Impact of Design on Teamwork and Communication
in a Med-Surg Unit

BSA

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Delivered in an Integrated Design Event (IDE) style, this hands-on focused approach utilized full-size mock-ups, allowing for brainstorming ideas and challenging the status quo. This approach empowered users to embrace the design, meaning they were a part of the decision-making process as active participants, not just providing periodic feedback to a design process outside their control.

This Lean approach to design also allowed for testing the seven flows of healthcare. This challenged the existing facility solution, current operational approaches to clinical services, identified operational savings, and potential patient and staff satisfaction opportunities. Patient care spaces were studied in greater detail. Options were considered to increase access to daylight, communication between caregivers and the patient, and improve wayfinding.
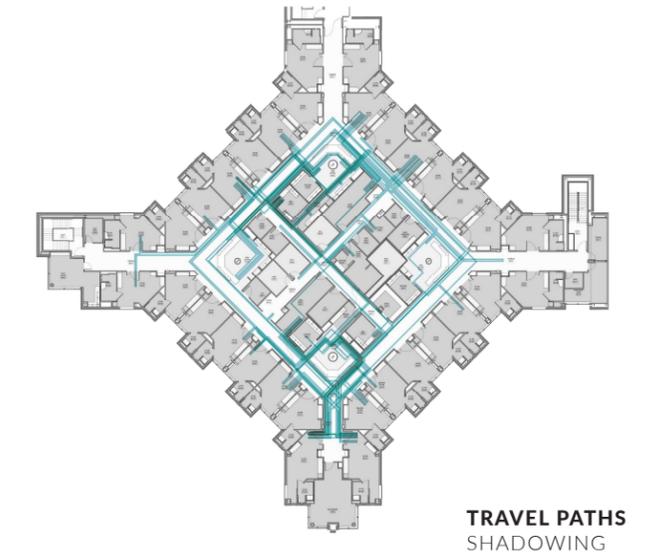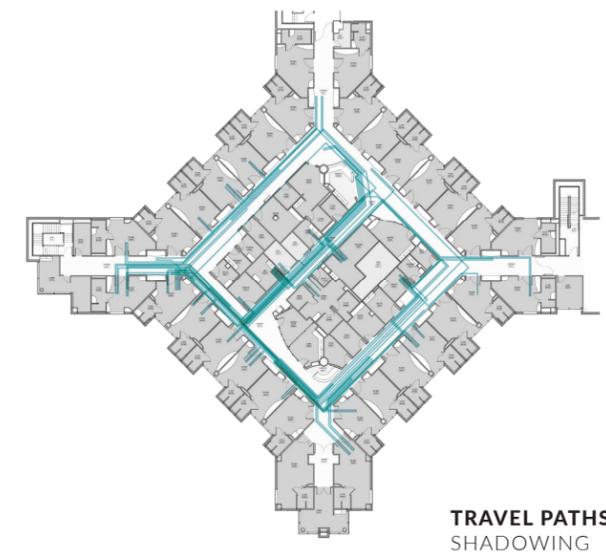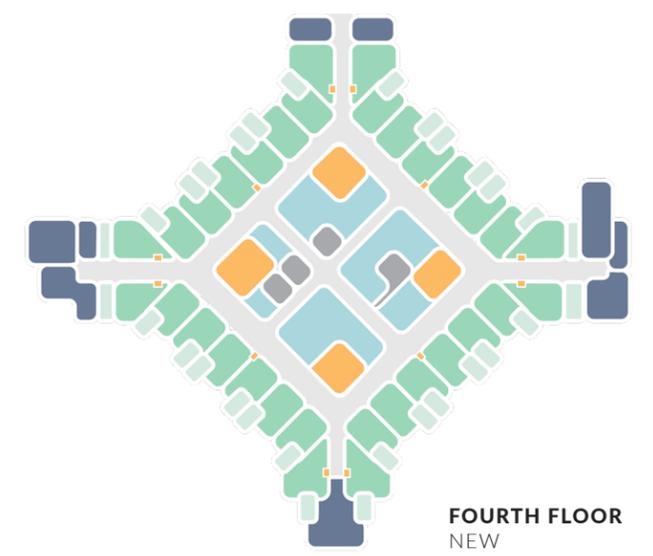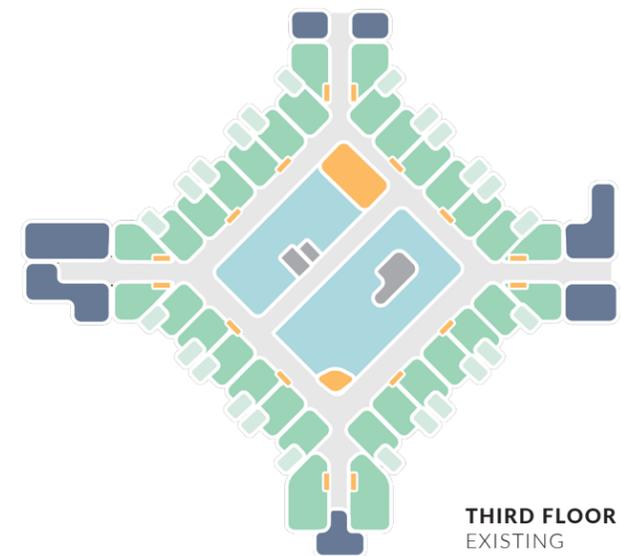
RESEARCH METHODS
survey, observation, shadowing, space syntax

