How Do Residents Spend Their Time in the Intensive Care Unit?

Authors

Pascale Carayon, PhD, Matthew B. Weinger, MD, Roger Brown, PhD, Randi S. Cartmill, MS, Jason Slagle, PhD, Kara S. Van Roy, PhD, James M. Walker, MD and Kenneth E. Wood, DO

Section Editor

Jeffrey G. Wong, MD, FACP

Abstract: *Purpose:* To describe the work of residents and the distribution of their time in 6 intensive care units (ICUs) of 2 medical centers (MCs). *Methods:* A total of 242 hours of observation to capture data on tasks performed by residents in 6 ICUs, including adult, pediatric, medical and surgical units, were conducted. For each observation period, the percentages of total time spent on each task and on the aggregated task categories were calculated. *Results:* Overall, while in the ICUs, residents spent almost half of their time in clinical review and documentation (19%), conversation with team physicians (16%), conversation attendance (6%) and order management (6%). The 2 MCs differed in the time that residents spent on administrative review and documentation (4% in one MC and 15% in the other). The pediatric ICUs were similar in the 2 MCs, whereas the adult ICUs exhibited differences in the time spent on order management and administrative review and documentation. *Conclusions:* While in the ICUs, residents spent most time performing direct patient care and care coordination activities. The distribution of activities varied across 2 MCs and across ICUs, which highlights the need to consider the local context on residents' work in ICUs.

Key Indexing Terms: Intensive care; Time study; Human factors engineering; Resident; Work. **[Am J Med Sci 2015;350(5):403–408.]**

From the Center for Quality and Productivity Improvement (PC, RSC, KSVR), Madison, Wisconsin; Department of Industrial and Systems Engineering (PC), University of Wisconsin-Madison, Madison, Wisconsin; Center for Research and Innovation in Systems Safety, Department of Anesthesiology (MBW, JS), Vanderbilt University School of Medicine, Nashville, Tennessee; School of Nursing (RB), University of Wisconsin-Madison, Madison, Wisconsin; Cerner Corporation (JMW), New Cumberland, Pennsylvania; and Geisinger Health System (KEW), Danville, Pennsylvania.

Submitted September 29, 2014; accepted in revised form May 12, 2015.

The authors have no conflicts of interest to disclose.

This research was made possible by funding from the Agency for Healthcare Research and Quality (AHRQ), Grant R01 HS15274 (PC, KEW), Grant 1UL1RR025011 from the Clinical and Translational Science Award (CTSA) program of the National Center for Research Resources National Institutes of Health and a AHRQ T32 training Grant (HS000083) (KSVR, PC, KEW).

Correspondence: Pascale Carayon, PhD, Department of Industrial and Systems Engineering; University of Wisconsin-Madison, 3126 Engineering Centers Building, 1550 Engineering Drive, Madison, WI 53705 (E-mail: carayon@engr.wisc.edu).

Physicians' time is a valuable resource, particularly in settings such as intensive care units (ICUs) with critically ill patients who require a highly qualified workforce.[1,2] Understanding how physicians spend their time is important in this context. The Institute of Medicine report on Resident Duty Hours[3] has highlighted the importance of accurately describing the activities performed by residents to ensure that both educational and patient care objectives are adequately satisfied. In addition, the implementation of various health information technologies, such as computerized provider order entry (CPOE) and electronic health records (EHRs), has led to concerns about workload and time spent on indirect patient care activities.[4] The authors sought to gather more information about how residents spend their time while working in the ICU.

Studies have examined the work of physicians in hospitals,[5–7] in particular in the emergency department,[8,9] anesthesiology[10,11] and surgery,[12,13] but little is known about the work of physicians in ICUs; in contrast, some research has examined the work of ICU nurses.[14,15] A recent study[16] reports results of a time study of 18 critical care attending physicians and 3rd-year fellows in a pediatric ICU and a general adult ICU in 2 Canadian hospitals. Observers used a personal digital assistant to record activities performed by critical care physicians; the total observation time was 58 hours spread over days and nights, and weekdays and weekends. Critical care physicians spent about 75% of their time on communication with other staff, about 25% on indirect patient care (eg, reviewing and reading documents related to patients, ordering tests, checking for results), 17% on documentation, about 10% on either direct patient care (eg, admitting patient, examining patient, patient communication), 10% in transit and the rest of their time on supervision/education, medication-related tasks, administration and personal or social activities (note that they frequently observed physicians multitasking, so their percentages add to more than 100). The major weakness of this study is the lack of discrimination of communication activities. Patient communication was categorized as direct care, but all other communication activities were grouped and represented about 75% of time spent by physicians. Hoffman et al[17] compared work performed by a nurse practitioner (NP) to the work performed by 6 critical care and pulmonary fellows in 1 step-down medical ICU. Results showed that the NP and the fellows spent about 40% to 44% of their time in routine management of patients (ie, procedures/testing, information gathering

and documentation), and that the NP spent more time in coordination of care (ie, consultation and patient/family interaction), whereas the fellows spent more time in nonunit activities (ie, educational activities, administration, transit and personal activities). This study was limited to a single step-down medical ICU and data were obtained through work sampling instead of direct continuous observations. ICUs are uniquely complex environments in which multiple health care professionals work together in multiple teams to meet the needs of critically ill patients. Therefore, further research is necessary to specifically define the work done by residents in ICUs.

