



Using a Task Analysis to Describe Nursing Work in Acute Care Patient Environments

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To improve the healthcare environment where nurses work and patients receive care, it is necessary to understand the elements that define the healthcare environment. Primary elements include (a) the occupants of the room and what knowledge, skills, and abilities they bring to the situation; (b) what tasks the occupants will be doing in the room; and (c) the characteristics of the built environment. To better understand these components, a task analysis from human factor research was conducted to study nurses as they cared for hospitalized patients. Multiple methods, including a review of nursing textbooks, observations, and interviews, were used to describe nurses' capabilities, nursing activities, and the environmental problems with current patient room models. Findings from this initial study are being used to inform the design and evaluation of an inpatient room prototype and to generate future research in improving clinical environments to support nursing productivity.

A growing body of research shows that workplace design and work processes in healthcare facilities present occupational hazards that threaten staff and patient safety.¹⁻³ In particular, workplace design has been

linked to operational efficiency,⁴ staff satisfaction,^{5,6} and medical errors.⁷ As some of the most highly trained healthcare providers in hospitals, nurses spend considerable time at the bedside monitoring patients' health and symptoms. Because a significant amount of time is spent at the bedside, workplace hazards often originate in hospital patient rooms. While there have been an increasing number of initiatives targeting nursing work processes at the bedside, there has been less emphasis on the role of the built environment in helping or hindering care delivery.

There is recent research activity aimed at describing nursing work in general medical-surgical nursing units in acute care hospital settings.⁸⁻¹⁰ These studies quantify how nurses spend their time (direct care, indirect care, nonnursing, and personal time) and where they spend their time (patient room, nursing station, on unit, and off the unit). Understanding complex nursing work is a concern voiced by the Committee on the Work Environment for Nurses and Patient Safety with the Institute of Medicine (IOM). The committee remarked, "Because data are not collected routinely on the activities performed by nurses and how nurses spend their time, it is difficult to measure the effects of interventions aimed at redesigning care to improve safety or efficiency or to understand the implications of policy changes for nursing practice. Research is needed on how to collect information on nurses' work on an ongoing basis."^{2(p322)} Nurses have responded to this call with efforts to frame nursing productivity in terms of "value-added activities," patient-centered activities that directly benefit the patient; "necessary activities," those that are a part of care delivery but do not benefit the patient directly; and "non-value-added

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activities, those that do not benefit the patient.¹¹ While most research focuses on nursing/unit-level investigations, additional research is needed that also examines the patient room, because this is a location where nurses spend considerable time.

National organizations, such as the Robert Wood Johnson Foundation, the Institute for Healthcare Improvement, and the Institute for Medicine, have joined forces to seek ways to improve bedside healthcare delivery in medical-surgical nursing units.¹² This initiative used a “deep dive method,” where experts from around the nation came together to propose solutions to address the troubling statistics revealed in the IOM’s landmark *Quality Chasm Series* regarding healthcare quality, safety, and medical errors.^{2,8} With little objective information available that describes what nurses do at patients’ bedsides, many proposed solutions are based on subjective interpretations.² Consequently, many of today’s hospital patient rooms are designed with little empirical knowledge of the range of nursing activities involved in caregiving, the cognitive and physical demands posed by these nursing tasks, and the environment and equipment issues needed to support nursing activities.

In response to this gap in the literature, a commonly used method in human factors (HF), a task analysis, was performed to describe nursing activities in acute care hospital patient rooms. A task analysis is a detailed analysis of the individual steps in a particular task or activity and the arrangement of these steps.¹³ In this case, the task analysis was informed by reviewing nursing textbooks, observing nurses during a day shift, and interviewing subject-matter experts (nurses) as outlined in the methods section. The study aimed to answer the following 4 questions: (1) What are the activities that nurses typically carry out in an acute care patient room? (2) What are the frequencies of these activities? (3) Where do these activities typically occur? (4) What environmental problems are encountered while performing these activities? Answering these questions is critical in both informing design and operational concepts for hospital patient rooms in the formative (or planning) stages as well as in evaluating design and operational concepts in the summative (or postconstruction) phases.¹⁴ The execution of a nursing task analysis in patient rooms reveals a more comprehensive understanding of the issues surrounding what nurses do when delivering care to ill patients.