Improving communication and teamwork through design

It's critical to explore the environmental qualities of healthcare facilities supporting effective collaboration and communication for quality of care outcomes. The built environment influences nurses' ability to feel part of a team by inhibiting or supporting ease of communication, visual access, and integration.

This project included the addition of forty-six new patient beds to the hospital. The current inpatient unit layout had two centralized care team stations with decentralized care team stations outside every patient room. During the design process, the staff reported a sense of isolation during shifts and longed for a more visual connection to the team, especially in emergent, critical situations.

We used space syntax to place the care team stations in higher visibility areas, potentially increasing the probability of impromptu conversation and teamwork. The resulting design layout included four large, centralized care team stations. The service corridors were also altered, in a shape of a cross, to improve access from each care team station to clinical support rooms. Post-construction, the designers and researchers developed a research plan to evaluate the initial hypothesis that the new layout enhances collaboration and communication. We employed surveys, systematic observation, and shadowing to understand the nature of communication and collaboration patterns in the context of the physical environment.

METHODS SUMMARY & RESEARCH QUESTIONS

37 BEHAVIOR OBSERVATION
ROUNDS

44 SHADOWING
SESSIONS

42 SURVEY
RESPONSES

- Do floor levels differ in terms of durations and counts of interactions?

- What predicts higher satisfaction for team collaboration or communication?

- Will units have different satisfaction levels for team communication, collaboration, patient visibility, or team visibility?

THIRD FLOOR
EXISTING

FOURTH FLOOR
NEW

TRAVEL PATHS
SHADOWING

TRAVEL PATHS
SHADOWING

- CARE TEAM STATIONS
- CLINICAL SUPPORT AREAS
- MED/SURG PATIENT ROOMS
- EGRESS & MISC.
- INFRASTRUCTURE
- CIRCULATION
- NURSE TRAVEL PATHS FROM SHADOWING SESSIONS (*OVERLAID*)

LESS USE ⟷ MORE USE

TOP LEFT | *Existing floor plan. The unit has mainly decentralized care team stations (CTS) with two centralized CTS. There is one service corridor for accessing clinical support rooms.*

TOP RIGHT | *New floor plan. The service corridor is shaped like a cross to increase access for the four centralized CTS. Corridors are wider for more visibility.*

We documented face-to-face communication and technology interaction duration while following the clinicians. These diagrams show the walking pattern of shadowed nurses across different time intervals. The shadowing finding showed that the floor plans did not differ in terms of durations and counts of interactions.

Space syntax allows researchers to rely on **objective concepts**. The analytical procedure of the method is **straightforward, accurate, & replicable.**

Space Syntax

WHAT
Space syntax is a method for quantifying the environment as a set of predictive variables for certain occupant behaviors.

WHY
We apply this method to evaluate the degree of spatial openness, wayfinding, depth, connectivity, or visibility.

HOW
The Depthmap software provides a spatial elements map, connects them with relationships, and executes a graph analysis of the resulting work.

