Use of Productivity and Financial Indicators for Monitoring Performance in Academic Radiology Departments: U.S. Nationwide Survey

PURPOSE: To determine how productivity- and finance-related indicators are used by radiology departments to evaluate departmental performance.

MATERIALS AND METHODS: The study met the criteria to be exempt from institutional review board approval. All subjects were informed of the purpose of the study and that their questionnaire responses would be kept confidential. For the study, a survey was sent to 132 members of the Society of Chairmen of Academic Radiology Departments (SCARD) nationwide. The survey was designed to (a) assess organizational information about hospital and radiology departments, (b) determine the types and mean numbers of productivity and financial indicators used by radiology departments, (c) determine how these indicators are used to influence departmental productivity, and (d) assess the reference-standard goals with which each indicator value was compared. A total of 77 variables were studied. Summary statistics, Spearman rank correlation coefficient, and \( \chi^2 \) analyses were performed.

RESULTS: The response rate was 42% (55 of 132 surveyed SCARD members). The mean number of productivity indicators used by radiology departments was 4.55 \( \pm \) 2.56 (standard deviation), while the mean number of financial indicators used was 2.89 \( \pm \) 1.99. Twenty-two (40%) of the 55 responding departments used productivity indicators to monitor and provide feedback to radiologists, hospital leaders, and technical staff members for improved productivity, but only 11 (20%) departments used these indicators to compare personnel performances against specific productivity standards. The most frequent goal (of seven [13%] responding departments) of using the indicators was to increase the examination volume from the previous year by 5%–10%.

CONCLUSION: Academic radiology departments across the United States do not use a standardized set of productivity and financial indicators to measure departmental performance. Examination volume is the most frequently used productivity indicator, whereas general expenses are commonly used as indicators of financial status.

Today the field of radiology is faced with the challenges of increasing service use, declining reimbursements, and staff shortages (1,2). In such an economically challenging environment, it becomes crucial for radiology departments to monitor their performance so that they can provide a high quality of services while staying within operational boundaries. However, health care is still a major industry in which no unanimously accepted indicators are used to define and measure the quality of services (3). By default, the traditional approach has been to use easily measurable units, such as those related to finance, as...
MATERIALS AND METHODS

A multiinstitutional study survey of academic radiology departments across the United States was conducted from May 2002 to November 2002 (8). The study met the criteria to be exempt from approval by the institutional review board of Brigham and Women’s Hospital. All subjects who were sent the questionnaire were informed of the purpose of the study and that their responses would be kept confidential. To maintain confidentiality, all responding hospitals were assigned an identification number by the webmaster of Brigham and Women’s Hospital, and the study investigators were allowed to access only the final database by using these identification numbers. All of the authors reviewed the questionnaires. Details of the survey design have been described previously (8). Some of the terms commonly used in this article are defined in the Appendix.

Financial Indicators

Statistical Analyses

Throughout this article, the 55 respondents are referred to as hospitals, radiology departments, or members of the Society of Chairmen of Academic Radiology Departments (SCARD). The overall response rate was 42% (55 of 132 surveyed SCARD members). Most of the respondent hospitals were located in the Northeast (20 [36%] of 55) and Midwest (18 [33%] of 55). Additionally, eight (14%) of the 55 hospitals were located in a Southern region; five (9%), in a Southwest region; and four (7%), in a Pacific region. Thirty-two (58%) of the responding hospitals had more than 500 beds in operation, while 21 (38%) had between 200 and 500 beds in operation. Two (4%) responding hospitals had fewer than 200 beds in operation.