Literature Review

Six themes found in the literature highlight the value of understanding relationships between work pro-

cesses, the capabilities and needs of nurses, and the built environments.

The Impact of Facility Design

Inadequately designed nursing units and substantial occupational stressors contribute to operational inefficiencies and safety compromises for both staff and patients.¹⁵⁻¹⁷ Of all hospital personnel, nurses have the most physically intensive contact with patients. The lifting, bending, straining, and reaching to perform nursing activities often contribute to musculoskeletal disorders and lower-back-related injuries, frequently stemming from ergonomic hazards in the workplace. Compared with workers from other occupations, nursing personnel are among the highest at risk for musculoskeletal disorders and back injuries, which translates into a costly burden for hospitals.¹⁸

In addition to staff-related injuries, medical errors, nosocomial infections, and other adverse events have been linked to unsafe hospital environments. According to the well-documented study published in 1998 by the IOM, *To Err Is Human: Building a Safer Healthcare System*, approximately 44,000 to 98,000 people die each year due to medical errors, costing an estimated \$29 billion dollars per year.¹⁹ In a later IOM study, *Keeping Patients Safe: Transforming the Work Environment of Nurses*, published in 2004, the IOM urged hospitals and other healthcare organizations to better patient safety by improving the work environment for nurses. In addition, publications supported by the Center for Health Design’s initiative advocating for “evidence-based design” point out that facility design is an integral component to improving safety.²⁰ Aspects of facility design that may pose occupational stressors for nurses (and possibly increase errors) include inadequate lighting, absence of daylighting, noise, unit layout, double-occupancy rooms as opposed to single-occupancy rooms, and lack of standardization, materials, and layout, just to name a few.²¹

Human Factors Research

Human factors is a field of inquiry that is related to psychology and engineering. The field attempts to use knowledge about people’s mental and physical capabilities and limitations to better understand work-related problems and to suggest solutions. The goal of the field of HF (similar to a variety of domains) is to reduce error, increase productivity, and enhance safety and comfort during work. Because of the high potential for work-related injuries (not to mention patient-related injuries) in healthcare, HF-related issues in healthcare have been actively studied. For example, 2 recent volumes dedicated to HF issues in

healthcare have been released.^{1,22} Despite the concentration of HF-related research in the healthcare domain, there is surprisingly little research examining patient care environments as a whole system. Instead, most research is focused on a particular medical device (eg, blood glucose meter) or high-risk environments (eg, operating rooms).

Patient- and Family-Centered Care

A patient- and family-centered care movement has blossomed in the last 10 years that has encouraged a culture of care that recognizes and respects the unique preferences and perspectives voiced by a diverse group of patients and families.^{23,24} Clinical caregivers are asked to provide patients and families with accurate and timely information and offer them the choice to participate in the decision-making process. To promote a patient- and family-centered culture, nurses are asked to involve patients and families in collaborative efforts such as program development, policies, care delivery, facility design, and evaluation.²⁵ Facilities need to be designed to support these objectives.

The changing profile of the customer, hospitalized patients and their families, also influences work for nurses and the demands from the built environment. A reduction in the number of hospitals, a decrease in the number of patient beds, the need to reduce costs, technological advances, and an increase in outpatient services have all influenced the characteristics of a “typical” inpatient. Patients admitted to hospitals today are more acutely ill than previous decades, consequently increasing physical and cognitive workload demands for nurses.²⁶ In addition, many patients are from various cultures, are physically larger due to the obesity epidemic, and are older. Expectations are elevating, and individualized care plans need to be tailored to the unique requirements and preferences of patients and families. Comfort and personal control of room amenities are now expected by patients and families.

