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Provider Management of and Satisfaction with Laboratory Testing in the Nursing Home Setting: Results of a National Internet-Based Survey

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Abstract

Objectives—To describe the management of and satisfaction with laboratory testing, and desirability of laboratory health information technology in the nursing home setting.

Design—Cross-sectional study using an Internet-based survey.

Participants and Setting—National sample of 426 nurse practitioners and 308 physicians who practice in the nursing home setting.

Measurements—Systems and processes available for ordering and reviewing laboratory tests, laboratory test result management satisfaction, self-reported delays in laboratory test result review, and desirability of computerized laboratory test result management features in the nursing home setting.

Results—A total of 96 participants (48 physicians and 48 nurse practitioners) completed the survey, for an overall response rate of 13.1% (96/734). Of the survey participants, 77.1% had worked in the nursing home setting for more than 5 years. Over half of clinicians (52.1%) reported three or more

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recent delays in receiving laboratory test results. Only 43.8% were satisfied with their laboratory test results management. Satisfaction was associated with keeping a list of laboratory orders and availability of computerized laboratory test order entry. In the nursing home, 35.4% of participants reported the ability to electronically review laboratory test results, 12.5% and 10.4% respectively had computerized ordering of chemistry/hematology and microbiology/pathology tests. The following three features were rated most desirable in a computerized laboratory test result management system: showing abnormal results first, warning if a test result was missed, and allowing electronic acknowledgment of test results.

Conclusion—Delays in receiving laboratory test results and dissatisfaction with the management of laboratory test result information are commonly reported among physicians and nurse practitioners working in nursing homes. Test result management satisfaction was associated with computerized order entry and keeping track of ordered lab tests, suggesting that implementation of certain health information technology could potentially improve quality of care.

Keywords

Laboratory techniques and procedures; laboratories; nursing homes; medication monitoring

INTRODUCTION

In ambulatory care and hospital settings, a large proportion of physicians express dissatisfaction with how they receive laboratory results and communicate this information to patients and other clinicians.^{1–3} Delays in receiving laboratory test results are common and have been found to be correlated with levels of dissatisfaction with laboratory test result handling.⁴ Failure to follow-up on completed laboratory results represents about 20% of all laboratory testing errors in both inpatient and outpatient settings.^{1, 5} The majority of these problems involve delays or failure in reporting laboratory results to physicians, or failure to appropriately respond to abnormal laboratory results when they are made available.⁵ Errors and delays in laboratory test result follow-up have also been shown to be a major cause of malpractice liability.⁶ Although laboratory test result follow-up has been studied in hospital and ambulatory care settings,^{3, 4} it has not been well-characterized in the nursing home setting.

Laboratory testing and follow-up are particularly important in nursing homes because residents receive on average 8.8 medications per day, placing them at considerably increased risk for developing adverse drug reactions (ADRs).^{7, 8} ADRs are defined as unintended or noxious responses to a drug given in a dosage intended for prophylaxis, diagnosis, or therapy.⁹ In the nursing home setting, ADRs represent the most common form of medication-related adverse events and have an incidence ranging from 1.19 to 7.26 per 100 resident-months.¹⁰ The majority of ADRs are preventable and occur at the monitoring stage of the medication use process, which frequently involves laboratory testing.^{11, 12} Potentially reducing ADRs by better understanding and improving the laboratory ordering and reporting processes may represent an important way to improve medical care among nursing home residents.

The nursing home setting can present unique challenges to laboratory test result follow-up. Physicians and nurse practitioners commonly care for residents at multiple facilities that often have different laboratory test ordering and reporting protocols.¹³ There is often insufficient nursing staff and difficulty recruiting and retaining qualified staff.^{14, 15} Moreover, nursing staff assigned to review incoming laboratory test results may have inadequate training to recognize and communicate normal, abnormal, and critical values.^{16, 17} Laboratory test results are frequently reported after hours to an on-call physician not familiar with the resident's medications or medical problems.^{18, 19} Furthermore, laboratory specimens may be sent to multiple testing facilities from a single nursing home to comply with differing insurance plan

regulations, further complicating test management. Because the majority of nursing home residents are cognitively unable to check-up on laboratory test results, the safety net of direct patient vigilance is often absent.²⁰

In our cross-sectional study, we designed and administered an Internet-based survey to a national sample of physicians and nurse practitioners working in the nursing home setting. The objectives were to determine the methods available for ordering and reviewing laboratory tests, laboratory test result management satisfaction, and desirability of computerized laboratory test result management features in the nursing home setting.