The staff of 28 (51%) of the 55 responding radiology departments performed between 200 000 and 400 000 examinations annually, while the staff of 14 (25%) radiology departments performed between 100 000 and 199 999 examinations annually. Of the 55 responding departments, 10 (18%) performed more than 400 000 examinations each year, while three (5%) performed fewer than 100 000 examinations each year.
TABLE 1
Radiology Department Use of Productivity versus Financial Indicators

<table>
<thead>
<tr>
<th>Financial Indicators Used</th>
<th>Productivity Indicators Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>43</td>
</tr>
<tr>
<td>No</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
</tr>
</tbody>
</table>

Note.—Data are numbers of surveyed radiology departments that reported using or not using given indicators.

Number of Indicators

The numbers of productivity indicators used by the departments ranged from zero to nine (mean, 4.55 ± 2.56 [standard deviation]). To monitor financial status, the departments used between zero and seven financial indicators (mean, 2.89 ± 1.99).

The numbers of productivity and financial indicators used were moderately correlated (r = 0.51, P < .001). Furthermore, the number of productivity indicators used correlated minimally with the number of radiologic examinations performed (r = 0.19, P > .05), the number of FTE employees (r = 0.14, P > .05), and the number of hospital beds in operation (r = 0.15, P > .05).

Productivity Indicators

Distribution of indicators.—Among the productivity indicators reportedly used, examination volume and examination volume per modality each were used by 43 (78%) of the 55 responding departments. Professional RVUs and professional RVUs per FTE employee were used by 32 (58%) and 31 (56%) departments, respectively. Indicators such as gross charges per modality and collections by FTE employee were used by 29 (53%) and 27 (49%) departments, respectively. Other indicators such as technical RVUs, technical RVUs per FTE employee, and examination volume by resource or device were used by 16 (29%), 12 (22%), and eight (14%) departments, respectively. Three (5%) of the 55 responding departments did not use any productivity indicator (Table 1).

Frequency of monitoring.—Among the responding departments that used productivity indicators, 47%–79% of them monitored these indicators on a monthly basis. Among those indicators that were monitored weekly, biweekly, and monthly, examination volume and examination volume per modality were the most frequently monitored (Tables 2, 3). Among the indicators that were monitored quarterly, professional RVUs and professional RVUs per FTE employee were the most frequently monitored.

Usefulness of indicators.—The indicators found to be the most useful by the departments were examination volume per modality and professional RVUs per FTE employee, as stated by 28 (51%) and 27 (49%) of the 55 responding departments, respectively. Two (4%) departments reported technical RVUs to be the most useful, and four (7%) departments reported examination volume (RVUs per collections) by resource or device to be the most useful. Only one of the 55 responding departments reported that none of the indicators were useful.

Eleven (20%) of the 55 responding departments used the indicators for monitoring and providing feedback to radiologists, hospital leaders, and technical staff members to improve productivity and applied standards of reference with which to compare the indicator values. Twenty-two (40%) responding departments used indicators to monitor, provide feedback, and improve productivity but did not apply standards of reference for comparison, while 10 (18%) departments used indicators for monitoring purposes only, without providing feedback or comparing the indicator values with any reference-standard goals.

In terms of examination volume, as well as technical and professional RVUs, the most common goal was to see growth as well as technical and professional RVUs, while six (11%) used it for technical and professional RVUs. Other goals included information regarding productivity indicators. These sources included the Medical Group Management Association, the Radiology Business Managers Association, the Association of Administrators in Academic Radiology and Radiation Oncology, Healthcare Benchmarking Systems International, the University Health System Consortium, and the Association of American Medical Colleges.

Use of indicators.—The type of productivity indicator used did not vary significantly according to hospital location, hospital size, or radiology department size. Those departments that monitored examination volume and examination volume per modality to improve productivity, as well as compared the values of these indicators with specific reference-standard targets, differed significantly from those departments that used these indicators for productivity monitoring only, without comparing them against reference-standard goals (P < .001). This was true of even those departments that monitored technical RVUs (P = .013), professional RVUs (P = .001), technical RVUs per FTE employee (P = .017), and professional RVUs per FTE employee (P = .015).

