Resource Requirements for Evaluating Ambulatory Health Care

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Abstract: We implemented the most frequently used form of quality assurance activity: abstracting information on the quality of patient care from medical records and communicating findings to providers in 16 ambulatory care groups. Site providers accepted the evaluation criteria, agreed that deficiencies in care were detected, and, for some medical tasks, effected improvements in care. Direct costs in 1980 dollars for the quality assurance cycle including data system development were $46 per evaluated case. Per-case costs varied considerably among tasks, decreased with larger numbers of cases and as experience grew, and were reduced through computerization. Measured costs were high due to: a demanding research design; our extended accounting of direct, indirect, and induced costs; and the substantial resource requirements of rigorously performed evaluations. (*Am J Public Health* 1984; 74:1244–1248.)

Introduction

Identification of serious correctable deficiencies in patient care[1–10] led to mandatory programs to assure the quality of care—applied first to hospitals,[11–13] then to ambulatory care.[14–18] For ambulatory care, these requirements have been made without explicit attention to economic issues—either in terms of recognizing the magnitude of resource requirements or indicating how these resources were to be obtained. Not surprisingly, both anecdotal accounts and formal studies have indicated that quality assurance actions often were ineffective.[19–22] Ambulatory health care facilities are felt still to lag behind acute care hospitals in organizing quality assurance activities.[23]

While the effectiveness of programs of quality assurance is becoming better understood, documentation of costs remains rudimentary. The 1979 PSRO Program Evaluation, one of the few studies to attempt comparing benefits and costs of quality assurance, concluded that "the data and the findings of this study are separated by several layers of assumptions and approximations."[24] We report here the results of a study designed, in part, to focus on the costs of quality assurance: what the resource requirements are; how the costs are affected by the characteristics of ambulatory care settings; and what steps might be taken to limit costs.

Research Methods

Study Design

The Ambulatory Care Medical Audit Demonstration (ACMAD) Project implemented and evaluated quality assurance activities using written medical records to determine whether explicit criteria were being met and to guide corrective actions.[25–27] This strategy of quality assurance continues to be commonly mandated and pursued.[15–17] Eight medical tasks were studied in 10 sites—four hospitals and six neighborhood health centers. Four of the tasks were in adult medicine:

- follow-up of low hematocrit
- screening tests for women aged 25 to 65
- follow-up of abnormal serum glucose
- monitoring of patients on digoxin.

The four pediatric tasks were:

- follow-up of positive urine cultures
- well-child care for children aged 12 to 18 months
- initial visits for gastroenteritis
- follow-up of otitis media.

Each of the four hospitals served as a site for studying either the adult or the pediatric tasks. Both sets of tasks were investigated at all six neighborhood health centers.

A balanced concurrent crossover design was applied with random assignment to intervention and control status for each task. Intervention consisted of four steps: 1) naming of evaluation; 2) presentation of evaluation criteria for discussion and ratification; 3) feedback to providers of findings for their own cases and of overall site performance; and 4) corrective action. In each of the first three steps, mailings were sent to providers and meetings held with them; the fourth step was at the discretion of the sites.

Case finding was based on manual review of laboratory logbooks and on computerized searches of billing records, with back-up use of patient rosters, appointment books, and encounter forms. Case finding, followed by abstraction, was pursued until either 38 eligible episodes per audit period (three months) were abstracted, or all eligible episodes had been abstracted. The sampling procedure was structured so that all patients treated for relevant episodes at the site within the three-month period were equally likely to be audited and repeat evaluation of the same patients across periods was minimized. Information from abstracted patient records was fed back to providers on their performance on individual and group bases and used to judge the effectiveness of evaluations in improving provider behavior. To verify the accuracy of the abstraction, a randomly selected 5 per cent of the abstracted sample was reabstracted.

Cost Analysis

Cost analysis focused on budgetary direct costs, nonbudgetary direct costs, indirect costs, and induced costs.

