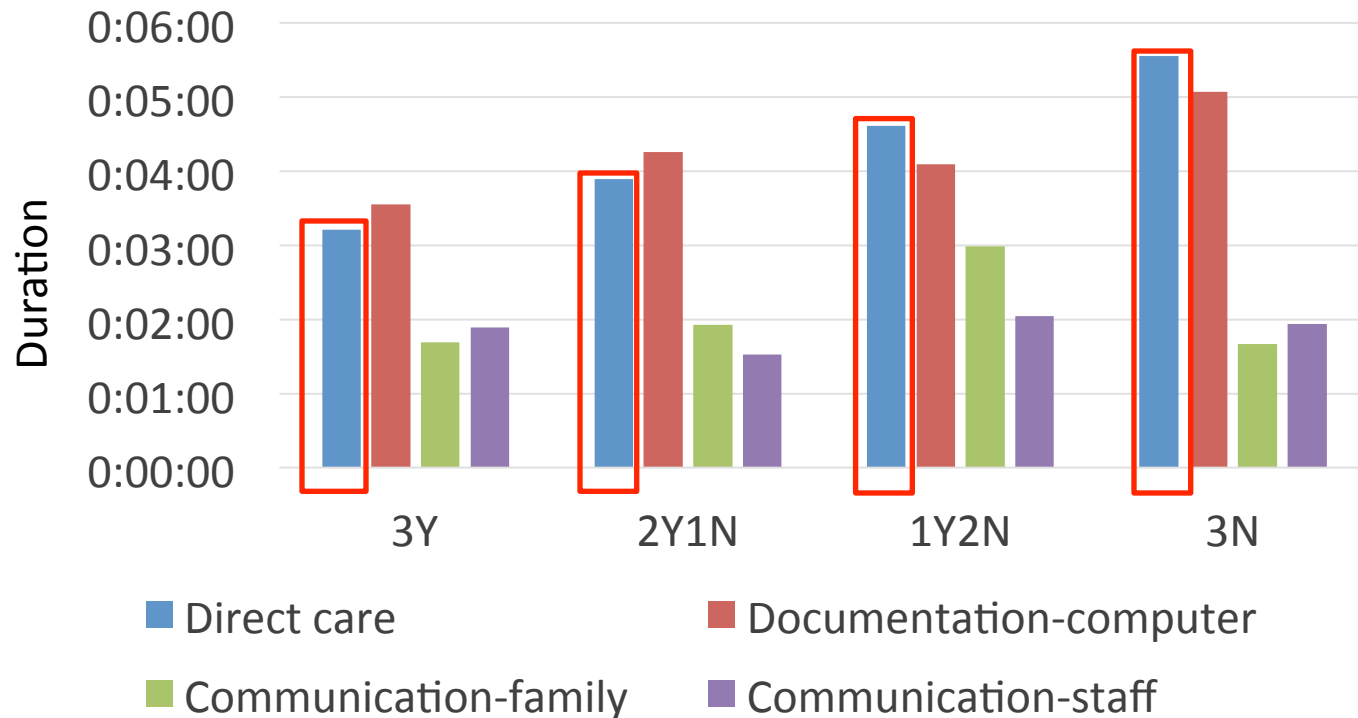
Behavioral Observation

- Average duration of selected behaviors by nurse group (h:mm:ss)