Whether a department communicated the information regarding the productivity indicators or benchmarked these indicators, and the individual(s) to whom the indicator information was communicated did not vary significantly according to hospital location, hospital size, or radiology department size. However, there was a significant relationship between the numbers of productivity indicators used and both the communication of indicator information and the individual(s) to whom the information was communicated (P < .04). Compared with the departments that used fewer than five productivity indicators, those departments that used five or more indicators to monitor productivity were more likely to communicate the information to all of the following: hospital leaders, other radiologists, and technical staff members.

Financial Indicators

Use of indicators.—The type of financial indicator used by the departments did not vary significantly according to hospital regional location, hospital size, or number of radiologic examinations performed annually.

Distribution of indicators.—The financial indicators used most frequently were general expenses, which were used by 37 (67%) of the 55 responding departments, and number of charges spent in accounts receivable, which were used by 36 (65%)
responding departments. The indicator collections by modality was used by 30 (54%) responding departments, while average number of RVUs per examination was monitored by 16 (29%) departments. Fourteen (26%) responding departments used costs per RVU as an indicator, while 10 (18%) and seven (13%) departments, respectively, used number of worked hours per RVU and supply costs per RVU as financial indicators (Table 4).

Frequency of monitoring.—Almost all of the responding departments monitored the financial indicators monthly or quarterly (Figs 1, 2). Only one of the 55 responding departments monitored collections by modality on a biweekly basis.

**DISCUSSION**

The field of radiology is continuously growing. Radiology departments need to increase their examination volumes and improve efficiency. These goals necessitate regular monitoring of performance and better management of departmental work flow processes.

The results of our survey show that the most common indicators used to monitor productivity were those related to examination volume and RVUs. Although most departments use resource-based RVUs and examination volume as the indicators to measure radiologist workload (9,10), these indicators have drawbacks. Examination volume is not a uniform unit of work and cannot be used to compare productivity across departments. Thus, the value of this indicator is limited, and, consequently, many radiology facilities currently use the RVU—a measurement designed to indicate a physician’s work activity in uniform units—as an indicator to measure productivity (11).

Previous study results have shown that RVUs are generally not comprehensive measures of a radiologist’s clinical productivity (9,11–13). These units indicate only that portion of the clinician’s workload that is related directly to patient care. RVUs fail to indicate other activities, such as continuing education, research, participation in conferences, and administrative duties (9). Although these activities are not directly measurable in terms of clinical productivity, they constitute an important part of the radiologist’s workload and thus need to be incorporated into the evaluation of radiology staff performance.

Our study results show that there was no comprehensive set of indicators reflecting all aspects of the radiologist’s workload that was used unanimously by all departments. There also was no com-

| TABLE 2  
Radiology Department Monitoring of Productivity Indicators |
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<tbody>
<tr>
<td>Indicator</td>
</tr>
<tr>
<td>Examination volume</td>
</tr>
<tr>
<td>Examination volume per modality</td>
</tr>
<tr>
<td>Technical RVUs</td>
</tr>
<tr>
<td>Professional RVUs</td>
</tr>
<tr>
<td>Professional RVUs per FTE employee</td>
</tr>
<tr>
<td>Gross charges by modality</td>
</tr>
<tr>
<td>Collections by FTE employee</td>
</tr>
<tr>
<td>Examination volume by resource or device</td>
</tr>
</tbody>
</table>

Note.—Data are numbers of surveyed radiology departments. Numbers in parentheses are percentages.

| TABLE 3  
Productivity Indicators Ranked as Top Three Most Frequently Monitored according to Frequency of Monitoring |
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Monitoring Frequency</td>
</tr>
<tr>
<td>Weekly Examination volume per modality</td>
</tr>
<tr>
<td>Biweekly Examination volume, examination volume per modality</td>
</tr>
<tr>
<td>Monthly Examination volume</td>
</tr>
<tr>
<td>Quarterly Professional RVUs</td>
</tr>
</tbody>
</table>