Budgetary direct costs were monies paid out of the project budget for goods and services. All project employees kept cost diaries for all work performed. In these they recorded date, amount of work, the site and task for which the work was done, and whether the work was done for

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operational or research purposes. These figures were translated into dollars through multiplication by hourly wage rates incorporating fringe benefits. Payments for supplies, travel, photocopying, telephones, and computer services were registered in the same format.[28,29]

Non-budgetary direct costs were contributions in kind by the participating institutions. These included the time of physicians, administrators, and record room personnel, space made available, and uncharged access to telephones, computer terminals, and photocopying. Records were kept of all time spent by employees of the participating sites when meeting with project members. Additional time devoted by site personnel was ascertained by questionnaire. In-kind contributions were valued at the estimated costs to the sites. Space was valued at prevailing neighborhood rates ranging from $5 to $12 per square foot per year.

Indirect costs were the costs of institutional overhead.

Induced costs were the changes in actions of physicians and of other site personnel effected by the project. These costs were estimated through interviews with site personnel.

Results

Cost Totals

Budgetary direct costs over the operational phase of the ACMAD Project from August 1978 through June 1982 (excluding the final 15 months devoted entirely to research) amounted to $955,000. Wages and salaries accounted for $773,000 and nonpersonnel items for $182,000. The estimated value of in-kind contributions by the sites was $45,000. Indirect costs averaged 57 per cent of the budgetary direct costs.

Sixteen groups—one at each of the four hospitals, plus separate adult and pediatric groups at the six health centers—estimated induced costs. Eleven of the 16 groups judged that the project had led to more nurse practitioner consultations with physicians; ten groups judged that it had led to higher rates of physician-physician consultation; three, to more time in taking patient histories; two, to increased time for patient examinations; nine, to more time for follow-up; and eight to more recording of clinical reasoning and treatment plans. Over the study period, the average number of lines written per case in the medical records for the control tasks declined from 22.3 to 19.3 and rose for the experimental tasks from 22.0 to 25.0. The difference of 6.0 (= (25.0 − 22.0) − (19.3 − 22.3)) is statistically significant ($p = 0.001$).

Cost Components

Comparison of resource requirements across medical tasks is shown in Table 1. The first three columns display the numbers of minutes devoted to record abstraction, data entry, and case finding per audit-eligible case. These time requirements are reported on a per-case basis because of their marginal nature: to increase the numbers of audited cases would raise total costs for these three activities. In contrast, the costs of computer programming are fixed for each medical task: once the programming for a task has been completed, its costs will not rise with greater numbers of cases. Accordingly, the fourth column displays total costs of programming assignable to specific tasks. Charges for the computer time itself amounted to $80,600. The numbers of audited cases are in the fifth column. Column six displays all direct costs—both budgetary and non-budgetary—of the project as allocated to the various tasks. Research costs (those entries in the personnel diaries recorded as performed only because of the research nature of the project) are excluded from Table 1. Costs (such as those of central project administration) not assigned directly to tasks have been allocated on a prorated basis to the various tasks and are included in column six.

Table 2 shows the allocation to various work activities of $577,000 in wages and salaries of the project: the $773,000 paid during the operational phase of the project, less $160,000 devoted to research activities, less $36,000 allotted to efforts on a ninth medical task and in an eleventh site that could not be pursued to completion. The first column of Table 2 shows the wage and salary payments for different work activities as recorded in the personnel diaries; the second column re-expresses this activity in terms of percentages. Numbers of hours devoted to the different activities are in the third column, which when divided into the wages and salaries yield the pay rates per hour shown in the fourth column. Expenditures per audited case on the various activities are listed in the fifth column.

Costs Across Tasks

The most expensive task shown in Table 1 is hematocrit follow-up. Its case finding required manual examination of many laboratory slips; its abstraction form was long, demanding that many pieces of information be recorded and later entered into the computer. Only 6.3 per cent of the case finding was computerized—a figure that is second lowest to the 5.0 per cent of computerized case finding for the urine culture task and that contrasts sharply with the average of 56.3 per cent over all tasks. Nearly as expensive was digoxin monitoring, which had extensive case-finding lists and long abstract forms. It also required examining the records of many patients with heart disease who would on inspection prove inappropriate for the evaluation because digoxin had not been prescribed for them. Moreover, omissions of ICD (international classification of diseases) codes from case billing tapes at times necessitated extensive back-up case finding. The hematocrit and digoxin tasks had lowest proportions of case-found records proving to be audit-eligible: 28 and 31 per cent, respectively. Programming costs were highest for well-child care which involved complexities in assessing the adequacy of growth charts and in assuring the accuracy of data entry.