Result: Behavioral Observation

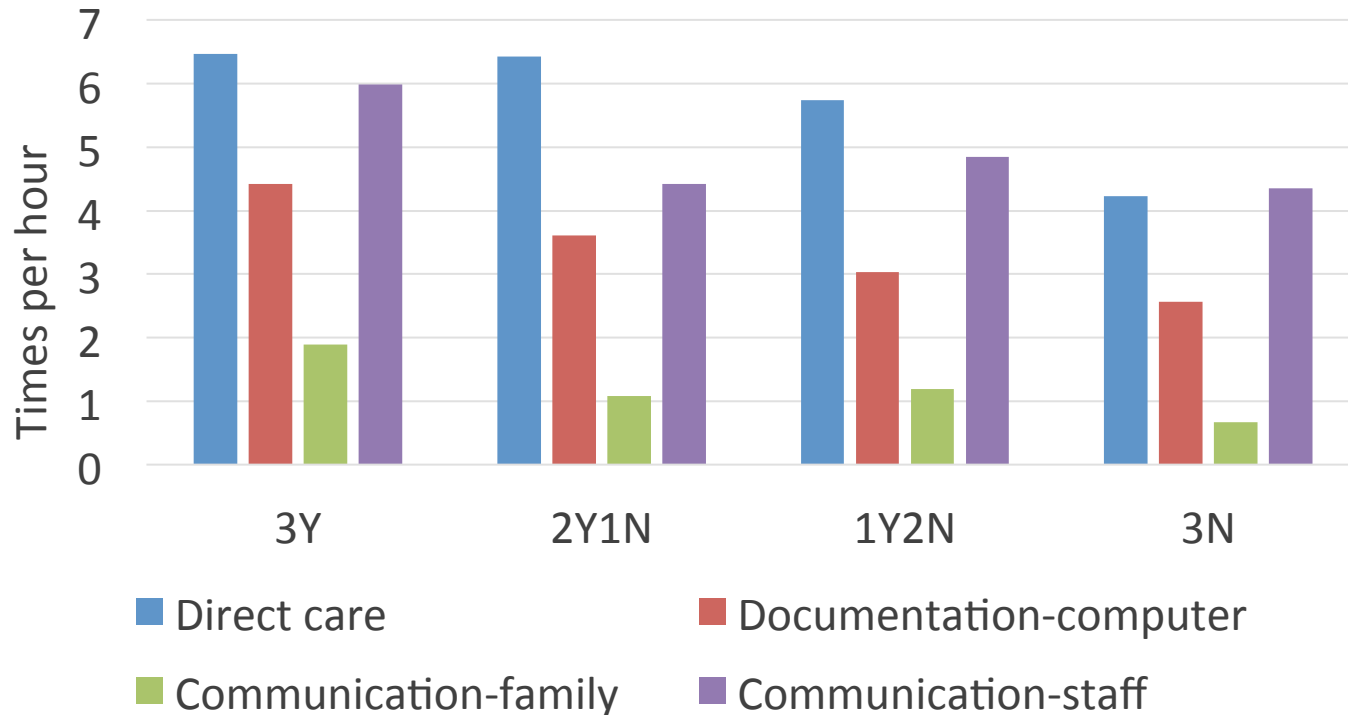
- Average duration of selected behaviors by nurse group (hh:mm:ss)



Result:

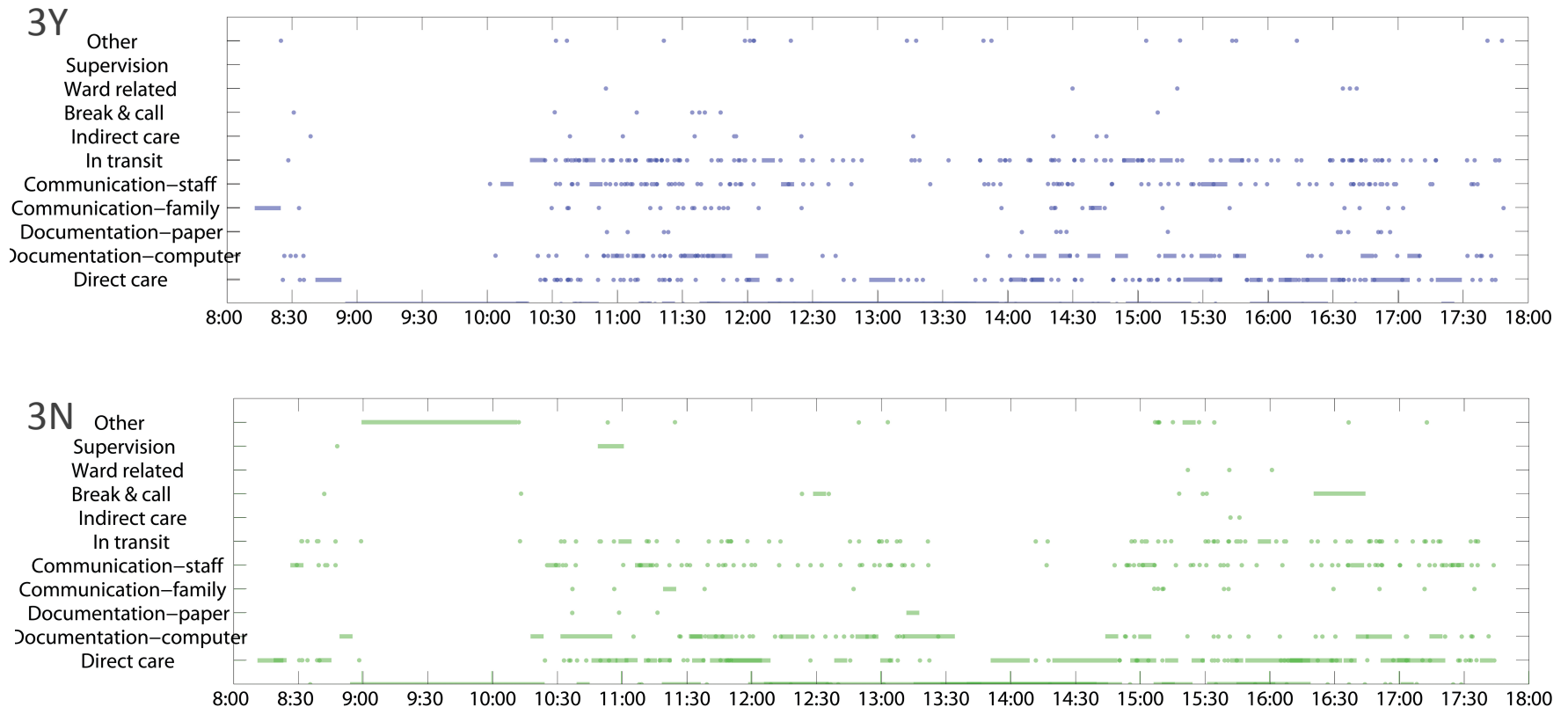
Behavioral Observation

- Average frequency of selected behaviors by nurse group



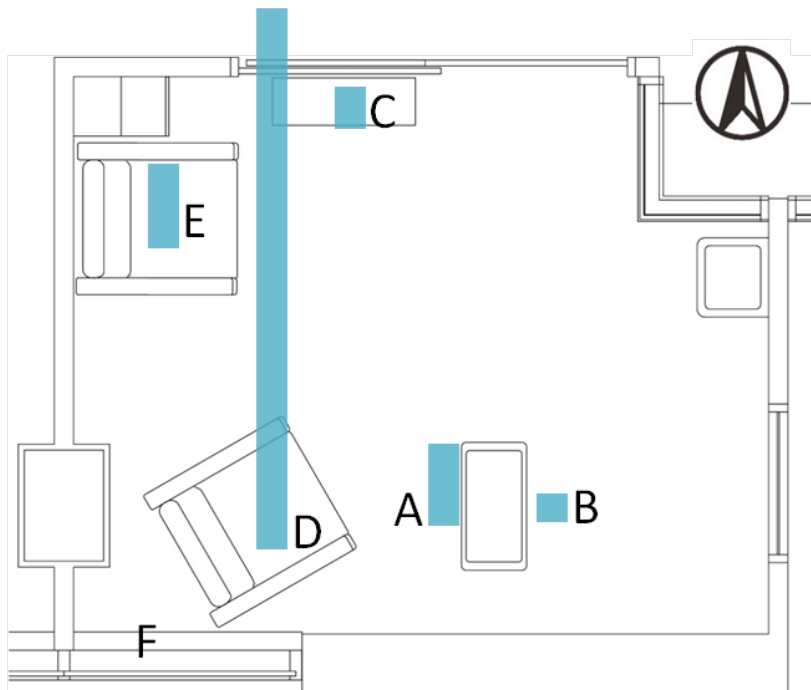
Result: Behavioral Observation

Individual behavioral pattern



Result: Lighting Measurement