METHODS

Study Participants and Setting

We surveyed physicians and nurse practitioners because these professionals are directly involved in the process of ordering laboratory tests and reviewing subsequent results in the nursing home setting. Potential physician participants were identified from a list of 327 American Medical Directors Association (AMDA) Foundation long-term care Research Network member email addresses. The AMDA Foundation long-term care Research Network provides a mechanism to meet the needs of both community-based medical directors and established investigators, and to advance the research agenda for long-term care. Potential nurse practitioner participants were identified by obtaining e-mail addresses of a random sample of 500 of the approximately 1,000 members of the National Conference of Gerontological Nurse Practitioners (NCGNP). The NCGNP is the primary organization for advanced practice nurses who want to pursue continuing education in gerontological care and who seek peer support from experienced clinicians.

Survey tool

For the purposes of this study, we defined laboratory testing to include chemistry, hematology, microbiology, and anatomic pathology tests. In the survey, we asked participants to indicate their profession (physician or nurse practitioner), gender, facility characteristics in which they worked (nonprofit, for-profit, government, number of beds), and duration of time working in the nursing home setting. To determine the presence of laboratory health information technology (HIT) currently available to participants, we used five “yes or no” questions, two questions about ordering (i.e., computerized provider order entry [CPOE]), two about reviewing (i.e., electronically view) laboratory test results, and one question about computerized decision support for either task.

The remainder of the survey contained questions about laboratory test result management systems adapted from the Poon et al survey.⁴ This survey assesses systems used for laboratory test result tracking, self-reported delays in reviewing laboratory results, satisfaction with test result management, and the desirability of certain features in an electronic laboratory results management system. Our survey included minimal modifications to the Poon et al 2004 survey to reflect situations more common in the nursing home setting. Modifications included changing questions to reflect the potential role that family and caregivers play in the management of nursing home resident’s laboratory test results. Also, questions were reordered so that provider satisfaction was assessed before asking questions about potential communication difficulties and late test results (Appendix).

When describing systems of test result management, clinicians were able to select multiple methods of communication (e.g., phone, pager, fax, and flagging in the chart). To measure delays, clinicians were asked, “How many times over the last 2 months have you reviewed nursing home laboratory test results that you wish you had known about earlier?” Satisfaction

with laboratory result management was graded on a five-point scale from “very satisfied” to “very dissatisfied.” To assess desirability of laboratory health information technology (HIT), participants were asked to rate the utility of eight potential features of a computerized system for laboratory test result management on a seven-point scale from “useless” to “indispensable.”

We asked two physicians and two nurse practitioners to pilot-test the survey before we administered it to others. The University of Pittsburgh Institutional Review Board approved the study as exempt, and informed consent was not needed for study participation.

Survey Administration

Between September and October 2007, we contacted potential survey participants using the email addresses provided by their professional organization (the AMDA Foundation Research Network or the NCGNP). The initial e-mail described the purpose of the study and invited those that were interested to click on a link that would take them to an Internet-based survey. If there was no response, potential participants were sent a reminder email after 2 weeks. Upon entering the website, participants were required to enter their email address, and choose to receive a \$5 gift certificate or donate \$5 to their professional organization as an incentive for completing the survey.

Statistical analysis

For purposes of calculating response rates, we defined potential participants as individuals who had a valid e-mail address. If an individual’s e-mail address was invalid (i.e., if it did not allow the e-mail to be delivered within a 1-week period), the individual was removed from the list of potential participants. To calculate the overall response rate, we divided the number of actual participants by the number of potential participants.

We used descriptive statistics to summarize participant responses to each specific question and demographic data. Chi-square, Fisher’s exact, and Kruskal-Wallis tests were used to make comparisons between professions.²¹ We used Kendall’s tau and Cochran-Armitage trend test to examine association between laboratory HIT availability, delays in laboratory test result reporting, and test result management satisfaction.²¹ We used SAS® version 9 for Windows (SAS Institute, Inc., Cary, NC) for all statistical analyses.

