How Many People Does it Take to Operate a Picture Archiving and Communication System?

Rosemary Honea

The most frequently asked question without a correct answer is: "Just how many people does it take to operate a picture archiving and communication system (PACS)?" At Texas Children's Hospital, our consensus is that we do not yet know. As soon as we felt we had adequate staffing to provide timely response for routine services, we found that including the Intensive Care Units (ICUs) increased our demand for urgent response beyond our capacity. The addition of inpatient bedside imaging to PACS also increased the demand for round-the-clock and weekend PACS services. Our answer to the staffing question changes every year, in accordance with changes in the scope of services that our PACS is expected to provide. Our administration drew up a 5-year plan for PACS implementation, concentrating on purchase and installation of equipment, but neglected to estimate requirements for full-time equivalents (FTEs) for PACS. Our administration reasonably assumed that existing employees would be galvanized into PACS personnel. It is now clear that new FTEs need to be created strictly for the PACS service. Our 5-year plan also did not anticipate significant changes in the extent of our healthcare enterprise. Our PACS accommodates limited remote service: providing a PACS Analyst to travel to the site when a problem is not resolved remotely is another demand on staffing. Our PACS service was formed using staffing numbers based on assumptions about the minimum number of employees needed to perform routine duties, field trouble calls, conduct training, and work on special projects, such as adding new acquisition modalities or troubleshooting longstanding problems. This staffing was based on a single shift operation, with on-call coverage for second, third, and weekend shifts. The number of employees also considered absences for vacation, sick leave, and training. The service has administrative overhead that should be covered by a secretary. Someone is also needed to supervise the team. Once the number of personnel is determined, detailed definition of qualifications and responsibilities is required. Each job description must accurately reflect what is expected of the employee, but must be constructed in such a way to be graded appropriately by Human Resources, without excluding potentially desirable applicants. In addition to competitive pay,

other factors play an important role in recruiting and retention. These include training that the hospital provides, opportunities for advancement, relief from menial duties, adequate working space and facilities, and opportunities for self-development. There is high turnover of personnel in computer services, and we are in a highly competitive market. The correct number of FTEs must consider that we will have to operate the PACS during periods when one or more positions are open or occupied by "greenhorns." In our case, where the vendor provides on-site service engineers, we are able to operate with fewer FTEs. The more distant and tenuous our vendor support, the more we would need to depend on hospital FTEs. While remote vendor maintenance is helpful, it is not useful in reducing the number of FTEs. Instead of adding PACS responsibilities to supervisors of imaging services, we are creating new PACS FTEs outside the PACS service. The idea is to give imaging supervisors the assets they need to perform the additional tasks involving PACS, such as first-line response to trouble, user training, and quality-control oversight. It also frees up PACS service personnel to deal with training and problems with customers outside the Radiology Department.

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RATHER THAN PROACTIVELY obtaining a staff for the picture archival and communications system (PACS), many sites begin to amass a staff in response to customer complaints of delays in getting their patients' images and diagnostic reports. Our PACS evolved from an ultrasound niche-PACS beta site to a hospital-wide filmless operation. Other factors that affect the staffing of a totally digital radiology service are projected expansions of hospital operations and additions of remote sites whose images will be interpreted at a central location. The x-ray department is often the first service converted to digital using computed radiography (CR). The first criterion of installing a PACS is the need for employees to maintain the system. How this need is addressed often sets a precedent for how future staffing needs are met. Radiology administrators debate on how many full-time employees (FTEs) are needed to adequately accommodate the hospital-wide PACS service, now and in the future.¹ Our 5-year plan for PACS divided up the hospital by services and sections for the purpose of PACS equipment and

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From the Texas Children's Hospital, Houston, TX.

Address reprint requests to Rosemary Honea, RTR, RDMS, Edward B. Singleton Diagnostic Imaging Services, Texas Children's Hospital, 6621 Fannin St, MC 2-2521, Houston, TX 77030. E-mail: rhonea@texaschildrenshospital.org.

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0897-1889/01/1402-1009\$35.00/0

doi:10.1053/jdim.2001.23812

implementation, but did not include a plan for hiring PACS FTEs.

STAFFING INITIATIVES

"Additional Duties, as Assigned"

To chart the course of our PACS implementations, a Steering Committee was formed consisting of the Chief of Radiology, a Neuroradiologist, the Director of Radiology, the Assistant Director of Radiology, and the Radiology Information Manager.² Shortly after its inception, the committee voted unanimously to hire a PACS Coordinator, whose full-time job would be to continue the planning and preparation of hospital-wide filmless operations.