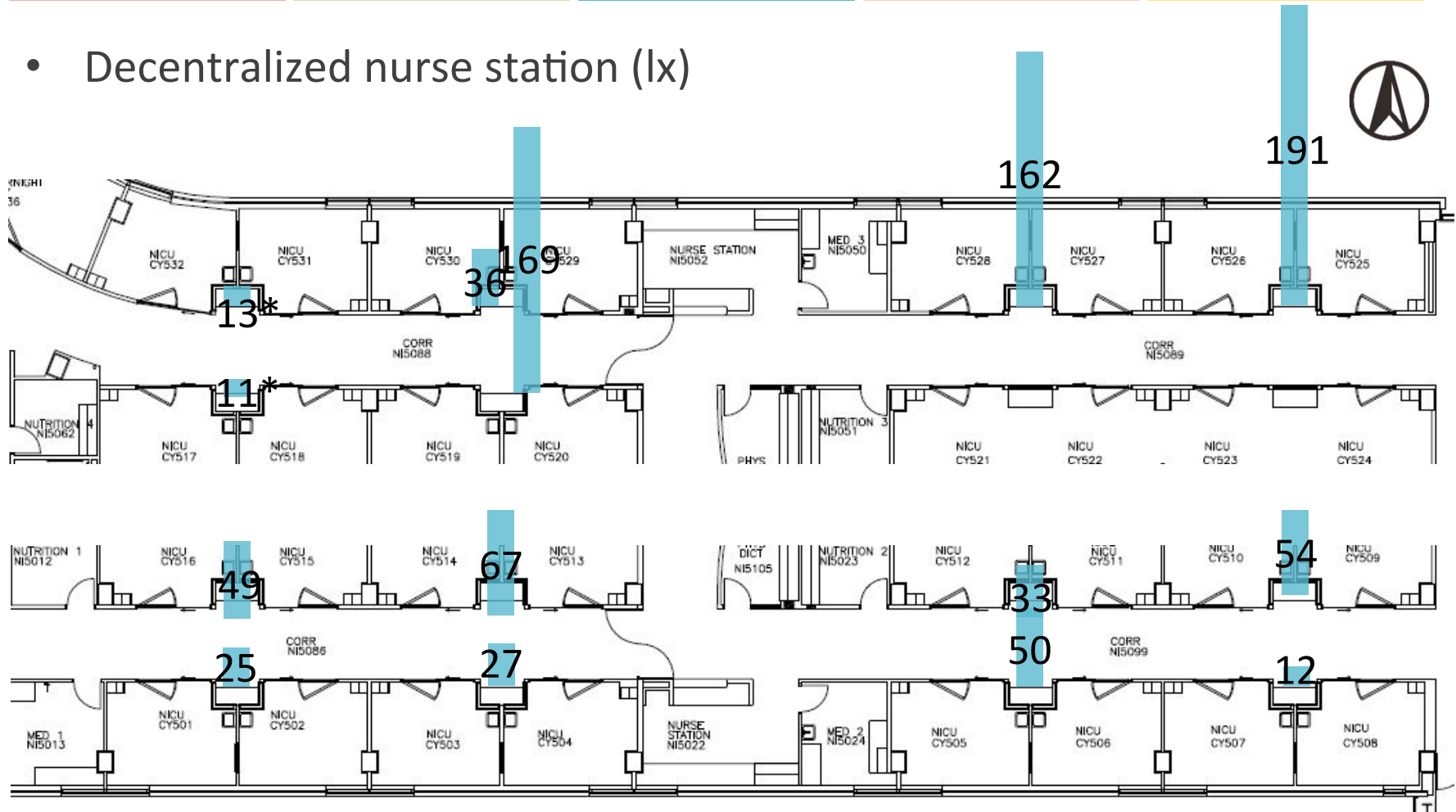
- Patient room (lx)



Time	A	B	C	D	E	F
2:25pm	49	19	33	626	83	4300
3:25pm	40	17	25	78	40	2750
3:30pm	228	75	95	1625	170	6520
4:30pm	82	24	58	487	130	2800
5:50pm	38	13	17	78	24	1020
Average	87	30	46	579	89	3478