A job task analysis of residents was conducted to measure the time spent by residents on various activities in a range of ICUs in 2 medical centers (MCs). The job task analysis captures information on all tasks performed by the residents while they are in the ICUs. The authors also assessed the impact of structural characteristics (ie, hospital, ICU, adult versus pediatric ICU, surgical versus medical ICUs) on time spent by residents in the ICU.

METHODS

Sample

The study was conducted in 6 ICUs in 2 different MCs. In the 1st academic MC (MC1), data were collected in one 24-bed adult medical/surgical ICU (Trauma and Life Support Center or TLC), an 8-bed cardiothoracic surgery (CT-Surg) ICU and a 17-bed pediatric ICU (PICU). In the 2nd academic MC (MC2), data were collected in one 24-bed adult medical/surgical ICU (AICU), a 38-bed neonatal ICU (NICU) and an 11-bed PICU. The 2 adult medical/surgical ICUs were hybrid ICUs where medical patients are cared for by intensivists and surgical patients are the responsibility of surgeons. The 2 PICUs and the NICU were closed ICUs with dedicated pediatric intensivists and neonatologists. In the cardiothoracic surgery ICU, patients were the responsibility of the surgical team with the assistance of physician assistants. At the time that data were collected, residents in ICUs of MC1 used an EHR to access and document patient information but were not able to enter orders electronically; in MC2, there was no EHR system installed; all physician documentation and ordering were done on paper.

Participants in this study were residents who were doing a rotation in one of the participating ICUs. This research effort was part of a larger study to examine the impact of CPOE on physician tasks in the ICU (http://cqpi.engr.wisc.edu/cpoe_home). Resident physicians were chosen as the subjects for this particular study due to the goals of the parent project, that is, to determine how CPOE affects the work of physicians in the ICU setting. During their rotation, residents spend the majority of their time in the ICUs and are responsible for writing the majority of patient orders and thus, would provide the most relevant data pertaining to order-writing. The composition of physician teams in each ICU is described in Table 1.

TABLE 1. Composition of physician teams, by unit

	MC1			MC2		
	TLC	CT-Surg	PICU	AICU	NICU	PICU
No. attendings	1	1	1	1	1	1
No. fellows	1	1	0	0	0	0
No. senior residents	1–2	2–3	1–2	1	2–3	1
No. interns	0–1	0	0–1	1	0–1	1
No. PAs or NPs	0	0	0	0–1	0–1	0

MC, medical center; ICU, intensive care unit; TLC, Trauma and Life Support Center; CT-Surg, Cardiothoracic Surgery ICU; PICU, Pediatric ICU; AICU, Adult ICU; NICU, Neonatal ICU.

Data Collection Tool

The method for the job task analysis was real-time direct observations by outside observers who used a computerized data collection tool developed by Weinger et al[10] and Slagle et al[18] to document the tasks performed by ICU residents. Each recorded task was automatically time stamped and logged into a data file.[10,18] Using a stylus on the touch screen of a tablet computer facilitated data collection by permitting observers to enter data while standing or walking. Outcomes obtained from the analysis include total time and percent time for each task.

Data Collection Procedures

Four trained human factors engineers followed residents for periods of a maximum of 3 hours. Only 1 resident was followed during each observation. The observer remained at a distance that allowed clear identification of physician tasks but did not interfere with patient care. Conversation with participants was minimal. The observer recorded each task the resident performed in real time on the tablet computer.

Early pilot observations aided the research team in preparing for data collection. An initial list of 62 tasks developed based on the literature[14] was progressively refined to 17 tasks (see Table 2 for the list of 17 tasks and their definitions). The 17 tasks were organized into 4 categories: (1) direct patient care, (2) care coordination, (3) indirect patient care and (4) non–patient care. A human factors engineer and a critical care physician (P.C. and K.E.W.) classified the job tasks into high-level categories, in consultation with another physician (J.M.W.). The pilot observations provided training for the observers and a means for making further revisions to the software's user interface, task taxonomy and observation procedures. In addition, the software was designed so that task categories could be rapidly, accurately and reliably selected. A training manual was created to standardize data collection procedures, such as where the observers should stand, how they should avoid disrupting patient care and proper use of the job task analysis software.

Interobserver reliability was assessed between a human factors engineer and a physician, as well as between pairs of the 4 trained human factors engineers on the observation team.[19] Reliability was assessed by calculating the degree to which the same tasks were recorded by 2 researchers independently observing the same resident. After each reliability-testing observation, the researchers examined the data and discussed discrepancies in how tasks were recorded. Data collection began once interobserver reliability reached the desired goal of at least 80% agreement. The stability of interobserver reliability was assessed periodically throughout the data collection period.

Participation in the study was voluntary. The study received institutional review board approval at the research university and both participating hospitals. Each resident participant was given an information sheet explaining the purpose of the study, as well as the risks and benefits associated with participation. If family members were available or if the resident was caring for an awake and alert patient, the observer asked the resident to briefly explain the research study to the family members and/or patient; this provided them with an opportunity to refuse to have their caregiver (ie, the resident) observed while caring for this patient. Observations were suspended during residents' personal time and when residents were behind closed curtains with their patients.