The least expensive evaluation per case was glucose follow-up. Appropriate cases could be found with relative ease as 93 per cent of its case-found patients were audit-eligible and the abstract form was relatively simple. Screening women age 25–65, and follow-up of otitis media were the next least expensive tasks—due, in part, to their saving of costs of case finding through computerization and to their large numbers of audited cases. Table 1 shows that the costs of case finding can vary by more than a factor of 10—depending largely on whether it may be done by computer.

Costs of Work Activities

Table 2 shows that the direct audit activities of case finding, chart pulling, data entry, programming, and record abstraction accounted for 51.2 per cent of operational wages and salaries. The remainder was paid for support activities. Meetings constituted the most expensive of these activities and included formal group meetings with providers at the sites, other encounters with site personnel, and meetings among ACMAD Project employees. The pay rates per hour (Table 2) indicate the extent to which higher paid classes of personnel became involved in the activities. The relatively low rates of pay for case finding, chart pulling, data entry,

TABLE 1—Resource Requirements of Quality Assurance Activities for Different Medical Tasks, ACMAD Project

Task	Minutes Spent by Project Personnel per Audited Case on:			Costs of Computer Programming ($1000)	Number of Audited Cases	Total Direct Costs per Audited Case
	Record Abstraction	Case Finding	Data Entry			
Hematocrit	109	52	30	$7.1	1584	$82
Screening, Women	55	7	11	6.5	3100	36
Glucose	45	25	9	5.5	2012	32
Digoxin	135	15	18	6.1	1077	81
Urine Culture	73	43	21	8.2	858	66
Well Child Care	58	3	17	13.4	2661	39
Gastroenteritis	50	6	11	5.6	1294	40
Otitis Media	63	3	10	5.9	2223	36
Total	68	16	15	58.2	14809	46

Minutes spent per audited case include time spent on cases that would prove ineligible for audit. (If 1000 cases for a task were abstracted at an average time of 30 minutes each and if half were ineligible for audit, the time spent per audited case would be 60 minutes.)

The costs of computer programming are amounts actually paid, not adjusted for inflation, and exclude $37,800 in payments that could not be assigned to specific tasks.

Total direct costs per audited case include payments for wages, salaries, services, and purchases and the values of in-kind contributions by participating sites. These figures have been adjusted for inflation to prices and rates of pay prevailing in January 1980.

and record abstraction indicate that these activities were performed by persons without advanced degrees who were specially hired and trained for them. Physicians devoted 4,400 hours to the project: 4,000 by the principal investigator; 400, by site staff members.

Other Factors Affecting Costs

To investigate the simultaneous interaction of task characteristics, site characteristics, computerization, and numbers of cases on per-case costs, we performed multivariate regressions described in the final report of the project.[30] These regressions adjusted for the individual working speeds of project employees, for inflation, and for case finding performed but not used (because of resource limitations). These analyses indicated that all the hospitals were substantially more expensive than the neighborhood health centers; computerization lowered costs; increasing the number of cases significantly lowered per-case costs; adult evaluations were 11 per cent more expensive than pediatric, and laboratory evaluations 53 per cent less expensive than others; and that the second cycle of evaluation (occurring six months after the first) was 22 per cent less expensive.