Changing and Stressful Nursing Work

With each new patient admission, a nurse is confronted with a personalized care protocol and unique patient and family needs and preferences. In addition, to offer state-of-the-art healthcare services to their patients, hospital leaders continuously integrate new and emerging technologies into the care environment, such as new infrastructure, healthcare equipment, medical devices, and informatics.²⁷ Over the course of a day, nurses travel great distances taking various supplies, healthcare equipment, and medical devices in and out of patient rooms to support

clinical activities. Clinical activities might include “assessing a patient’s condition, monitoring and detecting when a change in therapy is needed, and integrating an individual’s patient healthcare needs with the interventions of a variety of different healthcare providers to formulate a plan of care tailored to the particular patient.”^{2(p89)} Due to ongoing advances in technological processes, medicine, and operations in healthcare, the care protocols, documentation requirements, and regulatory mandates are constantly redefined, altering work expectations and practices.

Nurses are involved with life-threatening scenarios in care delivery settings where the risks are high. The necessity for nurses to accurately fulfill established care protocols is mandatory; however, sometimes, delivering such care is difficult given the unpredictable nature of healthcare service delivery. This often elevates stress levels for nurses because some activities are time sensitive. Wolf et al²⁸ shadowed 7 nurses and found that, for about 62% of the time, nurses had 10 or more activities waiting to be performed and experienced approximately 3.4 interruptions each hour. These findings suggest that nurses need to remember many things in the course of their ongoing tasks that can lead to substantial cognitive burdens.²⁸

While the medical-surgical RN-to-patient ratio varies among units, the average workload for most nurses is increasing, which also increases physical demands, fatigue, and stress.²⁹ Work-related stress also contributes to errors in healthcare delivery, reduction in patient safety, staff dissatisfaction, burn-out, and nursing turnover rates.³⁰ According to a 2004 national survey of 3,500 RNs investigating their opinions about their work environments, 53% of the RNs agreed with the following statement: “My job is often so stressful that I felt burnt out.”³¹ The cost implications associated with staff turnover are significant, estimated to be upward of \$62,100 to replace each nurse.³² Therefore, investments in a more human-centered physical environment could increase staff satisfaction, assist with reducing physical demands, and decrease cognitive overload.

Work-arounds

Poorly designed hospitals are a contributing factor to “work-arounds” for nurses. Work-arounds are work patterns or shortcuts used to complete a nursing activity when the usual planned method does not work.³³ Morath and Turnbull³⁴ define a work-around as “work patterns an individual or a group of individuals create to accomplish a crucial work goal within a system of dysfunctional work processes that prohibits the accomplishment of that goal or makes it difficult.”^{34(p52)} In a review of the literature, Halbesleben et al³⁵ report that conditions

leading to work-arounds are linked to policies/laws/regulations, clinical protocols/guidelines, work process, technology, and people. These work-arounds often compromise quality and safety in hospitals.³⁵

In a stressful, time-sensitive workplace, nurses often use work-around strategies to overcome environmental barriers and workflow blocks. Environmental barriers such as inadequate planning of programmed spaces, room configurations or sizes, narrow door widths, a lack of storage, insufficient lighting and room finishes, improperly placed accessories, and incompatible technologies are some aspects that might cause blocks in workflow routines. While environmental problems can be fixed and work-around can thus be abandoned, the design of the physical environment is often not viewed as the source of such problems. With the recent surge in studies demonstrating a correlation between the built environment and numerous outcomes (such as safety, medical errors, satisfaction, and financial indicators), it is evident that more research is needed to encourage a knowledge-informed design process.³⁶

Nurse-Friendly Environments

Despite the ongoing estimates supporting nursing work shortages, Dr Peter Buerhaus and coauthors cited in the July/August 2009 *Health Affairs* that there is a recent surge in nursing employment that could be attributed to the economic recession. This could be a temporary position as they predict that nursing shortage is still projected to grow to about 260,000 RNs by 2025, and they claim it is primarily due to the retirement of the aging nursing workforce.³⁷ According to a recent survey published by Health Resources and Services Administration's Bureau of Health Professions, the average age of RNs was 46.8 years in 2004. This survey further showed that more than 41% of RNs were 50 years or older in 2004, and only 8% of RNs were younger than 30 years as compared with 25% in 1980.³¹