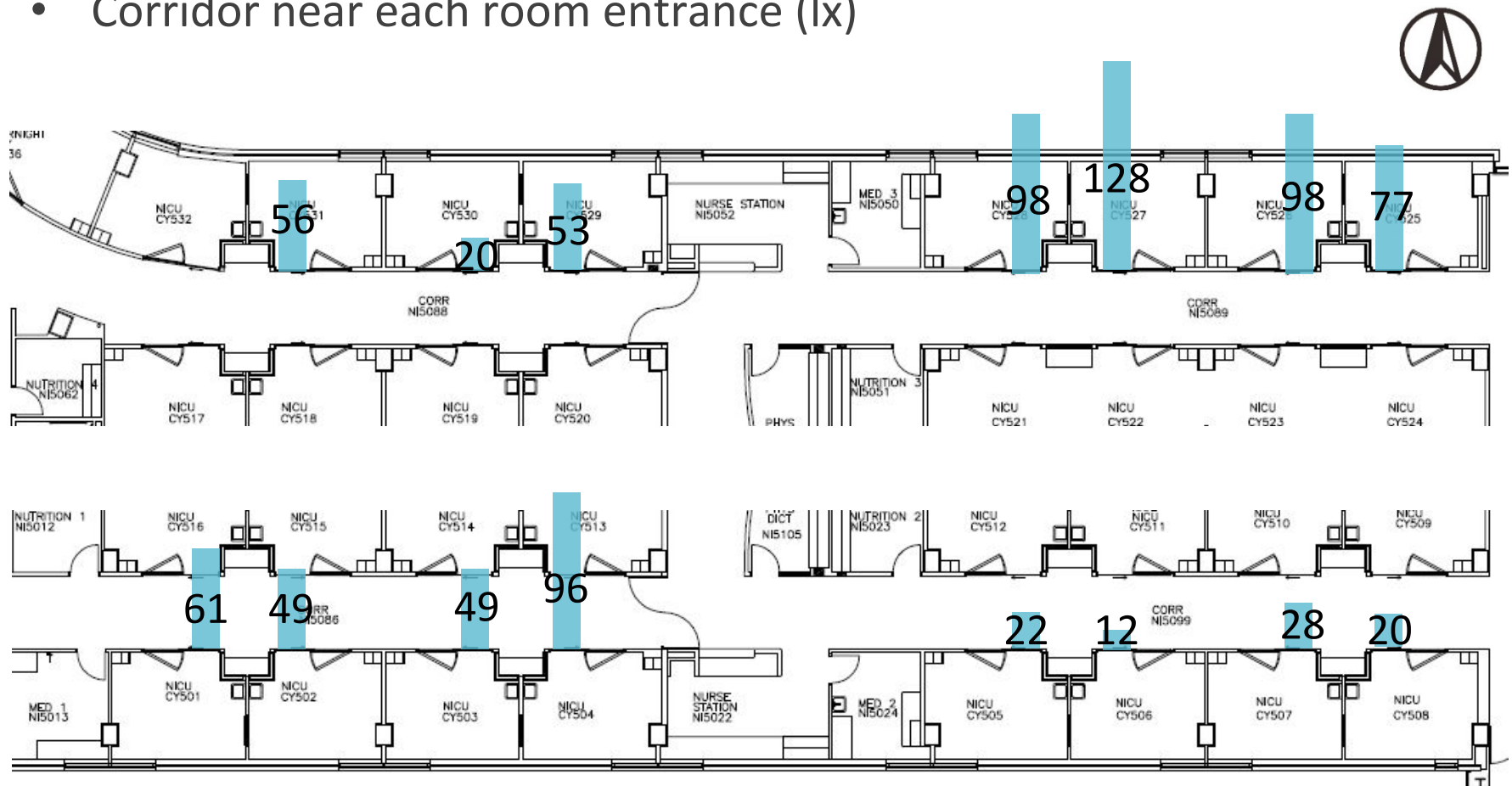
Result: Lighting Measurement

- Decentralized nurse station (lx)



Result: Lighting Measurement

- Corridor near each room entrance (lx)



Discussion



Behavioral pattern

- Direct care
- Documentation on computer
- Communication with staff
- In transit

