Steps to Create the Optimal Nursing Unit

Using simulation to develop a consensus on the ideal nursing unit

**SUMMARY**

Investigators at Ascension Health and Kaiser Permanente led a multisite study designed to explore how nurses use their time and whether the design of their workplace has an impact on patient care.

The investigators then convened a "summit" conference of nurses, researchers, and other experts in the field to discuss their findings and issue a series of "principles" to guide design decisions in creating optimal nursing units.

**Key Findings**

The investigators reported their findings in an article published in The *Permanente Journal* (12[3], 2008; available online).

- Nurses devote 19.3 percent of nursing practice time to patient care activities.
- Most of nursing practice time is taken up by documentation (35.3%), medication administration (17.2%), and care coordination (20.6%).
- Nurses spend 38.6 percent of their time at the nursing station and 30.8 percent in the patient room.
- Nurses walk between 2.4 and 3.4 miles per 10-hour daytime shift—a level of physical activity the project team said is among the most strenuous of any industry.
- No consistent, statistically significant relationship was found between various unit designs and nursing time spent with patients.
Key Recommendations

Summit conference participants made a number of recommendations in the conference report: Time & Motion: Transforming the Hospital Patient Care Environment. A Proclamation for Change. In order to transform the hospital-patient care environment and improve the delivery of safe, high-quality, patient-centered care, participants agreed on the need for:

- **Patient-centered design.** Hospital and technology design should be organized around patient needs—helping patients and their families feel engaged in the caregiving process rather than removed from it—and be tailored to address unique factors and diverse patient populations.

- **System-wide, integrated technology.** Architects and technology vendors should work closely with nurses, physicians and personnel in other caregiving departments (i.e., those in pharmacy, lab, housekeeping and admitting departments) in all aspects of designing workspace and technologies in order to ensure a system-wide approach to meeting patient needs.

- **Seamless workplace environments.** To consistently provide the highest quality care to patients, the physical design of medical-surgical units should be completely integrated with caregiver work processes and the technologies they use, so caregivers always have the right medication, materials and information, in the right place, at the right time.

- **Vendor partnerships.** The design and operation of technology devices should be intuitive and error free and part of interoperable systems—so that health care providers can access information in hospital or outpatient settings—and not waste time serving as human bridges that link multiple technology devices in different locations.

Funding

The Robert Wood Johnson Foundation (RWJF) supported the study and conference with two grants totaling $699,000 from February 2005 through April 2007.

THE PROBLEM

Studies show that the more time nurses devote to patient care the better the patient outcomes, according to a 2007 analysis commissioned by the U.S. Agency for Healthcare Research and Quality, Nurse Staffing and Quality of Patient Care, available online.

Research also suggests that a number of variables in the hospital environment may contribute to better patient outcomes, according to a report by the Center for Health Design, The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity, available online.
However, there had not been a comprehensive study measuring the relationship between nursing activity and these work environment variables, according to the lead investigators.

**CONTEXT**

RWJF has funded an array of projects and programs related to environmental health design, including:

- *Transforming Care at the Bedside*, a national program to create, test and spread prototype hospital nursing unit-level strategies to improve the work environment and quality of care. For more information, see Program Results Report.
- Developing tools and products to facilitate the adoption of evidence-based hospital design to enhance the work environment of nurses (The Center for Health Design, ID# 055450).
- Developing a graduate-level interdisciplinary curriculum for creating safe and effective health care environments (Emory University, ID# 058385).

**THE PROJECT**

Investigators at Ascension Health and Kaiser Permanente led a multisite study designed to explore how nurses use their time and whether the design of their workplace has an impact on patient care.

Researchers at 36 different hospitals in 15 states used wireless monitors and personal digital assistants (PDAs) to track the movements of 767 nurses over a one-week period on each study unit. (See Appendix 1 for a list of study sites.)

The team accumulated 21,955 hours of data spanning a total of 2,201 work shifts. That represents "the largest environmental multi-site time and motion study reported in the literature," according to the lead investigators.

**Activities**

The investigators:

- Randomly selected 14 medical-surgical units (seven from Ascension Health and seven from Kaiser Permanente) to be part of a startup study. This pilot phase allowed the project team to test and refine the study methodology and data-gathering technology and analysis.
- Added an additional 23 sites, drawn from 16 various health systems (including additional sites from Kaiser), to the study, broadening its scope and geographic diversity. (One site eventually dropped out.)
• Analyzed their data and developed a preliminary set of findings (see Findings).