GOAL / OUTCOME
The goal is to derive variables that impact social or experiential differences. Designers can integrate or remove prominent physical attributes that may impose the use of facilities in the pre-construction phase, saving time and cost.

> *Bill Hillier and Julienne Hanson developed the Space Syntax theory in 1984 to evaluate how the layout properties, such as visibility or connectedness to other spaces, influence social behavior or communication patterns.*
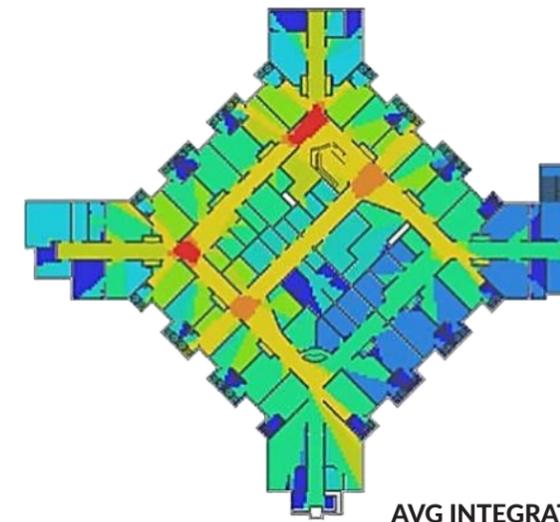

AVG INTEGRATION: 2.5
(LOWER IS BETTER)
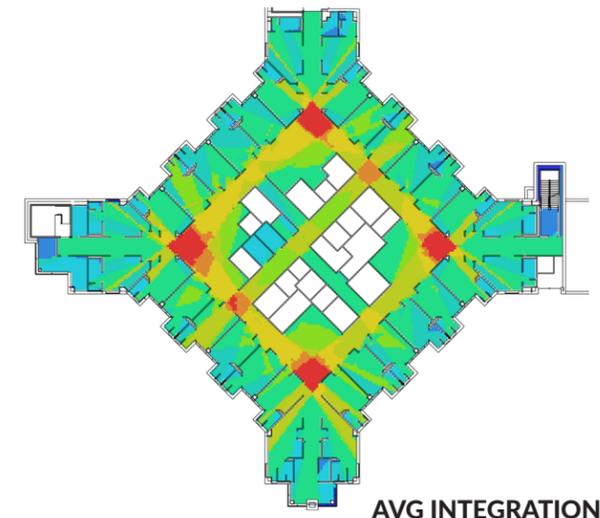
AVG INTEGRATION: 2.3
(LOWER IS BETTER)

**OPEN CORNERS SPACE SYNTAX ANALYSIS:** LEVEL 3 (L) & LEVEL 4 (R)

During the project's design development (DD) phase, the staff commented on a sense of isolation and a need for improved team visibility. The space syntax analysis of the current state (Left Figure) demonstrates that the bottom corners of the central layout lack visual connectivity to patient rooms and openness for team collaboration projects. Therefore, the future state layout (Right Figure) comprised more open and wider corridors at the corners of pathway intersections. The hypothesis was that this layout would improve engagement, team collaboration, and communication.
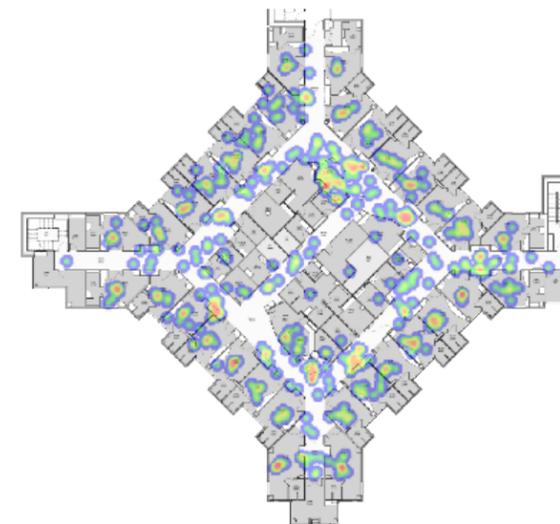
BEHAVIOR HEAT MAPS: LEVEL 3 (L) & LEVEL 4 (R)

