

“I Wish I Had Seen This Test Result Earlier!”

Dissatisfaction With Test Result Management Systems in Primary Care

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Background: Failure to review and follow up on outpatient test results in a timely manner represents a patient safety and malpractice concern. Therefore, we sought to identify problems in current test result management systems and possible ways to improve these systems.

Methods: We surveyed 262 physicians working in 15 internal medicine practices affiliated with 2 large urban teaching hospitals (response rate, 64%). We asked physicians about systems they used and the amount of time they spent managing test results. We asked them to report delays in reviewing test results and their overall satisfaction with their management of test results. We also asked physicians to rate features they would find useful in a new test result management system.

Results: Overall, 83% of respondents reported at least 1 delay in reviewing test results during the previous 2 months. Despite reporting that they spent on average 74

minutes per clinical day managing test results, only 41% of physicians reported being satisfied with how they managed test results. Satisfaction was associated with fewer self-reported delays in reviewing test results. Physicians who actively tracked their test orders to completion were also more likely to be satisfied. The most highly desired features of a test result management system were tools to help physicians generate result letters to patients, prioritize their workflow, and track test orders to completion.

Conclusions: Delays in test result review are common, and many physicians are not satisfied with how they manage test results. Tools to improve test result management in office practices need to improve workflow efficiency and track test orders to completion.

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FAILURE TO FOLLOW UP ON abnormal test results represents one of the most problematic safety issues in the practice of outpatient medicine.¹ Lack of timely action on test results jeopardizes patients' safety and satisfaction. Although research has shown that both patients² and physicians³ are concerned about this issue, studies⁴⁻⁸ continue to underscore the ongoing need to address this quality gap. Furthermore, failure to make a timely diagnosis has become the fastest growing area of malpractice litigation.⁹ This

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issue is also beginning to receive national attention. For example, the Agency for Healthcare Research and Quality, in an effort to prevent medical errors, now advises patients that “no news (on test results) is not good news”¹⁰ and recommends that they should ensure their physicians review all their test results. In sum, much work remains to be done to ensure safety, effective-

ness, and timeliness in the test result management process.

These quality gaps in the management of test results in the ambulatory setting highlight the need for a critical examination of the systems that physicians use to perform this important task.¹¹ Previous research suggests that these systems may be inadequate. For example, Boohaker et al¹² found that three fourths of physicians did not routinely notify patients of normal test results and that up to one third of physicians did not even always notify patients about abnormal test results. Boohaker et al¹² also found that fewer than one fourth of physicians had a reliable method for identifying patients overdue for follow-up of abnormal test results. A recent analysis of malpractice cases by a large malpractice insurer showed that about one quarter of diagnosis-related malpractice cases can be attributed to failures in the follow-up system.¹³ Taken together, these studies strongly suggest that current test result follow-up systems do not meet the needs of patients and physicians.

As part of an effort to improve these systems, we conducted a survey of attending physicians and house staff to further explore the weaknesses in existing test result follow-up systems and to assess the delays in the review of test results that might be caused by these weaknesses. To assess physicians' readiness to change their existing systems, we also assessed their level of dissatisfaction with their current systems and solicited their views on how to improve these test result management systems.

METHODS

PARTICIPANTS AND SETTING

We mailed surveys to all 173 internal medicine attending physicians and 89 internal medicine house staff practicing in 15 primary care practices affiliated with 2 major academic medical centers and 1 integrated delivery network in Boston, Mass. The practice sites included 8 hospital-based practices, 5 off-campus office practices, and 2 community health clinics. Surveys were administered between October 2002 and December 2002. We mailed nonrespondents a repeat survey 4 weeks after the initial mailing. Institutional review board approval was obtained at both academic medical centers.

All practices had an electronic medical record system that provided full access to the results of all tests performed by laboratories in the 2 major academic medical centers. However, practices maintained different policies and procedures regarding the primary person responsible for result review (ordering clinician vs support staff) and the method of review (online vs paper printouts).