RESULTS

Response Rates and Participant Characteristics

Of the 827 emails, 93 did not reach the intended recipient. Of the 734 individuals with valid e-mail addresses, 96 (13.1%) completed the survey. Half of the 96 participants were physicians, and response rates were slightly higher among physicians (15.6%) than among nurse practitioners (11.3%) (Table 1). Most physicians worked at nonprofit facilities, while most nurse practitioners worked at for-profit facilities ($p=0.004$). The vast majority (77.1%) of participants had worked in the nursing home setting for more than 5 years, with physicians reporting more nursing home work experience than nurse practitioners ($p<0.001$). Nurse practitioners spent a larger percentage of their clinical time providing nursing home services ($p=0.004$), and worked in smaller nursing homes ($p=0.033$).

Current Management of Laboratory Tests

There was substantial variability in both normal and abnormal laboratory test result reporting mechanisms. Participants were informed of *normal* laboratory results via flagging results on chart (49.0%), by phone (41.6%), and by fax (35.4%). Sixteen participants (16.7%) reported that normal results were not routinely communicated to them. Participants were usually informed about *abnormal* results via pager (37.5%), flagging results on chart (30.2%), fax

(30.2%), and phone (24.0%). *Critical* results were most often reported by phone (81.2%) and by pager (51.0%). Few (4.2%) participants reported failing to hear about abnormal results, and no participants reported failing to hear about critical results.

In the nursing home setting, 52.1% of participants reported three or more delays in receiving laboratory test results in the past 2 months, while 80.2% reported at least one delay. There was no significant difference between physicians and nurse practitioners in incidence of self-reported delays ($p=0.178$).

Twenty percent of participants reported spending over one hour a day reviewing and managing laboratory test results. Physicians spent less time than nurse practitioners on average (16–30 versus 31–45 minutes; $p=0.02$). Fewer physicians than nurse practitioners kept a record of ordered tests (6.3% versus 41.7%; $p<0.001$), and were able to detect when a test result had not been received (25.0% versus 39.6%; $p=0.127$).

Few of the nursing homes in which participants worked had laboratory HIT resources available (Figure 1). Nursing homes were more likely to have the capability to electronically view laboratory test results (35.4%) than have CPOE for generating new laboratory test orders (11.5%). A small fraction of nursing homes had CPOE with computerized decision support (6.3%).

Satisfaction with Current Laboratory Result Management

Overall, 43.8% of participants reported being somewhat or very satisfied with their laboratory test result management. Fewer physicians than nurse practitioners were satisfied with their current reporting system (37.5% versus 50.0%), but the difference was not significant ($p=0.386$). Satisfaction was significantly associated with having CPOE for chemistry/hematology orders ($p<0.001$), microbiology/pathology orders ($p=0.002$), or having a record of tests ordered ($p=0.04$). There was no significant association between satisfaction and having computerized decision support for CPOE ($p=0.07$), experiencing test result delays ($p=0.184$), or being able to electronically view chemistry/hematology ($p=0.43$) or microbiology/pathology results ($p=0.36$).

Desirability of Laboratory Health Information Technology

The three features of laboratory HIT systems rated most valuable were: showing abnormal results first, warning the appropriate clinician that a resident missed a requested test, and providing electronic acknowledgment of completed results (Figure 2). Participants also considered it useful for laboratory HIT systems to provide decision support to clinicians about abnormal test results and to provide various methods to facilitate communication of test results to residents, their family members, and other clinicians.

DISCUSSION

Our study demonstrates that the majority of physicians and nurse practitioners who work in nursing homes are generally not satisfied with the management of laboratory test result information, and experience delays in receiving laboratory test results. We also found that relatively few nursing homes have the laboratory HIT resources that are commonly found in ambulatory care and hospital settings (e.g., electronic viewing of laboratory test results or computerized order entry for ordering laboratory tests), even though these resources are considered desirable for laboratory test management.