TABLE 2—Allocation of ACMAD Project Wages and Salaries to the Component Work Activities of Medical Audits

Work Activity	Project Wages and Salaries ($000)	Proportion of Total Project (%)	Number of Hours (000)	Pay per Hour ($)	Cost per Audited Case ($)
Analysis	9	1.5	0.9	9.36	0.59
Case Finding	27	4.7	3.9	6.99	1.85
Chart Pulling	20	3.4	2.6	7.50	1.33
Data Entry	27	4.7	3.6	7.62	1.85
Instruction	10	1.7	1.2	8.39	0.67
Management	24	4.1	2.2	10.72	1.59
Meetings	82	14.2	7.0	11.74	5.53
Planning	15	2.7	1.1	13.72	1.04
Programming	96	16.7	4.1	23.24	6.48
Reading	15	2.6	1.4	11.15	1.02
Record Abstracting	125	21.7	16.7	7.46	8.44
Secretarial Work	36	6.3	4.7	7.60	2.43
Travel	15	2.5	1.7	8.60	0.99
Writing	34	5.8	3.4	9.79	2.27
Other	42	7.3	4.7	8.89	2.85
Total	577	100	59.4	9.71	38.94

Monetary figures are amounts actually paid, unadjusted for inflation. Project funding commenced in August 1978; costs incurred through June 1982 are reflected above. The median payment occurred in February 1981. Wages and salaries allocated to research activities are excluded from this Table.

Discussion

The possibilities for economizing in programs of quality assurance should be pursued, but with an awareness of their limitations. Sites cannot wholly evade responsibilities for quality assurance because of high projected costs. Similarly, a medical task involving multiple visits and substantial abstracting may be relatively expensive yet critical to evaluate. To pare back the costs of evaluations too much will ensure their ineffectiveness and may make them a greater waste than more expensive efforts.

Larger numbers of cases are associated with lower per-case costs because personnel learn how to be more efficient. Further, there are substantial fixed costs entailed in developing the algorithms for each task, in training the abstractors, and in making suitable arrangements with the records departments. We have examined the final column of Table 2 and estimated the extent to which the per-case costs would be incurred in increases in the numbers of cases audited (not at all for analysis, almost fully for record abstraction, and so on). We judge that more cases could have been included in the study at a cost of $20 per case. Over the final 2.5 years of the project, ongoing evaluations were in a routinized, steady-state mode and we appear to have been auditing additional cases at this marginal cost of roughly $20 (1980 dollars) per case.

Computerization—Our initial analyses for feedback to providers, which were done by hand, required 1.14 person-hours per case. The second round of feedback analysis was based on a partially automated system and required 0.93 hours per case. Comparable analysis done at the end of the project required 0.02 hours per case. Wage inflation, the continuing decline in data-processing costs, and the increas-

ing computerization of medical records add to the advantages of basing audits on automated systems.

Evaluation Components—Future medical care evaluations can economize in a limited way by eliminating some of the activities we included. They could, for example, use predeveloped materials and spare themselves the expense of criteria formulation—which would reduce costs by 0.6 per cent. Deleting site enlistment costs would save 0.4 per cent. The project phase of the initial audit interventions accounted for 1.3 per cent of ACMAD wages and salaries; analysis for feedback accounted for 5.9 per cent; the feedback itself, for 4.6 per cent; and quality control activities, for 3.1 per cent. The personnel time and reimbursed fares for travel among the multiple project sites amounted to 2.0 per cent of all direct costs. Evaluations designed only to measure the quality of care and not as a basis for interventions to enhance that quality could reduce costs to 79 per cent of those we experienced.

Sampling Fraction—Sample size significantly affects per-case and total costs. Our sample sizes were chosen to meet criteria of statistical power. Sites planning future activities of quality assurance should determine the scale of their efforts by estimating what is needed to detect deficiencies and to improve care and what the costs would be.

Using Underemployed Resources—The costs of quality assurance may be reduced if underemployed resources—what economists term "slack factors"—are available. For example, medical records personnel who are not fully occupied might be trained to perform case finding, abstraction, and data entry during free moments. Such arrangements require careful implementation and monitoring—without which errors and ineffectual evaluations would result.

Limitations to Cost Savings—Future planners of quality assurance activities will want to know how far the costs of evaluation may be reduced without compromising effectiveness. Our average direct costs of $46 per case may seem high but we would caution against being optimistic about reductions. For each of the more expensive tasks, we could identify complicating factors that increased costs, that would seem to be avoidable in future replications, but that we failed to avoid. Future efforts in quality assurance will also find gaps between the foreseen efficient ideal and actual entropy.