SURVEY INSTRUMENT

The survey consisted of 2 sections. The first consisted of 24 questions that characterized the systems used by health care providers to manage test results. Key elements included whether physicians kept a record of tests ordered, whether they had a system for detecting whether a patient had missed a test, whether a staff member was dedicated to screening results for significant abnormalities, and how they notified patients about test results. We also asked physicians to report the time (in minutes per week) they spent managing test results and their satisfaction (on a 5-point Likert scale) with the way they managed test results in general. To assess significant delays in result review, we asked physicians to report the number of times during the previous 2 months they had reviewed test results that they "wished they had known about earlier." To better understand the workflow used by physicians to manage test results, we asked them to rate how often (on a 7-point Likert scale) they referred to various types of information as they reviewed test results. These included previous test results, patients' problem lists, medication lists, and previous visit notes. To assess ways to improve the current test result management system, we presented to the physicians 9 potential features of an electronic result management tool and asked them to rate (on a 7-point Likert scale) how useful they would find each of them. These 9 features included the following:

1. A single list of all incoming test results
2. Prioritization of results such that abnormal test results are presented before normal results
3. Decision support prompts for abnormal test results
4. Mechanism to acknowledge test results electronically
5. Warning system to detect whether a patient misses a test
6. Letter-writing capabilities with predefined texts

7. Customizable letter templates
8. The ability to send result letters to patients via conventional e-mail, and
9. The ability to send result letters to patients via a secure Web-based patient application.

In the second section of the survey, we presented physicians with a clinical scenario and asked them to describe the actions they would take after receiving a report for an abnormal mammogram that required 6-month follow-up. Respondents could choose from a panel of 13 actions.

Physician practice patterns, including the number of clinical sessions per week and the typical number of patients seen per session, were collected on the survey. Physician characteristics, including sex, year of medical school graduation, and the primary clinic of practice, were obtained from administrative databases in each hospital.

The survey was pilot tested for comprehension and readability with 8 physicians who practiced in 1 of the 15 study clinics. Responses from these 8 physicians were not included in the data analysis.

DATA ANALYSIS

Descriptive statistics for the responses were calculated. The responses of house staff and attending physicians were compared using clustered regression models.

To identify potential strategies for improving physicians' satisfaction with test result management, we examined whether the presence of the various systems used for test result management independently affected physician satisfaction. To accomplish this, we constructed logistic regression models for a dichotomized physician satisfaction score. In constructing the multivariable model, we first assessed the univariate relationship between each item on the survey that reflected the systems used for results management and the dichotomized satisfaction score. We also examined the univariate relationship between each provider characteristic and the dichotomized satisfaction scores to look for potential confounders. To identify the test result management systems that were independently associated with satisfaction, we entered all variables significant in the univariate analyses at $P < .20$ into a multivariable model and eliminated variables in the multivariable model that were neither statistically significant ($P < .05$) nor confounders.

All logistic regression models were constructed using the generalized estimating equations approach to account for clustering within individual clinics. Statistical analyses were performed using SAS statistical software (SAS Institute, Cary, NC).

RESULTS

RESPONDENTS

Of the 262 surveys mailed, 168 were completed and returned, for an overall response rate of 64%. Of the 168 respondents, 76% were attending-level physicians, while 24% were house staff. The response rate was higher for attending-level physicians than for house staff (72% vs 45%; $P < .001$). However, respondents and nonrespondents did not differ statistically by sex (female, 59% and 54%, respectively; $P = .42$, χ^2 test) or number of years since medical school graduation (faculty only, 15.6 and 17.5 years, respectively; $P = .37$, Wilcoxon test). Of the respondents, 51% were in the clinic for 4 or more sessions per week (number of sessions per week was not available for nonrespondents).

Table 1. Systems Used for Test Result Tracking: Faculty vs House Staff

System	Overall, % (N = 168)	Faculty, % (n = 124)*	House Staff, % (n = 40)*	Statistical Comparison (Reference Group = Faculty)
Keeps records of tests ordered	52	52	55	Adj OR = 1.15 (<i>P</i> = .71)†
Has system to detect if patient has missed tests	32	33	28	Adj OR = 0.77 (<i>P</i> = .28)†
Has staff member to review all incoming test results	59	52	80	Adj OR = 3.75 (<i>P</i> = .004)†
Self-reported average time spent on results management (minutes per half-day session)	37	36	40	Difference = 3.7 (<i>P</i> = .86)‡

Abbreviation: Adj OR, adjusted odds ratio.

*Level of training was unavailable for 4 respondents.

†Adjusted for clustering at the clinic-site level.

‡Wilcoxon test.