The survey administered in nursing homes was a minimal modification of a survey that Poon et al,⁴ developed for use in hospital-based ambulatory care clinics. Similar to the original survey, our results showed that comparable proportions of healthcare professionals

experienced delays in receiving laboratory test results and were not satisfied with the handling of these results. However, our survey found no association between delays and lack of satisfaction, whereas the original survey did find an association between these factors.⁴ This difference between survey results may be attributable to the fact that the original survey was administered to clinicians in a hospital-based ambulatory care clinic in which the use of laboratory HIT was uniform and thus accounted for less of the variance in satisfaction. Alternatively, it may be attributable to differences in the number of clinicians that keep records of tests ordered in hospitals compared to nursing homes.

In our survey, the nursing home characteristics that were most closely associated with satisfaction levels were having a record of ordered laboratory tests and having CPOE for laboratory tests. These characteristics are not independent factors because CPOE systems often allow clinicians to view a list of ordered laboratory tests. It is not surprising that HIT was associated with satisfaction because such systems have been shown to improve quality, efficiency, and cost in both ambulatory care clinics and hospitals.²² Specifically, laboratory HIT systems have been shown to significantly reduce order and result delivery times, medication error rates, and ADRs in hospital and ambulatory care settings.^{23–25} We did not find HIT to be significantly associated with delays in our study, which may be partly due to not objectively measuring order delivery times, as assessed in other studies.

Our survey confirmed results of previous studies that the adoption of HIT in nursing homes lags behind other healthcare settings such as hospitals and ambulatory care.^{26–28} A study by Subramanian et al,²⁹ suggests that it may be more difficult to implement HIT systems in nursing homes, partly because the parties incurring the costs may not directly reap the benefits. Furthermore, recent research suggests that use of nursing home HIT systems is related to specific facility and staff-level characteristics, such as facility location, nursing home administrator tenure, and number of services offered.³⁰

Study Strengths and Limitations

Our study had several strengths. First, this was a national survey of physicians and nurse practitioners recruited from major professional organizations, working in nursing homes. Unlike prior studies, we surveyed doctors and nurse practitioners, since both groups of healthcare professionals are directly involved in the process of ordering laboratory tests and reviewing subsequent results. In an attempt to improve the survey response rate and reduce the possibility of non-response bias, we employed multiple methods, including university sponsorship, monetary incentives, and sending email reminders to potential participants.³¹

The study also had several potential limitations. The response rate was low, despite the brevity of the survey and the provision of a nominal incentive. The low response rate may limit the generalizability of the findings due to non-response bias. Nevertheless, our response rate was similar to that of other investigators who conducted Internet-based surveys, which appear to generate a somewhat lower response rate than that associated with traditional mail surveys.³² Using a combination of both Internet and paper-based techniques may have contributed to a higher response rate.³³ Response bias may have been introduced because this was an Internet-based survey, and individuals who responded are potentially more likely to be computer literate and predisposed to using laboratory HIT.

Implications for Future Work

Further research is needed in several areas. Additional research needs to be conducted to validate the findings of this study with a wider range of nursing home healthcare professionals, including geriatric psychiatrists, psychiatric/mental-health nurse practitioners, and physician assistants. Research is also needed to determine if designing and implementing laboratory HIT

systems that include the functionality rated as most desirable by survey participants would: (1) decrease time spent managing normal and abnormal laboratory data; (2) decrease delays in laboratory test result reporting; (3) decrease ADRs related to laboratory monitoring errors; and, (4) improve clinician satisfaction with laboratory test management.

CONCLUSION

Delays in receiving laboratory test results and dissatisfaction with the management of laboratory test result information are commonly reported by physicians and nurse practitioners working in nursing homes. Implementation of certain laboratory health information technology, such as computerized order entry and tracking of laboratory test orders, could increase satisfaction and reduce delays in laboratory result management, thereby contributing to improved quality of care.

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Appendix

Part I: Systems for ordering and reviewing laboratory results

When answering the questions in this section, think about the nursing home where you see the majority of your residents.