The red areas represent where people mainly gathered. Most accumulation occurred at the level 4 top north care team station, which was noted as a highly visible area in the space syntax calculations.
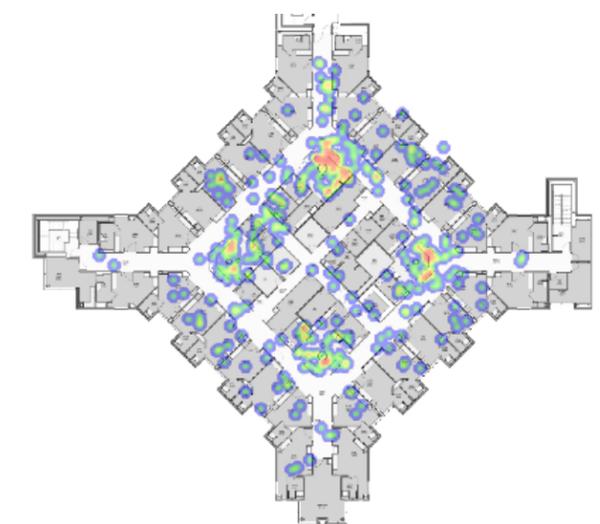
Survey responses aligned with this finding, where nurses mentioned that primary communication happens in these two care team stations.
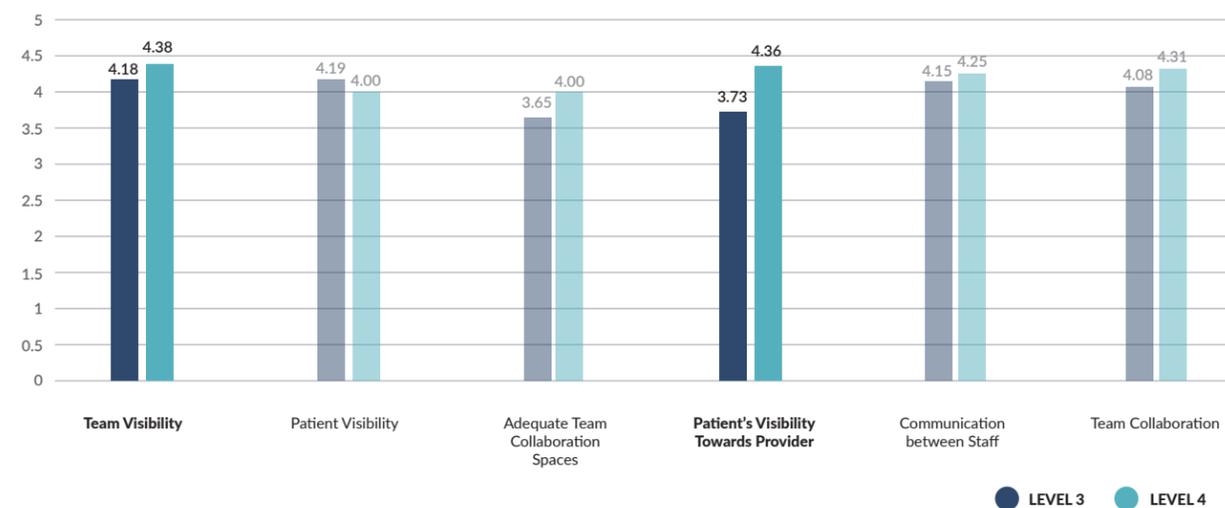
Surveys

A survey is a **method of gathering information** from a sample of individuals to gather critical insights. Online surveys are less costly, can reach new audiences, are more accurate, and are faster than traditional paper-based surveys.

(Definition source: Qualtrics).