TEST RESULT MANAGEMENT SYSTEMS IN PLACE

Regarding the systems that physicians used to manage test results, only 52% of respondents reported keeping a record of tests ordered and only 32% reported having a system to detect whether a patient had missed a test (**Table 1**). Most respondents (87%), however, notified patients about normal test results, most commonly by writing to the patient (78%). The responses of attending physicians and house staff were not statistically different.

Only 39% of physicians (n=66) had a mechanism to ensure that a patient with a marginally abnormal mammogram received a follow-up mammogram within 6 months. The mechanisms used varied. Of these 66 physicians, 32 (48%) would make a separate entry in their paper-based result follow-up folder, while 29 (44%) would make an entry in the “to do” list provided in the electronic medical record. Also, 16 (24%) of these 66 physicians took advantage of e-mail management software (Microsoft Outlook; Microsoft Corp, Redmond, Wash) to remind themselves in the future, while 3 (5%) of these physicians relied on a handheld device. In addition, 14 (21%) of these 66 physicians used more than 1 mechanism.

RESOURCES SPENT ON TEST RESULT MANAGEMENT

In terms of investment in human resources for results management, respondents reported spending on average 37 minutes on test result management per half day spent seeing patients (Table 1). This amount was not different between attending physicians and house staff (36 vs 40 minutes; *P* = .86). Among respondents, 59% reported that some staff member in the clinic screened all incoming results for abnormalities. Significantly more house staff than attending physicians reported that they used such a “back-up” system (80% vs 52%; *P* = .002), even after adjusting for the clustering effect at the practice level.

SELF-REPORTED DELAYS

Self-reported delays in result review were relatively frequent (**Table 2**). Among all respondents, 83% re-

Table 2. Self-reported Delays in Test Result Review

No. of Times Physicians Reported “Reviewing a Test Result They Wished They Had Known About Earlier” Over the Previous 2 Months*	Overall, % (N = 162)	Faculty, % (n = 120)†	House Staff, % (n = 38)†
0	17	18	13
1-2	41	37	55
3-4	23	23	24
≥5	18	22	8

*Six survey respondents did not answer this question.

† $\chi^2 = 5.9$; *P* = .12.

ported reviewing at least 1 test result “they wished they had known about earlier” in the past 2 months. Of all respondents, 18% reported that this type of delay occurred 5 or more times during the previous 2 months. There was no significant difference between attending physician respondents and house staff respondents on this question ($\chi^2 = 5.9$; *P* = .12).

SATISFACTION WITH TEST RESULT MANAGEMENT

With respect to satisfaction, only 41% of respondents reported feeling at least somewhat satisfied with the way they managed test results. There was a significant relationship between physicians’ satisfaction with test result management and the number of self-reported delays in test result reviews (**Figure 1**). The proportion of physicians who were at least somewhat satisfied regarding test result management steadily declined as physicians reported more delays in test result review.

On univariate analysis, none of the respondents’ characteristics, including full-time status, level of training, or sex, were significantly associated with satisfaction regarding test result management (**Table 3**). However, both the use of a system to record tests ordered and the use of a system to detect whether a patient had missed a test were significantly associated with satisfaction (recorded tests ordered: odds ratio, 3.0 [95% confidence interval, 1.8-5.0; *P* < .001]; used a system to detect whether

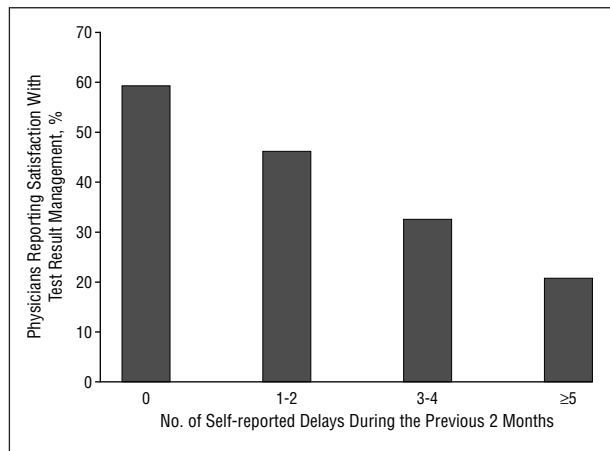


Figure 1. Relationship between satisfaction with test result management and self-reported delays in test result review (trend test: $\chi^2 = 10.5$; $P = .001$).

a patient had missed a test: odds ratio, 5.8 [95% confidence interval, 2.9-11.8; $P < .001$].