Part I, Section A:

Health information technology system currently in place:	Does the nursing home where you see the majority of your residents currently have any of the following health information technology in place?		[response options appear only if "yes" is selected] If the system is already in place, how frequently do you use it?					[response options appear only if "no" is selected] Does the nursing home where you see the majority of your residents plan to adopt any of the following health information technology in the next five years?		
	No ▼	Yes ▼	Not at all ▼	▼	▼	All the time ▼	No ▼	Yes ▼	Unknown ▼	
1. Computerized provider order entry (CPOE) for laboratory orders	☐	☐	☐	☐	☐	☐	☐	☐	☐	
2. Computerized provider order entry (CPOE) for microbiology or pathology	☐	☐	☐	☐	☐	☐	☐	☐	☐	
3. Computerized provider order entry (CPOE) for radiology	☐	☐	☐	☐	☐	☐	☐	☐	☐	
4. Electronically view results for chemistry/hematology tests	☐	☐	☐	☐	☐	☐	☐	☐	☐	
5. Electronically view results for microbiology or pathology tests	☐	☐	☐	☐	☐	☐	☐	☐	☐	

Continue→

Part I, Section B:

If a computerized system were to be provided in the nursing home to help you manage / review your residents' test results, how *useful* would you find each of the following features:

How <i>useful</i> would you find the following features:	Useless Indispensable						
	▼	▼	▼	▼	▼	▼	▼
1. Show me a list of all my incoming results.....	☐	☐	☐	☐	☐	☐	☐
2. Show me the critical/abnormal results first	☐	☐	☐	☐	☐	☐	☐
3. Allow me to acknowledge that I have seen results	☐	☐	☐	☐	☐	☐	☐
4. Suggest what to do with abnormal results	☐	☐	☐	☐	☐	☐	☐
5. An alert system to warn me if resident didn't get a requested test	☐	☐	☐	☐	☐	☐	☐
6. Generate resident/family/caregivers result letters with predefined text	☐	☐	☐	☐	☐	☐	☐
7. Help me write my own personalized result letters.....	☐	☐	☐	☐	☐	☐	☐
8. Notify resident/family/caregivers of results by email	☐	☐	☐	☐	☐	☐	☐

Continue→

Part II: Satisfaction with test result management and reporting

When answering the questions in this section, think about the nursing home where you see the majority of your residents.

1. How satisfied are you with the way you manage lab results in the nursing home setting?

- ☐ 1 Very Satisfied
 ☐ 2 Somewhat Satisfied
 ☐ 3 Neither satisfied or dissatisfied
 ☐ 4 Somewhat Dissatisfied
 ☐ 5 Very dissatisfied
 ☐ 6 Don't know

2. Over the past 2 months what was the usual way that nursing home STAFF communicated **NORMAL** test results to you, the PROVIDER? (select all that apply)?

☐ 1 Phone	☐ 3 Fax	☐ 5 Letter/postcard	☐ 7 Other computerized system	☐ 9 Other (please specify: _____)
☐ 2 Pager	☐ 4 Flagged in the chart or nursing station	☐ 6 Email	☐ 8 Not routinely communicated	

3. Over the past 2 months what was the usual way that nursing home STAFF communicated **ABNORMAL** test results to you, the PROVIDER? (select all that apply)?

☐ 1 Phone	☐ 3 Fax	☐ 5 Letter/postcard	☐ 7 Other computerized system	☐ 9 Other (please specify: _____)
☐ 2 Pager	☐ 4 Flagged in the chart or nursing station	☐ 6 Email	☐ 8 Not routinely communicated	

4. Over the past 2 months what was the usual way that nursing home STAFF communicated **CRITICAL/ PANIC** test results to you, the PROVIDER? (select all that apply)?

☐ 1 Phone	☐ 3 Fax	☐ 5 Letter/postcard	☐ 7 Other computerized system	☐ 9 Other (please specify: _____)
☐ 2 Pager	☐ 4 Flagged in the chart or nursing station	☐ 6 Email	☐ 8 Not routinely communicated	

5. Over the past 2 months, what was the usual way of communicating **ABNORMAL** test results to RESIDENTS, FAMILY, OR CAREGIVERS (select all that apply)?