Discussion

Behavioral pattern

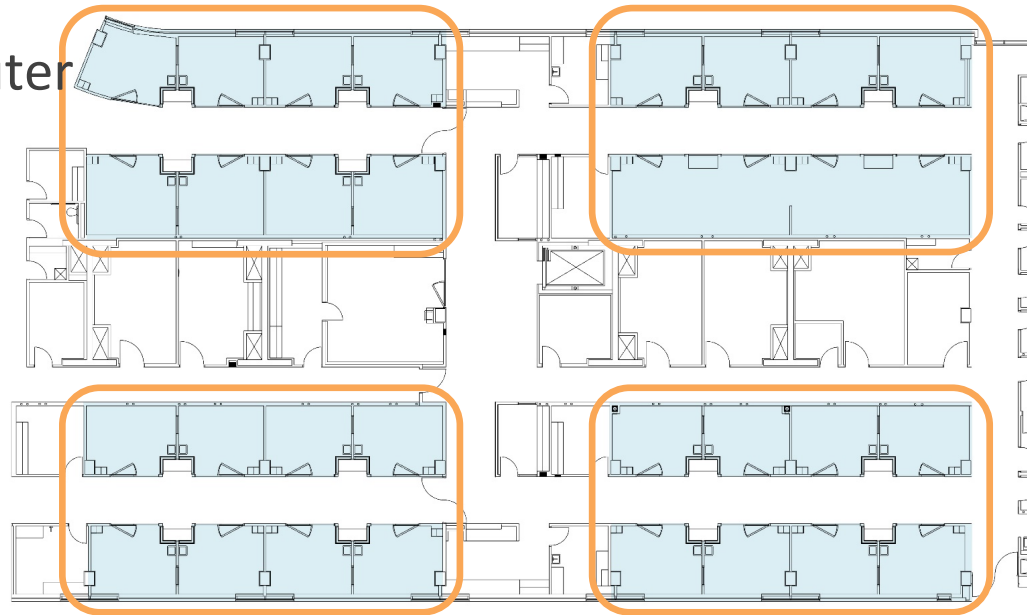
- Direct care
- Documentation on computer
- Communication with staff
- In transit



Discussion

Behavioral pattern

- Direct care
- Documentation on computer
- Communication with staff
Teamwork
- In transit



Discussion



Behavioral pattern

- Direct care
- Documentation on computer
- Communication with staff
- In transit