• Convened a "summit" conference, in January and February of 2007, of some 250 nurses, vendor partners, architects, physicians, and innovation and facilitation experts. Participants reviewed the preliminary findings of the study team and developed recommendations, including a "proclamation for change" to guide the design of nursing units. (See Recommendations.)

**Methodology**

In order to document the nurses' activities and movements:

• Participating nurses were randomly assigned to use either a PDA to record the time they spent on documentation or a PDA to record their location and activity at random times.

• Nurses also wore electronic "tracking tags" allowing investigators to measure the distance nurses traveled in relation to the physical layout of the nursing unit and the amount of time they spent in each location.

• Some nurses also wore electronic armbands that measured body temperature and other physiologic responses, allowing the researchers to estimate how much energy they expended.

The data were sent electronically (encrypted) to Purdue University each day. Researchers at Purdue University assisted in:

• Developing project methodology, model construction and data integrity, reliability and analysis.

• Managing the relationship among engineering, statistical and computer science data gathering and analysis.

For more detail on the methodology, see Appendix 2.

**Challenges**

• The large amount of data being gathered required the development of analysis methodologies that had not been anticipated. This delayed the analysis, as did problems with the tracking system design.

• The complexity of the study presented new challenges in data processing and analysis.

• That same complexity had consequences for the nurses, who needed to continue their jobs without interference from the demands of study participation.
The cost of travel, lodging and equipment was higher than expected and the complexity of installing and operating the wireless tracking network was also underestimated.

**Communications**

The investigators:

- Reported preliminary findings from the study at the April 2006 annual American Organization of Nurse Executives (AONE) convention, with more than 300 nursing leaders in attendance.
- Shared their findings with participating hospitals in a webcast, conducted on December 13, 2005.
- Published their findings in the *Permanente Journal* (12[3], 2008).

**Other Funding**

The Betty and Gordon Moore Foundation provided $176,875 to support the project. In addition 15 participating hospitals from phase II of the project contributed $10,000 each.

**FINDINGS**

The investigators' findings reported in the *Permanente Journal* include:

- Nurses devote 19.3 percent of nursing practice time to patient care activities.
- Most of nursing practice time is taken up by documentation (35.3%), medication administration (17.2%) and care coordination (20.6%).
- Nurses spend 38.6 percent of their time at the nursing station and 30.8 percent in the patient room.
- Nurses walk between 2.4 and 3.4 miles per 10-hour daytime shift—a level of physical activity the project team said is among the most strenuous of any industry.
- There was no consistent, statistically significant relationship between unit design and time spent with patients. One likely explanation from the investigators is that nurses' ability to organize their work and staffing assignments has greater impact than physical space by itself, the investigators say.
- There was considerable inconsistency in the results from site to site and shift to shift, suggesting that variables such as the location of supply and medication distribution points can affect nursing workload.
Recommendations

Summit conference participants made a number of recommendations in the conference report: *Time & Motion: Transforming the Hospital Patient Care Environment. A Proclamation for Change* (unpublished). In order to transform the hospital-patient care environment and improve the delivery of safe, high-quality, patient-centered care, participants agreed on the need for:

- **Patient-centered design.** Hospital and technology design should be organized around patient needs—helping patients and their families feel engaged in the caregiving process rather than removed from it—and be tailored to address unique factors and diverse patient populations.

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- **Seamless workplace environments.** To consistently provide the highest quality care to patients, the physical design of medical-surgical units should be completely integrated with caregiver work processes and the technologies they use, so caregivers always have the right medication, materials and information, in the right place, at the right time.

- **Vendor partnerships.** The design and operation of technology devices should be intuitive, error free, and part of interoperable systems—so that health care providers can access information in hospital or outpatient settings—and not waste time serving as human bridges that link multiple technology devices in different locations.

LESSONS LEARNED

1. **Be realistic when estimating the time needed to process complex data.** Underestimating the need for new methodologies to interpret the time-and-motion data gathered in the hospitals delayed findings from this research project. (Project Director/Hendrich)

2. **Understand that a change in one part of the methodology impacts other study components.** For example, increasing the number of participants and their locations required additional confidentiality and reliability safeguards as well as more frequent communications between facility contacts and the research project manager. (Project Director/Hendrich)

3. **Anticipate the needs of all funders and participants.** Since the study required each study site to obtain Institutional Review Board (IRB) approval, the start of the study was delayed. (Project Director/Hendrich)
AFTERWARD

The project staff is working with a marketing firm to disseminate the recommendations generated during this project.