☐ 1 Phone	☐ 3 In person during your next visit to the nursing home	☐ 5 Allow nursing home staff to communicate results
☐ 2 Letter/postcard	☐ 4 Not routinely communicated	☐ 6 Other (please specify: _____)

6. How many times over the last 2 months have you reviewed nursing home test results that you wish you had known about earlier?

☐ A
0

☐ B
1-2

☐ C
3-4

☐ D
5-6

☐ E
7-8

☐ F
>8

7. Do you keep a record of the tests you have ordered / recommended for your nursing home residents?

☐ 1
Yes

☐ 2
No

If so, please describe how (optional): _____

8. Do you have a system to detect if a test you have ordered / recommended is not obtained?

☐ 1
Yes

☐ 2
No

If so, please describe (optional): _____

9. Is there a staff member at your facilities (other than yourself) that reviews all in-coming test results?

☐ 1
Yes

☐ 2
No

If so, please describe who that person is and how he/she performs the review (optional): _____

10. How much time do you spend in a typical day managing / reviewing your nursing home test results?

☐ A
1-15 minutes

☐ B
16-30 minutes

☐ C
31-45 minutes

☐ D
46-60 minutes

☐ E
1-2 hours

☐ F
>2 hours

Continue→

Part III: Respondent and Facility Demographic Information

Part III, Section A: Respondent demographics.

1. Discipline (check all that apply):

	Degree	Residency Training	Fellowship Training	Certification	Other Qualifications
☐ Physician	☐ MD	☐ IM	☐ Geriatrics Fellowship	☐ CMD	Note here:
	☐ DO	☐ FP	☐ Other Fellowship		
		☐ Other	☐ CAQ		
☐ Advanced Practitioner	☐ RN			☐ Geriatric Nurse Practitioner	Note here:
	☐ BSN			☐ Gerontological Nurse	
	☐ MSN			☐ Nursing Administration	
	☐ PhDN			☐ Certified Hospice and Palliative Care Nurse	
	☐ CRNP				
	☐ PA-C				
☐ Pharmacist	☐ BS Pharm	☐ Pharm Pract		☐ BCPS	Note here:
	☐ PharmD	☐ Ger. Pharm Pract		☐ CGP	

2. Please indicate the number of years since completion of your terminal training?

☐ A ☐ B ☐ C ☐ D ☐ E ☐ F
 Less than 1 year 1 to 5 years 6 to 10 years 11 to 15 years 16-20 years > 20 years

3. Please indicate your gender:

☐ 1 ☐ 2
 Female Male

4. How long have you been working in the nursing home setting?

☐ A ☐ B ☐ C ☐ D ☐ E ☐ F
 N/A Less than 1 year 1 to 5 years 6 to 10 years 11 to 15 years > 15 years

5. What percentage of your clinical time is spent providing nursing home services?
☐ A	☐ B	☐ C	☐ D	☐ E	☐ F
None	<10%	11-25%	26-50%	51-75%	>75%

Part III, Section B: Demographic information about the nursing home where you see the majority of your residents:

1. Number of beds
☐ A	☐ B	☐ C	☐ D	☐ E
< 50 beds	50-99 beds	100-150 beds	151-200 beds	200+ beds
2. Ownership
☐ 1	☐ 2	☐ 3
Profit	Nonprofit	Government
3. Affiliation
☐ 1	☐ 2	☐ 3
Chain/multi-facility	Independent/free-standing	Hospital-affiliated
4. Location
☐ 1	☐ 2	☐ 3
Urban	Suburban	Rural

Figure 1.
Percent of survey respondents with laboratory health information technology in the nursing home.

Figure 2.

Desirability of features in an electronic laboratory results management system rated on 7 point scale from useless (0) to indispensable (7)

Table 1

Characteristics of respondents, stratified by profession

Characteristic	Physicians	Nurse Practitioners
Number of respondents	48	48
Number of potential respondents	308	426
Response rate (%)	15.6	11.3
Type of employment facility (% working in a nonprofit facility)	60.4	33.3
Percentage of clinicians spending >75% of their clinical effort providing nursing home services (%)	18.8	60.4
Number of years spent working in the nursing home setting (% working >5 years)	83.3	62.5
Facility bed size (% working in facilities with <100 beds)	18.8	35.4