Overall, surveys suggest that a major reason that nurses are leaving their positions is because of their concerns about their personal health and safety.² Other research points to the problematic aspects of nursing including performing complex job responsibilities such as medication administration,³⁸ navigating documentation systems,³⁹ working in an inefficient environment,⁴⁰ and compromising personal safety such as musculoskeletal injuries.⁴¹ Furthermore, research suggests that working in inferior healthcare environments (such as poorly designed equipment, technology, and physical structures) may be contributing to the problems that nurses face.⁴² From the perspective of designers/architects and HF psychologists, the changing demographic is critically important because it may

inform the design and evaluation of medical equipment and patient care environments. A major tenet of the systematic application of HF knowledge and principles is to understand who the user is (user being the individual that carries out a specified environment).

To design a nurse-friendly environment, it is important to understand nursing work processes. The nature of nursing work processes and work environment have changed dramatically with the advent of information systems and communication systems. These technological advances coupled with evolving regulations have aimed to streamline work processes, track medical expenses, improve accountability, and increase quality. Consequently, nurses spend considerable time during 8- to 12-hour shifts at the computer navigating software and information systems in an effort to document patient medical information. Technological systems, for example, have been implemented into nursing units as solutions to ensure that medication is given to the right person at the right time and is billed properly. The layering of new technologies in addition to the number of complex activities required to care for ill patients places excessive cognitive workload burdens on nurses.⁴³ Design solutions that offer nurses a therapeutic view to nature and access to daylight can offer visual relief from constant use of a computer screen. In addition, shared work areas are necessary to facilitate care coordination among the care team. Another assistive technology that could be used to support nurses would be displays located around the unit to trigger memory and assist nurses with remembering future time-based or event-based activities.

As noted earlier, there are increasing physical workload demands required of nurses. The increase in obese patients, older patients, and patients with higher acuities requires intense physical workload demands on the nurses. The lack of ceiling lifts, absence of grab bars, poor physical layouts of patient rooms, and excessive travel distances between supplies, work areas, and patient rooms are some examples of environmental barriers that can exacerbate physical workload stressors. A design solution that recognizes and accommodates the complexity of each nursing activity is a first step toward creating an environment that supports nurses in the delivery of nursing activities.

Research Approach, Methodology, and Analysis

During the fall 2006, faculty from architecture and HFs collaborated in a study to understand the nature of nursing activities in general medical-surgical units with a focus on describing the type of activities nurses

perform, the frequency of these activities, and any environmental problems or issues. The information gained from the research study was then used to inform a project to design a new inpatient room prototype for a hospital system described elsewhere.⁴⁴ The study setting for the research included general medical-surgical units in a large 588-bed community-based medical center located in the southeast region of the United States. The nursing units were located in a patient tower built in 1994, and each unit had 28 private rooms. The nursing unit typology is a relatively standard “race track” shape, with patient rooms located on the outside circulation track and staff work areas located inside a central core of the circulation track. This unit included a central nursing station, decentralized fixed work stations outside the patient rooms with a lockable medication storage drawer, and mobile computer work stations that floated from room-to-room for documentation and medication distribution purposes.

To better understand the full breadth of nursing activities, three complimentary activities comprised the task analysis. First current nursing textbooks were reviewed to gain an understanding of the breadth of clinical activities nurses perform in hospital patient rooms—what are nurses being taught? This inventory of complex activities (as well as knowledge of how to carry out typical procedures) was used to inform the second step. In step 2, 5 researchers (2 faculty and 3 graduate students from Clemson University) shadowed RNs on a general medical-surgical unit during a 7 AM to 7 PM shift. The only inclusion criteria were that the nurses had to have had at least 2 years of experience working in their current position and they had to have primarily worked in a general medical-surgical patient care unit. Finally, during the third step, interviews were conducted to fill in gaps inherent in the observations (such as follow-up questions, rationale for actions, etc). These three steps are further outlined in the next section. Prior to beginning the study, institutional review board approval was granted from both the university and healthcare provider institution. In addition, all researchers received educational training from the hospital system regarding patient confidentiality issues.