In a clustered, multivariable model (Table 3), physicians who maintained a record of tests ordered, who used a system to detect whether a patient had missed a test, and who self-reported fewer delays were more likely to be satisfied with their test result management. The level of training, the amount of time spent on test result review, and the presence of a staff member to screen test results for abnormalities were not significant correlates of satisfaction.

DESIRED FEATURES OF A TEST RESULT MANAGEMENT SYSTEM

When reviewing test results, physicians often referred to prior test results, clinical notes, medication lists, and problem lists (previous test results [mean \pm SD]: frequency score, 5.6 ± 1.3 [1=never, 7=always]; clinical notes: frequency score, 5.3 ± 1.4 ; medication list: frequency score, 4.7 ± 1.5 ; and problem list: frequency score, 4.2 ± 1.7). The top 3 highest-rated features of a potential electronic results management system (among the 9 asked) were (1) prioritization of results such that abnormal test results are presented before normal results (desirability score [mean \pm SD], 6.2 ± 1.2 [1=useless, 7=indispensable]); (2) letter writing capabilities with predefined texts (desirability score, 5.9 ± 1.4); and (3) warning system to detect whether a patient had missed a test (desirability score, 5.7 ± 1.4) (**Figure 2**).

COMMENT

Our survey findings suggest that significant problems exist with test result management systems in primary care physicians' offices. Many physicians report delays in the review of test results, and a significant proportion express dissatisfaction in their management of test results. This does not represent a lack of effort, since physicians on average reported spending more than 70 minutes per clinical day on test result management, and many physicians designated a staff member to screen test results for abnormalities. While these investments

in human resources do not appear to affect physicians' satisfaction with test result management, our findings suggest that satisfaction is related to the timely review of test results and the presence of systems to track the orders placed and to detect if a patient has failed to obtain tests.

The high frequency of reported delays is important since self-reporting typically significantly underestimates the true incidence of errors.^{14,15} The relationship between self-reported delays and dissatisfaction suggests that physicians also recognized delays in test result review as a significant problem affecting quality of care and patient safety. While our survey did not directly characterize the clinical importance of these delays, the fact that physicians "wished they had known about" these results earlier strongly suggests that many of these results might have changed patient management. Furthermore, patients consistently rate access to test results as one of the things they most desire.¹⁶ Getting results to patients in a timely manner represents an important aspect of good patient-centered care, one of the Institute of Medicine's 6 key goals for high quality care.¹⁷

A number of reasons may underlie the relatively high incidence of delays. First, the volume of data to be reviewed is large; previous estimates indicate that a typical primary care physician may have to review up to 800 data points from chemistry and hematology reports, 40 radiology reports, and 12 pathology reports per week.¹⁸ Significant opportunities exist for the important test result to be lost in the "sea" of normal results. Second, test results in the outpatient setting become available at times ranging from an hour to weeks after the tests are ordered. It is easy for a physician to forget to look for the results of a test ordered weeks earlier. Third, paper-based test reporting systems are subject to delivery delays and misfiling.

One approach to reducing these delays in the test result management process would be to provide more efficient tools. Our survey findings suggest several strategies for improving the efficiency of the result management system. For example, given how often physicians needed to refer to the patients' previous test results, clinical notes, and medication lists, a result management tool that is integrated with patients' electronic medical record may improve the efficiency of test result review. Furthermore, an electronic tool that allows physicians to focus their attention on truly abnormal test results and to easily generate letters to patients about their test results will likely promote efficiency.

We also found that health care providers who used a system to detect whether a patient had missed a test were more likely to be more satisfied with their management of test results. Furthermore, a system that would automatically warn physicians if patients have missed tests ranked among the most desired features of an improved result management system. These findings suggest that physicians were concerned about patients' nonadherence with agreed-on tests. In general, nonadherence signals a possible breakdown in the line of communication between the physician and the patient¹⁹⁻²¹ and ultimately may lead to an adverse outcome. Furthermore, recent malpractice case law suggests that physi-

Table 3. Predictors of Satisfaction in Results Management (Faculty and House Staff Combined)*

Predictors of Satisfaction	Unadjusted Analysis†		Adjusted Analysis‡	
	OR (95% CI)	P Value	OR (95% CI)	P Value
Provider characteristics				
Full time (≥4 sessions/wk)	1.20	.48
Faculty	1.00	.99	1.15	.67
Female	0.97	.90
Characteristics of systems used by physicians				
Provider maintained record of tests ordered	2.95 (1.76-4.95)	<.001	1.95 (1.04-3.64)	.04
Provider used system to detect if patient misses a test	5.83 (2.87-11.80)	<.001	4.75 (2.08-10.80)	<.001
Provider used a clinic staff member to screen tests	0.96	.90	0.88	.78
Investment in human resources§	1.16	.64	1.09	.66
Self-reported outcome	2.62 (1.30-5.28)	.007	2.74 (1.00-7.48)	.049

Abbreviations: CI, confidence interval; OR, odds ratio; ellipses, not included in the multivariable model.