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## APPENDIX 1

### Medical-Surgical Units Participating in the Study

(Current as of the end date of the program; provided by the program’s management; not verified by RWJF.)

<table>
<thead>
<tr>
<th>Medical-Surgical Unit</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascension Health–Brackenridge Hospital</td>
<td>Austin, Texas</td>
</tr>
<tr>
<td>Ascension Health–St. John Hospital and Medical Center</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>Ascension Health–Borgess Medical Center</td>
<td>Kalamazoo, Mich.</td>
</tr>
<tr>
<td>Ascension Health–Columbia St. Mary’s</td>
<td>Milwaukee, Wis.</td>
</tr>
<tr>
<td>Ascension Health–St. Vincent’s Medical Center</td>
<td>Jacksonville, Fla.</td>
</tr>
<tr>
<td>Ascension Health–St. Vincent’s Birmingham</td>
<td>Birmingham, Ala.</td>
</tr>
<tr>
<td>Ascension Health–Saint Thomas Hospital</td>
<td>Nashville, Tenn.</td>
</tr>
<tr>
<td>Aurora Health Care–Aurora West Allis Medical Center</td>
<td>West Allis, Wis.</td>
</tr>
<tr>
<td>Carolinas HealthCare System–Carolinas Medical Center</td>
<td>Charlotte, N.C.</td>
</tr>
<tr>
<td>Christiana Care Health System–Christiana Hospital</td>
<td>Newark, Del.</td>
</tr>
<tr>
<td>Duke University Health System–Duke University Hospital</td>
<td>Durham, N.C.</td>
</tr>
<tr>
<td>Henry Ford Health System–Henry Ford Wyandotte Hospital</td>
<td>Wyandotte, Mich.</td>
</tr>
<tr>
<td>Intermountain Healthcare–Utah Valley Regional Medical Center</td>
<td>Provo, Utah</td>
</tr>
<tr>
<td>Kaiser Permanente Baldwin Park Medical Center</td>
<td>Baldwin Park, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente Anaheim Medical Center</td>
<td>Anaheim, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente Riverside Medical Center</td>
<td>Riverside, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente Los Angeles Medical Center</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente West Los Angeles Medical Center</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente Panorama City Medical Center</td>
<td>Panorama City, Calif.</td>
</tr>
<tr>
<td>Kaiser Permanente South Sacramento Medical Center</td>
<td>Sacramento, Calif.</td>
</tr>
</tbody>
</table>
The implementation process for each study site included five distinct study phases and more than 145 activities and tasks, including:

- Pre-site preparation, including obtaining a computer-aided design (CAD) drawing of the unit and meetings with local IT departments to ensure that the research equipment did not interfere with the existing equipment.
- On-site set-up. This required a team of experts to install wires and related devices to walls.
- Designation of study-week responsibilities.
- Site teardown.
- Post-study follow-up.

The study had four study tracks, or protocols. Researchers collected data for seven consecutive days (24 hours a day) from nurses in each track:

- **Protocol A:** Randomly selected participating nurses in each unit carried PDAs, which they used to record the amount of time they spent on documentation.

- **Protocol B:** Randomly selected participating nurses in each unit carried PDAs, which they used to record their location and activity at random times.

- **Protocol C:** Nurses in each unit wore electronic "tracking tags" to measure the distance they traveled in relation to the physical layout of the nursing unit. The tags not only enabled the researchers to track a nurse's location at any time, but also the duration that the nurse remained at the location. During study set-up and testing, the researchers learned that nurses moved too quickly for a single tag to accurately track their movements accurately; therefore the number of tags worn by each participating nurse was increased to four, ensuring more accurate time and location tracking.

- **Protocol D:** Nurses who volunteered to participate in this track also wore electronic armbands that measured body temperature changes, galvanic skin response, skin temperature, calories burned per minute and peak activity levels. From these data, the investigators estimated each nurse's total energy expenditure (calories burned), distance traveled, speed, active energy expenditure, sleep and categories of physical activity.

Raw data were collected and transmitted (encrypted) over the Internet on a daily basis. The daily transmission timeline allowed the Purdue analysis team to verify the data as they came in, discovered any problems, and correct them immediately.
BIBLIOGRAPHY

(Current as of date of the report; as provided by the grantee organization; not verified by RWJF; items not available from RWJF.)

Articles


Reports

Hendrich A and Chow M. Time & Motion: Transforming the Hospital Patient Care Environment. A Proclamation for Change. This three-page report was part of a "toolkit" created by the research team to assist study-site participants in gaining endorsement for recommendations for change. Unpublished.