Examination of Nursing Education

The first source of information came from examining what nurses are taught in their basic educational programs for the purpose of gathering “canonical” information about common nursing activities in acute care settings. This provided a reference point for understanding the relative importance of certain activities and what skills and knowledge were required for those tasks. It also provided general in-

formation regarding the complexity or number of steps involved in each of the tasks as well as their potential problems. The research team examined textbooks, such as Potter and Perry’s *Fundamentals of Nursing*,⁴⁵ and conducted informal interviews with nursing faculty (referred to as subject experts) at the School of Nursing at Clemson University.

The outcome of the textbook analysis and subject-matter expert interviews was a structured data collection instrument that was then used in step 2, the observation research. This instrument allowed researchers to quickly record the observed nurse’s activities in the hospital, the equipment used, the location of the activity, and any problems encountered. Activities were categorized into 1 of 9 categories: administering medication, assessing patients, assisting patients, taking a break, cleaning/organizing/gathering, communicating, documenting, moving, or other. A paper-based data collection form was used because video or audio recording was prohibited in the hospital environment. Before the instrument was used to collect nurse activity data, the researchers were trained by reviewing the activity categories as a group. Finally, a preliminary test of the instrument was conducted in a small setting (a doctor’s office) where the usability and completeness of the instrument was refined as well as the activity categories.

Observational Research

Ten nurses were observed in 4 similar medical-surgical units during the day shift (7 AM to 7 PM). The purpose of the observations was to witness the nursing staff performing activities associated with patient care delivery and problems that were encountered. During the observations, the research team recorded the relative frequency of the nurse’s activities, the materials required to perform the activities, the locations in which they occurred, and any sources of task errors. The nurses were fully aware of the researcher and signed an informed consent prior to starting shadowing. While the nurses went about their daily rounds, the observer stood at a discrete distance and recorded the nurses’ activity and any problems they had to overcome on the data collection instrument. Other than asking the nurses occasional clarification questions, the researcher and the nurses did not interact. The data from the nurse observations were aggregated to tabulate the frequencies of tasks, materials, locations, and problems. A total of 2,756 minutes (approximately 46 hours) of observation time was recorded.

Structured Interviews

The purpose of the structured interviews was to gather subjective data involving the activities that nurses

perform on acute care units and to elaborate on any problems found during the observations. A total of 12 nurses participated in a 1-hour telephone or face-to-face interview to discuss their routine nursing tasks, how they prepared, and, within each task, the sequence of steps for each task. They were also asked the problems they encounter and how they solve those problems. This information provided an understanding of task knowledge requirements and issues that occur in patient rooms. Interviews were recorded with the nurses' knowledge and later transcribed for qualitative analysis. The transcribed interview data were independently coded by 2 coders (who had an interrater reliability of >75%). In the qualitative analysis, the text passages were categorized according to their main ideas. The categories, or coding scheme, were created by the researchers by analyzing a subset of the interview data.

Results

The results from the observations and interviews are presented in the context of the nurses' main activities, the locations in which they occur, the types of equipment used, and the problems encountered.

Nursing-Care Activities

A summary of the main activity categories in the observations and interviews and their frequency are shown in Tables 1 and 2. In general, there was a wide agreement in task frequencies reported by both observations and interviews. According to the observations, documentation was the most frequently performed activity (25.2%) but was the second most frequent activity reported in the interviews (17.6%). The documentation category included any activity that involved recording patient information and updating paper or electronic patient information. Following documentation, nurses frequently assessed patients and administered medication. The patient assessment category primarily consisted of taking patients' vital signs (eg, measuring the patient's temperature, and checking the patient's blood pressure and heart rate). Nurses were able to complete these activities, on average, much more quickly than documentation activities. Patient assessment activities took, on average, only 4.8 minutes to complete, whereas documentation took an average of 7.0 minutes to complete.