Our experience suggests that computerization, centralization, and sampling a fraction of cases offer greatest promise for controlling costs. The types of quality assurance programs mandated by accrediting bodies should take into account the status of data systems available for case finding, and of medical record systems. Many earlier efforts in quality assurance foundered on the lack of an adequate infrastructure of medical records.[31] Moreover, accrediting bodies might reasonably decide, after reflecting on the costs involved, to require the upgrading of routine data systems before insisting on quality assurance actions. Patient care could thereby be made more efficient, and quality assurance less expensive.

The evidence of learning curves and economies of scale we found indicates that larger, centralized quality assurance operations may have cost advantages exceeding their organizational drawbacks. A health care facility may find it most cost-effective to contract for quality assurance services from a specialized consultant—for basically the same reasons that it contracts for laundry services.

Benefits—This paper does not focus on the effectiveness of the ACMAD Project in enhancing the quality of care. The induced costs of which we have evidence (such as more frequent consultations, longer history taking, longer record entries) indicate greater resource demands and process changes—not necessarily improvements in care. Our analysis of project effectiveness, given elsewhere,[27] found that providers accepted the need to correct revealed deficiencies in care. Clinically significant improvements in care were detected in three tasks. Two of these improvements were statistically significant; the statistical significance of a third was marginal.

Generalizability

The evaluations we performed—using data abstracted from written records to measure compliance with explicit criteria—were the type that continue to be performed to meet accreditation mandates.[32] The patients in our study may have been slightly poorer, sicker, less accessible, and more frequently members of minority groups than the national average for patients at ambulatory care centers. Each of the 16 provider groups had between 5,400 and 32,100 patient visits in 1980, with a mean of 15,300 visits per group. Twenty-three per cent of the patients in the adult hospitals, 60 per cent in the pediatric hospitals, and 35 per cent in the health centers had Medicaid coverage.

The sites were general-practice teaching hospitals and primary-care health centers closely affiliated with the hospitals. Most of the physicians were board-certified general internists or board-certified general pediatricians. The sites had manual, computerized, and hybrid data systems similar to those which most sites for ambulatory care now have and are likely to have for the next few years. Our approach thus differs from other studies, which have predicated quality assurance on expensive, computerized, medical record systems[33,34] of types that many sites could not afford.

All 10 sites were nominally under quality assurance requirements prior to the ACMAD Project. Six had performed formal audits; a few had had informal site reviews; others had done little. The costs of these earlier efforts were not documented but seem to have been substantially less than ours. Because our quality assurance activities were centralized over many sites, there was no correlation between the costs of medical care and of quality assurance across the sites.

For two main related reasons, planners of future quality assurance activities may judge the relevance of our experience to be limited. First, they may reason that our research design forced us to be unreasonably thorough. Second, as a result, the calculated cost of $46 per evaluated case may be thought exorbitant.

Both arguments have some merit. Our research design did force us to be systematic and complete and to persevere with some audits at sites where unfavorable conditions raised costs. We had to obtain data covering 2.5 consecutive years—during which case finding was occasionally made difficult by disorganized records, prolonged unavailability of computer systems, and disruptive switches to new systems. Some programs of quality assurance in the future will be subject to similar circumstances. Our basic strategy—examination of medical records using specified criteria—remains, after a period of slight disfavor,[35] broadly required and implemented.[32,36]

Were our costs impractically high? Perhaps in some cases; not, we would judge, universally. Our reexamination of the 1979 PSRO evaluation[24] indicates that their estimated per-case costs were between $9 and $38—figures that, when adjusted for inflation, are in line with ours. Measured costs

often seem high in part because advocates of programs may make unrealistically low cost projections. They consider such direct and unavoidable costs as those of record abstraction, yet overlook administrative overhead, set-up costs, and unbudgeted contributions, as well as indirect and induced costs. Whether the comprehensive total of costs we have found justifies or precludes implementation of similar programs in the future must be determined through judgmental comparison with the benefits.

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