*Confidence intervals are only shown for variables that are significantly ($P < .05$) related to the outcome.

†Adjusted for clustering at the clinic-site level.

‡Adjusted for clustering at the clinic-site level and other variables included in the multivariable model.

§Amount of time spent on test result management (per incremental hour every session).

||Reported 1 or fewer delays in result reviews per month.

cians may bear significant medicolegal responsibility for such adverse outcomes if they fail to take steps to rectify patients' noncompliance with a workup plan.¹³ Manual paper-based systems are typically ineffective at catching events such as a patient's noncompliance with tests. While some physicians are conscientious enough to invent their own mechanisms to solve this problem, the significant variability in the mechanisms used highlights the weakness of this approach.^{22,23} Therefore, designers of effective test result management systems should incorporate standardized features that easily allow physicians to track the completion of test orders. These features may include electronic "ticklers" that can be set as physicians review abnormal test results¹⁸ or simpler solutions such as log books or spreadsheets that are managed by centralized personnel within a clinic.²⁴

Our results should be interpreted in light of several limitations. First, while the 15 clinics in our study used different systems for test result management, all clinics had access to a relatively advanced electronic medical record system that was integrated with the laboratory and radiology information systems. This information technology infrastructure is currently not typical of the larger US health care system. For example, if this survey had been done in the wider community with predominantly paper-based systems, one would expect an even higher incidence of delays and dissatisfaction. Second, the response rate was relatively low for house staff members, and our results might have been subject to responder bias. Third, retrospective self-reported delays in test result review might not have been reliable—future studies should consider the use of real-time surveying and medical chart review. Fourth, questions about deficiencies and inefficiencies in the result management system might have biased clinicians to report greater dissatisfaction. Fifth, we did not characterize the circumstances and consequences of test results clinicians "wished they had known about earlier." Sixth, our survey did not include the patient's perspective, and

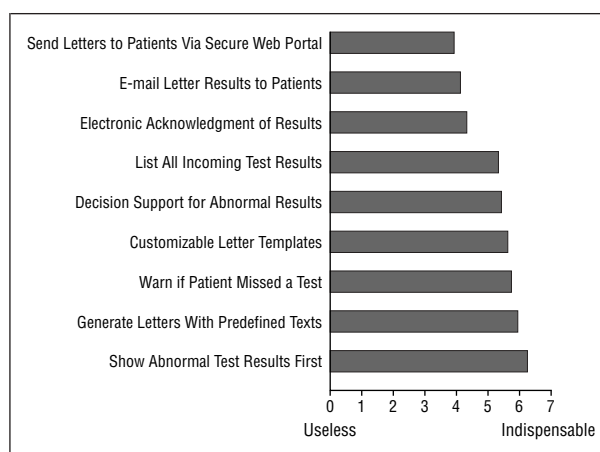


Figure 2. Desirability of features in an electronic results management system.

future studies might investigate the correlation between the satisfaction of physicians and patients.

In summary, our findings suggest that significant deficiencies in test result management exist in the ambulatory setting. Although the past decade may have brought some improvements in the rate at which physicians notify patients about normal test results,¹² the test result review system is still inefficient and fraught with opportunities for delays and loss to follow-up. Given the significant time investment physicians are already making in managing test results, asking individual physicians to be more vigilant or to spend yet more time on this activity is unlikely to yield significant improvements in quality. Instead, future efforts should equip practicing physicians with a comprehensive set of tools to facilitate test result review, patient-physician communication, and tracking of test orders. The level of physicians' dissatisfaction with existing test result management systems bodes well for their acceptance of new ones. We hope the results of this study will give further impetus to health care organizations and

primary care providers to make the necessary investments to address the widespread problems in ambulatory test result management.

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