Administering medication was the third most frequently observed activity, taking about 4.7 minutes

Table 1. Taxonomy of Nursing Activities

Activity	Description	Examples
Administering medication	Refers to the preparation, administration, and documentation of medications	Retrieving medications, preparing medications, administering medications, documenting administration of medications, monitoring intravenous pump
Patient assessment	Any action where the nurse is performing some sort of evaluation or assessment of the patient	Identifying patient, reviewing medical information, checking vital signs and other indicators of physical status, visual observation, talking with or listening to patient, patient teaching, wound/dressing care
Assisting patient	Tasks that require the nurse to assist with the hygiene or general well-being of the patient	Helping the patient to the toilet or shower, helping the patient with a bedpan/urinal or bed bath, general hygiene (eg, washing hands, brushing teeth), assisting with meals, dressing patient
Break	Any break a nurse takes away from the ward or any idle time	Lunch, scheduled break, idle time
Cleaning/organizing/gathering	Any activity where the nurse is cleaning or organizing a patient room or gathering supplies for a certain task	Changing bed linens, cleaning off the bedside table, looking for a needed piece of equipment
Communication	Any action where the nurse is conversing with someone other than the patient	Talking with a doctor, talking with another nurse, making a phone call to discuss a patient
Documentation	Any action where the nurse is recording information	Updating in-room board, completing chart on patient, using bedside computer
Movement	Actions where the nurse is helping a patient move from one location to another	Admitting patient, discharging patient, transferring patient to a different unit, transferring patient to a different room, transporting patient for diagnostic procedures, assisting patient in a move (eg, from a bed to a chair)
Other	Any activity that does not fall into one of the already-described categories	Any task that does not fit into one of the other categories

Table 2. Percentage of Occurrences of Each Type of Task

Task	Observation	Interview	Example Comment From Interview
Administering medication	21.2	25.9	“Check ’em according to... the medication record, making sure that the correct medication is... being administered to the correct patient”
Patient assessment	25.7	21.3	“Checking their temperature, checking their blood pressure, you know, all their vital signs”
Assisting the patient	7.8	17.6	“Either giving a bath or helping them with the bedpan, or cleaning them up”
Cleaning/organizing/gathering	1.6	0.9	“Running errands off the floor, you know going to get materials or [going to the] pharmacy”
Communication	7.2	0.9	“Communicating with the MDs”
Documentation	25.2	17.6	“Review my progression of care and document my review against the other shifts”
Movement	6.1	15.7	“Transport our patient to CT scan or MRI, or special procedures”
Other	5.2	0.0	N/A

to complete each time. This time also included the time it took to retrieve medication from the supply cabinet or locked room alcove, which was often located in a central location outside the room. Documentation, assessment, and administering medication comprised 70% of the total activities observed and 63% of the total amount of time; the remaining activities accounted for only 30% of the total number of activities observed and 37% of the total amount of time.

Location of Nursing Tasks

Table 3 summarizes the main locations where tasks occurred based on information from the observations and interviews. Again, there is general agreement between the data obtained via observations and interviews. The most prevalent location for nursing tasks was the patient bedside (42% and 47%).

Equipment Use

The data on equipment use could be recorded only from the observations. Table 4 illustrates the types of equipment used during nursing tasks and their relative frequency. The frequencies of equipment used

in nursing tasks are 29.1%, a computer; 14.2%, a chart in which patient information is documented; 11.1%, an intravenous (IV) pump, including the stand, the bag, and the needle in the patient’s arm; 9.3%, miscellaneous equipment; 4.3%, paperwork, including other recording requirements not associated with the patient; 4.1%, and syringes. In addition, the percentage of time an item was located and used in a patient’s room also revealed what remained in the patient rooms and what nurses had to take in and out of patient rooms. For example, IV pumps were most often found in the patient’s room, located there 73.8% of the time. This makes sense as the nurse was usually doing something to the IV pump that was

Table 3. Percentage of Visits to Nursing Task Locations

Location	Observation	Interview
Bathroom	2.5	3.2
Bedside	42.0	47.5
Hallway	5.1	5.1
Med station	7.4	7.0
Nursing station	22.5	8.2
Other	0.2	17.7
Outside room	14.4	3.2
Supply area	5.9	8.2