Note.—In some cases, two indicators were found to be the most or the third most frequently monitored indicator.

| TABLE 4  
Relative Frequencies of Radiology Department Use of Financial Indicators |
<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Indicator Used</td>
</tr>
<tr>
<td>Expenses</td>
</tr>
<tr>
<td>Charges spent in accounts receivable</td>
</tr>
<tr>
<td>Collections by modality</td>
</tr>
<tr>
<td>Average no. of RVUs per examination</td>
</tr>
<tr>
<td>Cost per RVU</td>
</tr>
<tr>
<td>Worked hours per RVU</td>
</tr>
<tr>
<td>Supply cost per RVU</td>
</tr>
</tbody>
</table>

* Frequency percentages calculated by dividing the number of departments that used the given indicator by 55, the total number of departments.
Radiology

Figure 1. Relative frequencies of financial indicators that are monitored monthly or quarterly. Graph shows numbers of surveyed departments that monitored the various financial indicators monthly or quarterly. A greater number of departments monitored each indicator monthly rather than quarterly.

Figure 2. Means and 95% confidence intervals (CI) of time spent monitoring productivity indicators. Graph shows average numbers of hours per week, and corresponding 95% confidence intervals, required by the departments to monitor productivity indicators, presented according to hospital location. Regional locations are as follows: 1 = Pacific, 2 = Southwest, 3 = Midwest, 4 = Northeast, 5 = South.

This information obviously needs to be relayed to departmental administrators to help them choose the changes in the work flow processes that are necessary to enhance productivity. The inadequate communication of this information, as evidenced in our study, suggests that the decision-making processes in these departments may be based on insufficient data and may not involve all concerned stakeholders.

Some potential limitations of our study were as follows: (a) the potential bias in the selection of indicators for the questionnaire, (b) the inclusion of only academic radiology departments in the survey, and (c) the response rate. To our knowledge, there was no unanimously accepted set of indicators used to measure radiology performance published in the literature. However, there may be other performance indicators that are monitored by other radiology departments that were not included in our survey. The study was performed in academic centers, and the performance indicators that are relevant in these settings may be different from those used in private practices. We would have to take this fact into account before extending these study results to nonacademic settings.

In conclusion, our study results suggest that most academic radiology departments in the United States do not use a comprehensive set of indicators to monitor productivity and financial status. The indicators most commonly used by academic radiology departments to monitor productivity are examination volume and RVUs, and those used most commonly to monitor financial status are general expenses. These indicators, although useful, have limited value when they are used alone. Hence, it is necessary for radiology departments to use a set of indicators that sufficiently encompasses all aspects of the radiologist's workload. According to our findings, as the next step, it would be useful to develop a "dashboard" of such indicators that could be used uniformly by all radiology departments. The use of a dashboard of indicators would enable a systematic view of a department's level of functioning—from the point of first contact between the physician and the patient to the patient's discharge. It would also facilitate quicker understanding of trends, problems, and opportunities within the department. Dashboards would enable objective comparisons of departmental performance across the country. Further research to evaluate and recommend the appropriate frequency with which to monitor each of these indicators also is necessary.

Finally, we would like to reemphasize the importance of benchmarking these indicators and communicating this information to departmental decision makers. Following the principles of continuous quality improvement, this feedback is essential to helping administrators make the right decisions to increase productivity and identify opportunities for improvement.

APPENDIX

Benchmark: comparative standard value against which other indicator values may be compared. This value is calculated by using academic specialty–specific billing data to determine statistical comparisons.

Cross-sectional survey: research design in which individuals or events are compared in terms of one or more variables at the same time.

FTE: percentage of full time a provider spends in billable clinical activity.

Management performance indicators: indicators used for management of departmental activities to improve performance.

RVU: nonmonetary unit of measure used to express the time, complexity, and cost of performing a given service relative to other procedures.

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References