Significant Savings in Radiologic Report Turnaround Time After Implementation of a Complete Picture Archiving and Communication System (PACS)

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One of the important advantages of the picture archiving and communication system (PACS) is the time saved in comparison with the conventional system. A group of 100 radiologic studies done in a conventional radiology department is compared with another group of the same number done in a completely filmless PACS department to assess the difference in the radiologist report turnaround time. There was a statistically significant ($P < .00001$) decrease in the median imaging-to-dictation time (IDT) of the PACS group (3 hours and 40 minutes) in comparison with the pre-PACS group (25 hours and 19 minutes). This can be attributed to the fact that PACS eliminates all the workload associated with hard copy films, thus, improving the department's efficiency and decreasing the number of lost films.

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KEY WORDS: picture archiving and communication system (PACS), radiology information systems, computer systems.

PICTURE ARCHIVING and communication system (PACS) is a hardware and software package that acts as a digital image management system in the health institute. It enables the radiologists and clinicians to retrieve and view a radiologic image at computer workstations throughout the institute.¹⁻⁴ In the conventional system, the film acts as the unique image document used for image capture, viewing, and storage. Eliminating films from the radiology department is one of the most important features of PACS. By doing so, PACS eliminates all the film-associated workload. This includes film processing, filing film folders, and retrieving previous studies from film stores. Time spent on these steps constitutes a considerable part of the total radiology turnaround time.⁵ Further delays could be caused by losing films or having them taken by the clinicians before being reported. That is why PACS is expected to reduce the report turnaround time significantly even in the most efficient radiology department.⁵⁻⁸

The radiology department of the Adelaide & Meath Hospital, Incorporating the National Children's Hospital (AMNCH) is the first in Ireland to install and operate a complete PACS. The PACS was installed in the new hospital in Tallaght and started operating the day of hospital opening on

June 21, 1998. An average of 300 studies are performed daily in this department.

The current study was planned with the aim of evaluating the effects PACS implementation in our department might have on radiology turnaround time.

MATERIALS AND METHODS

A total of 200 radiologic examinations performed in the radiology department of the AMNCH hospital were analyzed. One hundred of these examinations were done in the pre-PACS department in May 1998; the rest were done in the PACS operated department in November 1998 4 months after moving to the new hospital. The distribution of the studies by imaging modality was comparable between the 2 groups and represented the actual department's study mix. Three radiologists reported on the same type of studies in both groups.

Forms were distributed for every examination recording the dates and times from the patient's arrival into the department to the time the report was typed. The time intervals between imaging to dictating the report (imaging-to-dictation time, IDT), and then to typing it (dictation-to-typing time, DTT) were computed. The IDT is the main outcome of this analysis. DTT is used as an internal control in this analysis because there was no significant changes involving typing dictated reports in the new department.

The statistical significance of the differences between the 2 subgroups were then assessed using the Wilcoxon rank-sum (Mann-Whitney) test, for the differences between the medians of IDT and DTT, and a χ^2 analysis for the differences between proportions. A 2-sided P value of less than .05 was considered to indicate statistical significance. Data entry and analysis were performed using Microsoft Excel⁹ and the statistical package Stata (Stata Corp, College Station, TX).¹⁰

RESULTS

Table 1 shows the median, upper and lower quartiles of the IDT and DTT before and after

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Table 1. IDT and DTT Before and After Installing PACS

	Pre-PACS (n = 100) hh:mm	PACS (n = 100) hh:mm	P*
ITD			
Median	25:19	3:40	<.00001
Q1	5:07	1:55	
Q3	68:04	20:55	
DTT			
Median	3:23	2:55	.4444
Q1	1:22	2:00	
Q3	17:01	17:01	

*Two-sample Wilcoxon rank-sum (Mann-Whitney) test.

implementing PACS. There was a statistically significant ($P < .00001$) decrease in the median IDT of the PACS group (3 hours and 40 minutes) in comparison with the pre-PACS group (25 hours and 19 minutes). However, there was a smaller decrease in the DTT, which was not statistically significant ($P = .4444$) (Table 1).

In the PACS group, 59% of the studies were dictated on the same day of the examination and 96% by the next day (Table 2). The corresponding figures for the pre-PACS group were 32% and 61%, respectively. All the studies in the PACS group were dictated within 2 days from imaging compared with 73% in the pre-PACS group ($\chi^2 = 39.98$, $P < .0001$).

DISCUSSION

In this study, we assessed the effects PACS implementation might have had on the reporting time in our department. There was a 6-fold decrease in the reporting time in the new department. The typing time, which served as an internal control in this analysis, remained essentially the same.

Our experience is different from that of other PACS departments in which PACS usually is implemented in a step-by-step manner. In our case,

the department was relocated to a new hospital building where PACS was preinstalled, which makes any before and after comparison not a straightforward task. Changes involving factors other than PACS, eg, number of staff, workload, workflow, case mix, or imaging equipment could possibly account for the demonstrated improvement in reporting time. However, in this particular case, there was no change in the numbers of radiologists, secretarial staff, the case mix or the imaging equipment used. There was a small (7%) decrease in the average number of studies per month in the new department, but this factor alone cannot explain the large improvement seen in this analysis.

These results are consistent with the findings of Mattern et al¹¹ who found a 3.7-fold decrease in the average radiology interpretation time after implementing PACS. Tamm et al¹² reported a smaller decrease in the mean report time after a limited PACS implementation. They attributed the improvement to "a decrease in both the number of cases dictated the day following their completion and the number of outliers (markedly delayed dictations). The decrease in outliers is probably due to a decrease in the number of 'lost' film-based studies." In our case, the percentage of studies dictated more than 2 days after performing the study decreased from 27% in the pre-PACS department to none after moving to the new department. This can be attributed to the fact that PACS eliminates all the workload associated with hard copy films, thus improving the department's efficiency and also decreasing the number of lost films.

This study shows that PACS has significantly reduced the imaging-to-dictation and, therefore, the time required to make the report available to the referring clinician.

Table 2. The Distribution of Radiologic Studies According to the Number of Days Between Imaging and Report Dictation

Report Dictated	Pre-PACS		PACS		Total	
	No.	Cumulative Frequency (%)	No.	Cumulative Frequency (%)	No.	Cumulative Frequency (%)
On the same day	32	32	59	59	91	45.5
1 day later	29	61	37	96	66	78.5
2 days later	12	73	4	100	16	86.5
More than 2 days later	27	100	0	—	27	100
Total	100	—	100	—	200	—

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