Table 4. Frequency of Equipment Item Use

Equipment	No. of Times Used	Percentage of Total	Percentage of Time Item Was in the Patient Room
Computer	129	29.1	12.4
Chart	63	14.2	3.9
Intravenous pump	49	11.1	73.8
Miscellaneous	41	9.3	43.3
Paperwork	19	4.3	33.3
Syringes	18	4.1	0.0
Blood glucose meter	16	3.6	50.0
Blood pressure cuff	16	3.6	73.3
Telephone	16	3.6	15.4
Dressings	12	2.7	42.9
Urine bag/bottle/bedpan	12	2.7	54.5
Meds	10	2.3	16.7
Stethoscope	10	2.3	22.2
Food/beverage	9	2.0	14.3
Gown	8	1.8	0.0
Thermometer	6	1.4	40.0
Linens	5	1.1	20.0
Gloves	4	0.9	50.0
Total	443	100.0	31.4

already connected to the patient. In addition, paperwork, blood glucose meters, urine bag/bottles, bedpans, dressings, blood pressure cuffs, and telephones were also commonly used equipment that remained in patient rooms.

To summarize, the analysis shows that computers were used more often than any other piece of equipment, with charts being the next most frequently used item. In addition, nurses had to use charts and computers together more often than any other combination of items, which could indicate that information was being transcribed from one to the other. Finally, computers, the most often used piece of equipment, were located in the patient's bedroom only 12.4% of the time they were used. Most of the computers used were on moveable carts, yet there were variations across how nurses use the computers for documentation. Some would take the computer to a more private area to chart (often right outside the room) and would not take it into the patient room. Others would take the computer inside the patient room and do documentation in the room.

Problems During Nursing Tasks

Finally, the typical problems nurses encountered were examined. The results are summarized in Table 5. We broadly categorized potential problems as being related to equipment, physical/environmental, or safety. The problems discovered during the observational sessions were either visible to the observer, or the nurse explicitly stated that something was a problem. The problems identified in the interviews were coded. In summary, most problems recorded were equipment issues, followed by physical/environmental problems, and, finally, infection control. Most problems occurred at the bedside, comprising 44.1% of the total locations in which problems were encountered. This makes sense considering the fact that the bedside was the most frequently visited location. Environmental examples observed included nurses stepping over cords and equipment, nurses leaving the room to go search for

medical equipment, inadequate space for preparing medications to be administered, nurses having to move around the clutter in the room to the far side of the bed to assess the patient, and the bedside table being used by the patient so the nurse had to place objects on the bed when administering care. Of all of the activities performed, administering medication and assessing patients both involved the most number of problems. Documenting incurred the next highest number of problems, followed by assisting patients, communicating, moving, and cleaning/organizing/gathering.

Discussion and Future Research Directions

Without knowing the range of common and uncommon nursing activities performed in patient rooms in hospitals, it is not possible to create a knowledgeable-informed patient room design that can support the delivery of complex nursing activities. Furthermore, without this information, it is difficult to evaluate how the design of the patient room environment may facilitate or impede nursing activities. In response to these issues, a research study was completed to describe what nurses do in hospital patient rooms. From this investigation, 3 thematic areas are outlined for future research.

Focused Research on Specific Locations in Nursing Units

Additional work is needed that answers research questions that span the entire nursing unit level, the details of the patient room, and the areas that connect the two. Previous studies have commonly described nursing work at the nursing unit level across different unit configurations and different types of patient care units. There is, however, limited research that focuses specifically on understanding nursing activities in the patient room environment. This research as presented in this article aimed to address the gap in the literature by using a HF research method, a task analysis, to describe nursing work in the patient room. While the research has limitations—for

Table 5. *Examples of Types of Problems Observed*

Problem Type	Observation	Interview	Example Comment From Interview
Equipment issues	52.9	37.5	"We have to go all over the hospital to look to find equipment"
Infection control	8.6	23.2	"Some of the equipment... [isn't] always cleaned between patients and rooms"
Physical/environmental	38.6	16.1	"You can't do anything with the corners because you can't get into them to maneuver our computers in and out; you are always bumping into the walls, bumping into the bed"

example, only 1 hospital system was included, 1 floor plan typology was investigated, and a limited number of nurses were shadowed—the findings are consistent with those of other studies.