When our PACS effort began in 1991, as the Ultrasound Supervisor, I was the first facsimile of a system administrator on a half-time basis. In 1993, when the PACS system expanded to include additional modalities, so did the requirement for full-time PACS employees.

Initial Full-Time Employees

The PACS Coordinator was the first full-time PACS employee. This position was created at a modest level on the hospital staff. In our hospital's terminology, a "Coordinator" is an echelon below a "Manager," above a "Team Leader," and parallel to a "Supervisor." The next levels up in the hierarchy are "Assistant Director," "Director," and "Vice President." From its inception, this position was ineffectual, because it was subordinate to virtually all personnel inside and outside the department that had to cooperate to make PACS a success. The PACS Coordinator reported directly to the Administrative Manager, which relegated PACS to an administrative function rather than a clinical operational function. The PACS Coordinator was subject to passive-aggressive behavior from others throughout the organization, as well as intense political pressure from middle management and above who were inconvenienced by the PACS project.

With the PACS Coordinator hired, a short-term solution in getting PACS FTEs was to scout our Radiology Department to see if we could benefit from existing employees in other services, and identify "hidden talent." An appointment scheduler with minimal computer skills who worked on the weekends was willing to help out during the day.

Another employee from the file room would help out for a couple of hours during the evening. Since the system was small enough at the time, they could handle the problems that arose. This scouting for of resources was our first effort to assign PACS employees and seemed a good concept, but it did not go without resentment from the areas that had lost a FTE from their service for the purpose of accommodating the PACS service. After-hour call coverage was paid to help supplement the first PACS employees' salaries, since Human Resources Compensation graded their duties of "Digital Imaging Specialist" as a lateral move from their prior jobs and gave no pay increase. As the months passed and these employees gained experience with the PACS equipment and expansions, the job classification caused resentment and motivated more than one employee to leave. In fact, one employee applied for a secretarial job because it was graded higher!

The next job description created was one called "PACS Analyst." The qualifications and duties were largely plagiarized from the job description for the "Radiology Information System (RIS) Analyst," which had likewise been plagiarized from a job description for an "Information System Analyst" in the Information Services (IS) Department. This position was graded much higher by Human Resources, resulting in disputes over whether prospective candidates were qualified.

Another staffing tactic that has not yet been successful is creation of the "PACS Technologist." This radiographer would be shared between the Radiology Department and PACS. It was originally intended that they would perform examinations, do routine quality assurance and image accountability functions, and when problems arose, be the first response in troubleshooting. Problems that could not be corrected by the PACS Technologist would be escalated to the PACS Analyst. This was a good concept until the written job description was submitted to Human Resources Compensation for grading. The job was graded at the same rate as a beginning Radiographer, so no one ever applied. From one perspective, the job could have been viewed as an internship position to the PACS Analyst position, although that is not what was intended, because the Technologist skill set and the Analyst skill set are extremely different.

By 1998, we had a PACS Coordinator, a volun-

teer Ultrasound Team Leader still responsible for six Sonographers, two PACS Analysts, and a Radiologic Technologist transferred from another service.³

Restructuring the PACS Staff

The PACS Coordinator was the first position that was significantly modified. The position was assigned to report directly to the Chief of Radiology. This placed the coordinator in a position outside the hospital staff hierarchy, and relieved undue influence of hospital politics. This also allowed the coordinator to deal directly with radiologists and clinicians as a peer. This change allowed the Neuroradiologist who served as the Medical Director for PACS to recover some of his time. The change in the role of the PACS Coordinator created more responsibilities for the hospital PACS staff to assume the hands-on work on the PACS and to direct the day-to-day activities of the other PACS personnel.

To facilitate accounting and budgeting for PACS personnel, the Radiology Director eventually assigned the PACS services its own new cost center. The PACS Team was moved from the Administrative Manager to report to the Director, and later to the Assistant Director. This established PACS as a clinical operational service within the imaging department.