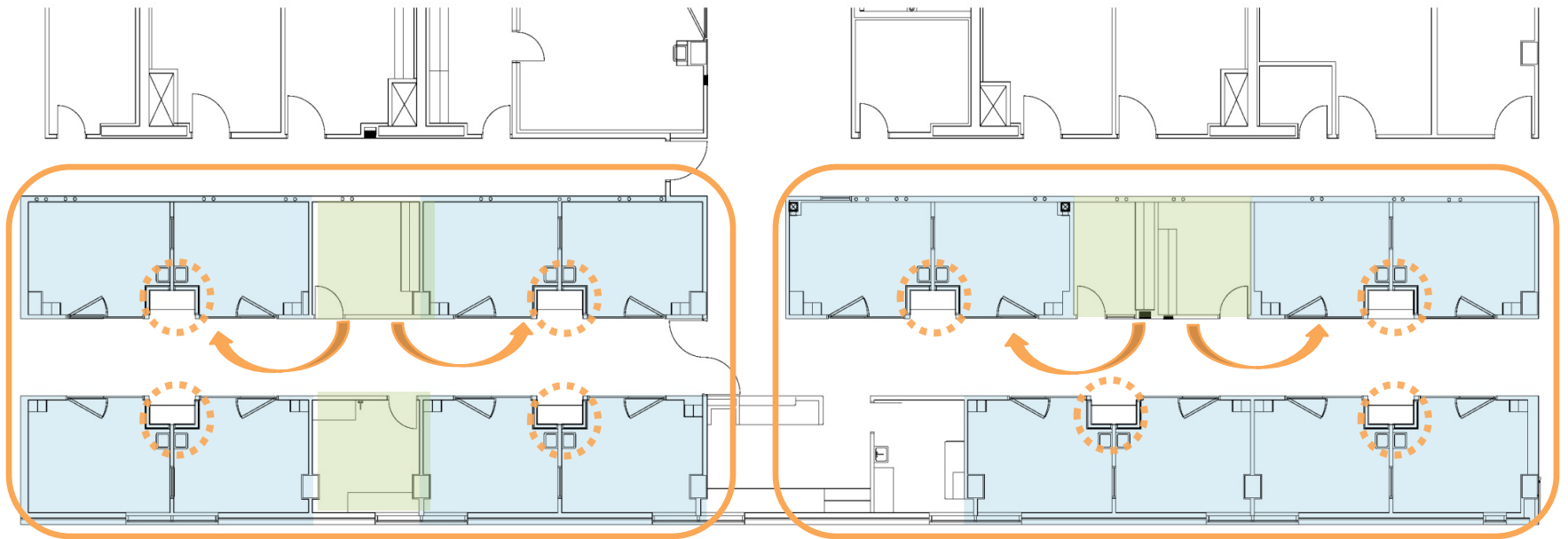
Discussion

NICU department design

- Direct care
- Documentation on computer
 - Decentralized nurse station
- Communication with staff
 - Cluster design
- In transit
 - Functional space