Previous research shows that the required or preferred locations where nurses work spend significant amounts of time including the bedside of patients and nurse work stations. The research conducted by the authors showed that 23% of a nurse's time is spent at the nurses' station (compared with 37%-39% found by Hendrich and colleagues⁸). Likewise, the research conducted by the authors showed that more than 40% of time is spent at the bedside of patients (compared with 30% of time in the study of Hendrich and colleagues⁸).

There was a discrepancy with the amount of time spent on assessing the patient and recording of vital signs. Our study showed that 26% of a nurse's time was spent assessing the patient, whereas Hendrich and colleagues⁸ found only 7.2% of time. This difference may be due to the fact that our study focused more on understanding nursing activities in the patient room. Also, the robust 36-hospital study conducted by Hendrich and colleagues⁸ showed that there are individual differences within nursing units and individual differences across hospitals. Additional research is needed to focus on specific locations where nurses spend time that can ultimately add value to patients and families.

Focused Research on Specific Nursing Activities

There appears to be a consensus that nurses spend considerable time on documentation and medication administration (upward of 50% of their time). Patient assessment and care coordination are 2 additional nursing activities that consume significant amounts of time. How the physical environment and the integration of technology can support or impede these specific nursing activities is vital to improving nursing productivity and the work environment. Additional research is needed to delve deeper into commonly repeated nursing activities to gain insight on the environmental needs and requirements to support 4 primary research activities: documentation, medication administration, patient assessment, and care coordination. Human factor research provides strategies to study and solve problems that we encounter through an integrated approach that considers nursing activities, the capabilities and needs of nurses, and the built environment.

A better way to look at nursing activities would be to use the "value-added, necessary, and non-value added categories" proposed by Upenieks and colleagues.¹¹ It would be a good starting point to examine relationships between environmental features

of nursing units (such as nursing layout, centralized or decentralized nurse work stations, medication storage area) and/or room layouts to time spent on non-value-added categories. For example, do excessive travel distances afforded by large nursing unit footprints increase the amount of time on non-value-added activities? Likewise, does locating medications in a supply cabinet or drawer in the patient room (or immediately outside the room) reduce the amount of time spent traveling to get medications, thereby reducing time spent on non-value-added activities?

Observed Activities Versus Self-report Activities

The authors of the study observed nurses and conducted interviews, and in certain cases, there were discrepancies between actual and perceived behaviors. For example, nurses spend more time at the nurse station than they think (as reported in the interviews) as shown in Table 3. While there have been an increase in decentralizing nursing work areas, additional work is needed to understand what nurses do at each of the different types of nurse work areas (centralized, decentralized fixed, and mobile). Likewise, nurses spend more time outside the room than they think. The amount of time nurses spend outside the room needs to be studied in detail to identify which activities can be improved to reduce wasteful or unproductive time that has no value to the patient and family. These findings suggest that multiple research methods are necessary to gain a more comprehensive understanding of the various types of nursing activities performed including direct and indirect patient care activities. Furthermore, to get an accurate understanding of what nurses do, objective tracking technologies, observation, and self-report data offer a different perspective necessary to understanding complex nursing activities.

Limitations

The data came primarily from observational and self-reported data collection methods. Given the sensitivity of certain aspects of the study topic (ie, observing and talking about errors and mistakes), this kind of data collection method may not be the best way of discovering common problems. In addition, the research team was primarily interested in analyzing general patterns of nursing work, so no statistical analysis was conducted (as is common with qualitative data analysis). Also common with qualitative research, the study involved a smaller sample size from medical-surgical units in 1 hospital system, which may limit the broad generalizability to other hospitals. Further research is necessary in multiple hospitals or in various

operational contexts before generalizable design principles can be obtained. Future research is needed regarding the problematic areas of patient rooms and

the role physical environments and technology could play in enhancing performance and mitigating errors that jeopardize personal safety.

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