> Statistical analysis did not show significant mean differences across units for communication, team visibility, patient visibility, or team communication. However, level 4 had a marginally higher satisfaction level for team visibility, communication, collaboration, and the number of collaboration spaces.
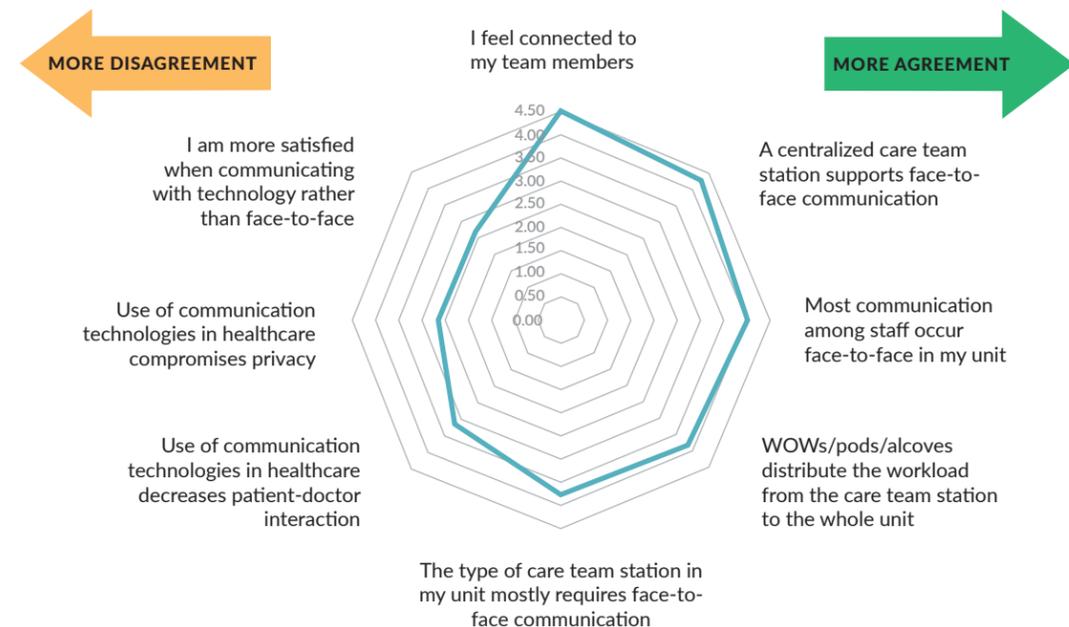
AVERAGE SATISFACTION LEVELS
ACROSS FLOOR PLANS

Bar chart data (LEVEL 3, LEVEL 4):
- Team Visibility: 4.18, 4.38
- Patient Visibility: 4.19, 4.00
- Adequate Team Collaboration Spaces: 3.65, 4.00
- Patient's Visibility Towards Provider: 3.73, 4.36
- Communication between Staff: 4.15, 4.25
- Team Collaboration: 4.08, 4.31

● LEVEL 3   ● LEVEL 4

COMBINED AVERAGE AGREEMENT LEVELS
WITH COMMUNICATION TECHNOLOGIES

Overall, we collected 42 responses from clinicians in both units. The diagram below explains the clinicians' level of agreement with different statements targeted toward communication and communication technologies. Consistent with our hypothesis, findings showed higher perceptions of team collaboration and observed interactions at the higher integrated locations. Nurses reported more satisfaction with team visibility and the number of collaborative spaces in the new unit. Most respondents felt connected with team members and believed that a centralized care team station supports face-to-face communication.

Clinicians preferred face-to-face communication rather than technology-based communication. Participants noted that technology-based communication reduced patient privacy and patient-doctor interaction. Nevertheless, nurses working in decentralized care team stations relied on technology mediums for collaboration and communication objectives. To improve team collaboration, an adequately sized department, acoustic levels, and frequent face-to-face communication were essential. Further, team visibility was the only predictor of positive staff communication.