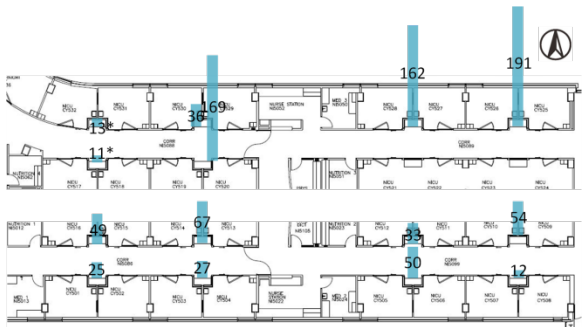
Discussion

NICU department design



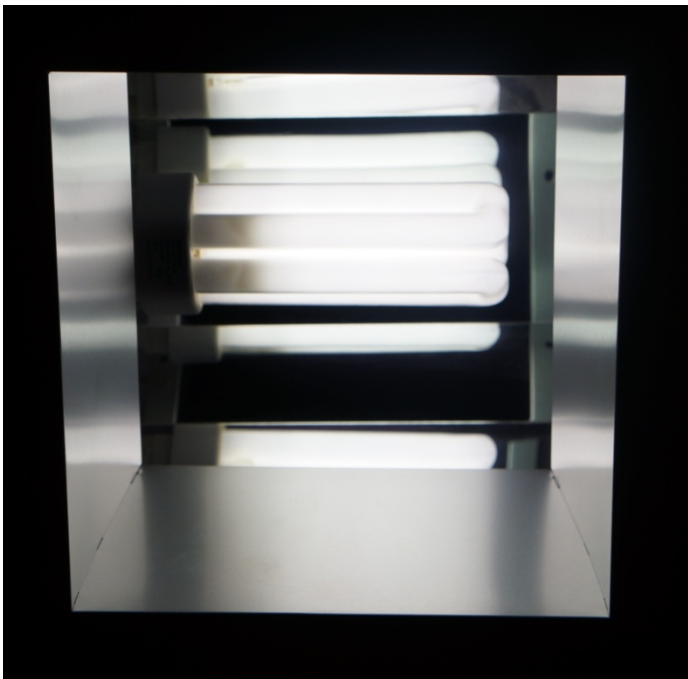
Discussion

Lighting environment design



Discussion

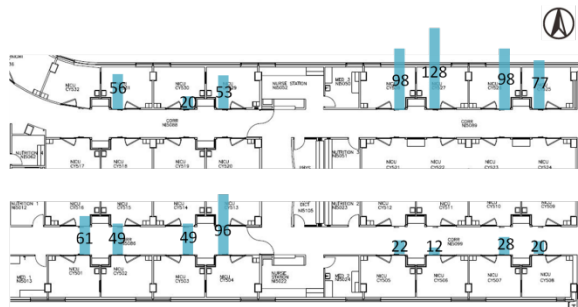
Lighting environment design



Discussion

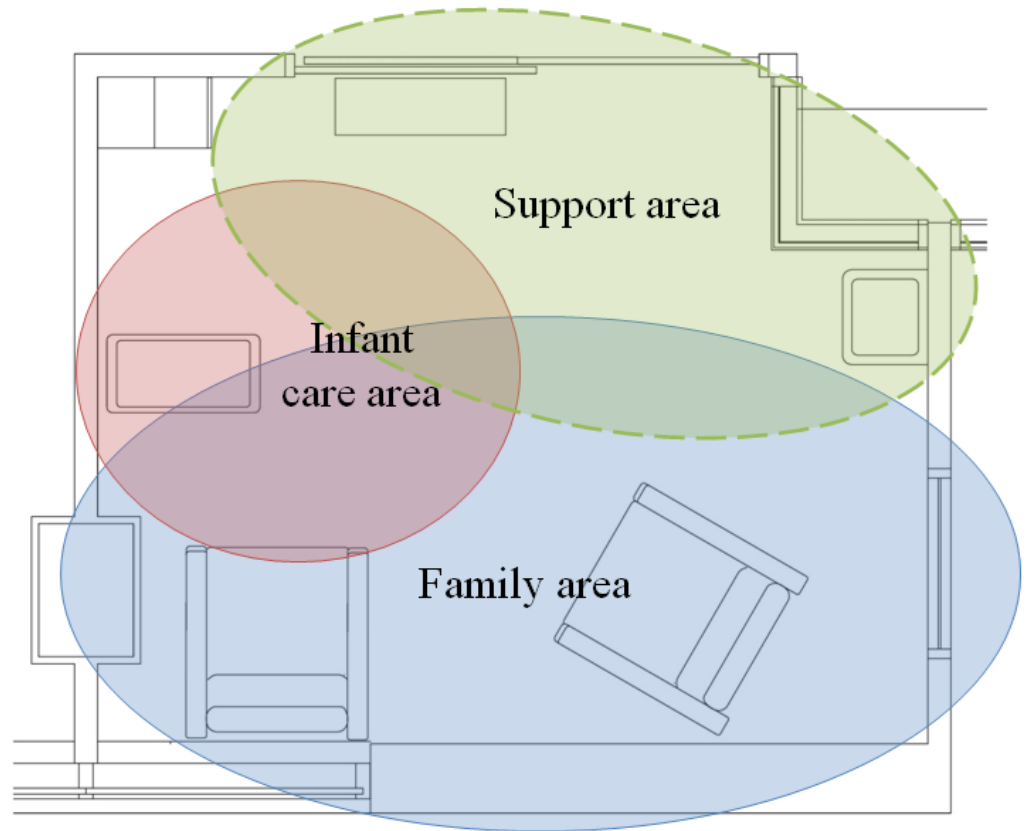
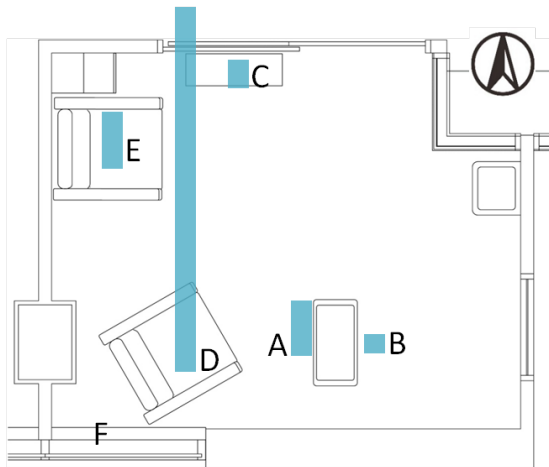
Lighting environment design

- Combine the ceiling plan and floor plan



Discussion

Patient room layout



Conclusion



Limitation

- Limited data
- Non-experimental
- Co-founding factors

Future study

- More behavioral mappings at different sites with longer observation days
- More systematic measurement of physical environment
- Collaboration with hospital
- Expand to envelop other disciplines

Conclusion

Applications to practice

- Provides a **practical example** of an NICU with the insight into the behavior of nurses
- Provide **design suggestions** to optimize NICU physical environment design

Thank you!

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<http://www.choa.org/Childrens-Hospital-Services/Critical-Care/~media/CHOA/Images/Services/Critical-Care/NICU-moon.png>