Next, the job description for "PACS Analyst" was revised to reflect accurately what was expected of the employee, and to construct it in such a way to be graded appropriately by Human Resources. A collection of job descriptions with similar functions was gathered from the IS help desk, workstation support, applications trainer, and RIS. All of these jobs had similar or less demanding functions as the PACS Analyst with a higher grade of pay. This collection of job descriptions helped decipher the code that our Compensation Committee uses to establish grades. The new job description was resubmitted and this time Human Resource Compensation graded it seven steps higher, with a substantial pay increase. By the time this compensation inequity was rectified, we had lost four PACS Analysts to higher paying jobs in the Information Technology industry in a single year. In addition, we lost their corporate memory and our investment in their technical training. Our intent to provide a career ladder within PACS never really materialized. In a small, relatively flat

organization, there is little room for advancement, especially in comparison to opportunities available internally within IS and externally within the booming Information Technology marketplace.

During fiscal year 2001, we completed the third phase of our 5-year PACS Project Plan. This involved installing viewers and CR equipment to support our Intensive Care Units. This provided justification for 24-hour, 7-day-a-week PACS help-desk staffing. Also, new job descriptions were created for a PACS Manager, a PACS Team Leader, a PACS Secretary, and an Applications Trainer. Although the Team Leader was not approved for the fiscal year, the PACS Manager, PACS Secretary, Applications Training Coordinator, and additional PACS Analysts were authorized. When all current positions are filled, there will be seven PACS Analysts and one PACS Technologist to operate our PACS.

EDUCATION AND TRAINING

Each newly hired PACS Analyst must attend two mandatory formal training courses: the vendor's System Administrators course and a course on the the Digital Imaging and Communications in Medicine (DICOM) Standard. While these courses certainly help with the fundamentals of the job, most of the actual training is on-the-job. New employees receive a site diagram and a rotation schedule of 2 hours through each of the services in Radiology. This acquaints everyone and provides first-hand knowledge of how each service's clinical operations are performed. These rotations provide the PACS Analyst the chance to see how an examination is ordered, acquired, archived, displayed, and interpreted. This perspective on clinical operations and personalities is extremely valuable in conducting PACS operations.

SERVICE

The PACS Analysts cover service for a help desk whose telephone number is posted at every viewer. They also provide training for all users, both on the web-based viewers and the review stations. After training is completed, the trainee signs a confidentiality statement form, and a user profile is then established. Our current user profiles include 650 web users and more than 300 review station users.

The vendor has provides two on-site Site Application Specialists (SAS) who have service respon-

sibilities for maintaining the PACS that are unique from the PACS Analysts. Their job is to perform routine maintenance on equipment, install, configure, handle, and test new software and hardware implementation, and install and test software patches and upgrades. Other duties of the SAS include unscheduled maintenance, such as releasing cassette jams, interpreting and clearing error codes, troubleshooting, and repairing or replacing defective components. The SAS helps to coordinate remote service from our vendor technical support because the SAS knows our site configuration and is responsible for the system's up-time. This division of labor also allows the PACS Analysts to escalate problems to the SAS when they are unable to resolve them, and to resume their other duties.

EXPANSIONS

Our hospital has added 15 additional floors to its main building, doubling the square footage of our Nursing Units. An outpatient treatment center will soon open, and three new outlying Health Centers have opened. None of these expansions of services was anticipated in our 5-year PACS plan, and they were not factored into our staffing projections.

While the expansion of services on-campus poses one set of problems, supporting the Health Centers involves geographic challenges: the closest one of these centers is 20 miles away. Each of the Health Centers transmits images to the hospital for interpretation over a single dedicated T-1 line. When the transmission of these images is inter-

rupted, the PACS Analyst must attempt to solve the problem remotely via telnet. Problems that cannot be fixed remotely demand that the PACS Analyst travel to the site, or initiate a service call with the PACS vendor. Supporting the Health Centers is likely to impact staffing because current plans include two additional Health Centers for a total of five during this fiscal year.

CONCLUSIONS

Determining the appropriate number of PACS FTEs varies from one health care enterprise site to another. The number of PACS FTEs is driven by the scope and size of current and planned clinical operations, the degree of support provided by the vendor, and by user expectations. Our hospital has extremely low toleration of delays that affect patient care. Our physicians have quickly forgotten that in the past a significant part of their day was spent hunting films: they have become accustomed to getting images within minutes.³ Providing rapid technical intervention around-the-clock requires a larger head-count. Our PACS staff requires a full-time Manager who can plan and direct operations, staffing, and budgeting. Our medical staff requires a full-time Coordinator, who can assure that PACS adequately supports the practice of medicine. A full-time Training Coordinator should allow the PACS Analysts to devote more of their time to their primary function, system administration. In an expanding health care enterprise, the appropriate size of the PACS staff is a "moving target."

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