MORE DISAGREEMENT   MORE AGREEMENT

Radar chart statements:
- I feel connected to my team members
- A centralized care team station supports face-to-face communication
- Most communication among staff occur face-to-face in my unit
- WOWs/pods/alcoves distribute the workload from the care team station to the whole unit
- The type of care team station in my unit mostly requires face-to-face communication
- Use of communication technologies in healthcare decreases patient-doctor interaction
- Use of communication technologies in healthcare compromises privacy
- I am more satisfied when communicating with technology rather than face-to-face
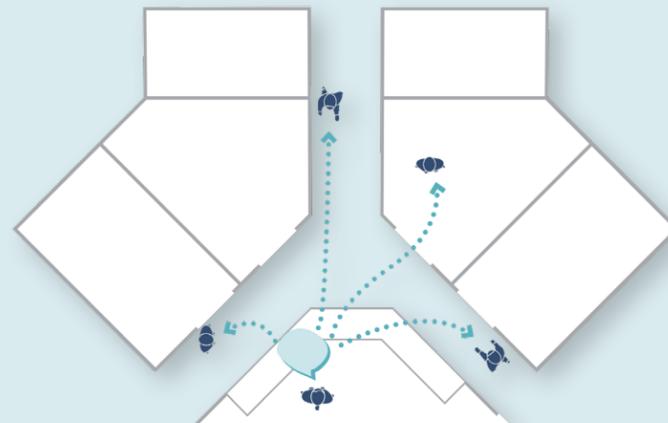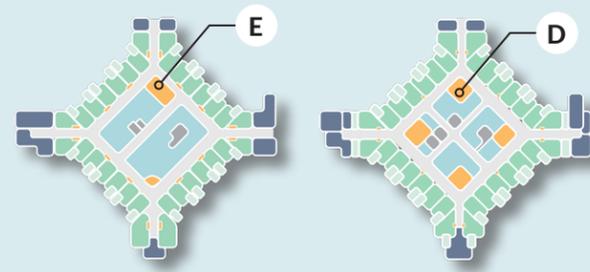
Conclusions & Design Recommendations

COMMUNICATION & COLLABORATION

There were more instances of communication and crowding in higher visibility areas. As expected, care team stations E and D had the most instances of staff cluster and perceived communication.

Increasing team visibility can improve team communication through highly integrated floor plan design or centralized team stations. Right-size departments also support face-to-face communication for staff collaboration.

v Decentralized care team stations supported staff collaboration. Many staff believed that WOWs, pods, and alcoves distribute the workload from the care team station to the whole unit.

Centralized care team stations improve the sense of unity and teamwork among staff.

E   D

TEAM VISIBILITY

CORRECTLY SIZED DEPARTMENTS

CENTRALIZED CARE TEAM STATIONS

SHIFT CHANGE LOCATION

EFFECTIVE COMMUNICATION TECHNOLOGIES
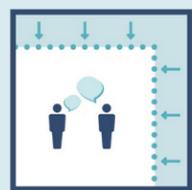
ACOUSTICS & MATERIALITY

^ NOISE

During the shift change hours, there are higher durations of communication that may impact noise levels. There is a need to identify design strategies for reducing noise levels while maintaining the cleanability of surfaces.

Provide a dedicated location for shift change and use cleanable materials/ adequate storage to reduce visual clutter.

< TECHNOLOGY

Although providing centralized care team stations improves face-to-face communication, staff at level 3 used other technologies and tools for collaboration purposes.

Face-to-face communication in team stations may not be essential for effective staff collaboration when effective communication technologies exist.
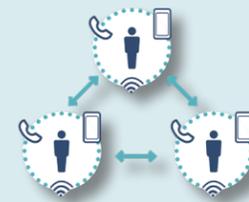
Indiana University Health is private, nonprofit organization and Indiana's largest comprehensive health system comprised of hospitals, physicians, and allied services dedicated to providing preeminent, patient-centered care. A unique partnership with Indiana University School of Medicine—one of the nation's leading medical schools—gives IU Health's highly skilled physicians access to innovative treatments using the latest research and technology.

Six underutilized pediatric beds at IU Health West Hospital were converted to a six-bed, 23-hour observation unit to be staffed and run by the emergency department. The licensed beds can flex to inpatient beds as needed, adding to the hospital's overall inpatient capacity. In the end, this vertical expansion finishes out two existing shell spaces as surgical suites and adds a total of 46 patient beds in a uniquely flexible configuration.

The team also leveraged a unique factor at the facility: When the hospital was built, its rooms were designed to be acuity-adaptable instead of having a dedicated ICU. With the vertical expansion, the hospital now has a permanent ICU. Still, all of its beds will retain the capacity to convert to ICU beds if needed, giving the hospital additional beds and virtually unlimited space for ICU patients.

In total, the vertical expansion is 105,000 square feet, and the renovation of about 28,000 square feet in the existing facility, an expansion and redesign that will prepare the facility for the next wave of community growth, no matter how rapidly it might come.

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