

Teaching Laboratory Management Principles and Practices Through Mentorship and Graduated Responsibility: The Assistant Medical Directorship

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Abstract

With the changing landscape of medicine in general, and pathology in particular, a greater emphasis is being placed on laboratory management as a means of controlling spiraling medical costs and improving health-care efficiency. To meet this challenge, pathology residency programs have begun to incorporate formal laboratory management training into their curricula, using institutional curricula and/or online laboratory management courses offered by professional organizations. At the University of Utah, and its affiliated national reference laboratory, ARUP Laboratories, Inc, interested residents are able to supplement the departmental lecture-based and online laboratory management curriculum by participating in assistant medical directorship programs in one of several pathology subspecialty disciplines. The goals of many of the assistant medical directorship positions include the development of laboratory management skills and competencies. A survey of current and recent assistant medical directorship participants revealed that the assistant medical directorship program serves as an excellent means of improving laboratory management skills, as well as improving performance as a fellow and practicing pathologist.

Keywords

competencies, graduated responsibility, laboratory management, pathology residency

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Introduction

In the rapidly changing field of health care, the scope of practice of new-age pathologists is rapidly expanding. New-in-practice pathologists are required not only to have pathology diagnostic skills and clinical knowledge but to possess laboratory management skills and serve as leaders and stewards of clinical laboratory utilization.^{1–3} Although the skills needed to become a diligent laboratory manager and an effective laboratory leader have been continuously stressed as essential for pathologists in a wide body of literature for almost 25 years, practicing pathologists and prospective employers continuously cite this as the area with the lowest trainee preparation rating.^{2,4–7} In a 2005 survey performed under the auspices of the College of American Pathologists (CAP), it was noted that

one-third of recent hires were only somewhat or slightly prepared to enter practice.⁶ Common categories of deficiencies noted by respondents included skills in management, interpersonal interactions, regulatory and compliance issues, and billing and reimbursement procedures. Skills such as clinical

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knowledge, laboratory management, clinical consultation, and informatics were often cited as essential skills required for a community pathologist; however, with the shift toward a more “value-based” health-care system, a focus on more concrete skills has emerged.^{8,9} These skills now include test selection strategies and utilization management techniques, knowledge of quality assurance procedures and inspection processes, and strategic laboratory planning including budgeting, personnel management, coding, billing, revenue collection, and contract negotiations.⁹⁻¹¹

A significant impetus to create lasting and effective changes to residency training program curricula was initiated when, in 2013, after several years of planning, the Accreditation Council for Graduate Medical Education (ACGME) introduced the Next Accreditation System (NAS) for use in all residency programs. The ACGME is the regulatory body that oversees US residency education in all disciplines and, as part of the NAS, designed educational outcomes termed “milestones” in all specialties to assess and provide feedback on resident progress in many areas of competence. Pathology milestones, designed by a pathology working group, were developed to provide uniform training goals for pathology residents.¹² These include many areas of evaluation in laboratory administration and management, in addition to the baseline competencies that residency programs traditionally focus on (patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism [PROF], and systems-based practice [SBP]).¹³

In this study, we describe a program used at the University of Utah to give interested residents the opportunity to engage in assistant medical directorships (AMDs) with an emphasis on augmenting the laboratory management training included in the residency training program, and we also present the results of a survey of current and recent participants in the AMD program.

Methods

Description of the Assistant Medical Directorship Program

The AMD Program in the University of Utah’s Department of Pathology and its ARUP Laboratories is designed as an elective longitudinal experience generally occupying 12 months during which the trainee functions as an apprentice medical director in one of a number of different subspecialty areas. The elective involves work in addition to the core training activities and is thus considered “moonlighting” for the purposes of ACGME time keeping.

The AMD activities available to interested and qualified residents at the University of Utah are listed in Table 1. Descriptions of several representative examples are found in Tables 2 to 8. Four of these AMD assignments are based on the subspecialty disciplines of clinical chemistry, surgical pathology, and transfusion medicine and have a strong quality assurance theme in their list of responsibilities (see Tables 4-6

Table 1. Available Assistant Medical Directorships (AMD).

AMD, Anatomic pathology
AMD, Automated core laboratory
AMD, Hematologic flow cytometry laboratory
AMD, Informatics
AMD, Website medical content management, assistant editor
AMD, Transfusion services
AMD, Anatomic pathology slide photographer for outside departments
AMD, Endocrinology laboratory
AMD, Digital pathology

Table 2. Assistant Medical Director (AMD), Informatics.

General description: Moonlighting opportunity in informatics for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting
Time commitment: Anticipated averaging 4 to 5 hours per week
Reporting to the medical director of informatics
Responsibilities include 1 or more of the following
<ul style="list-style-type: none"> • Developing enhanced laboratory reports. For each particular test, report development will involve discussion with the medical director and technical managers responsible for the test in order to determine the report requirements. The next step is coordination with the information technology (IT) department and the technical writer for charting to implement these requirements and then test for acceptability • Analyzing test ordering patterns (ATOP). This service involves review of client test order patterns in order to advise our clients’ pathologists about possible misordering by their local physicians. The AMD could help conduct some of these reviews. He/she could also develop new disease topics to add to the service line; this would involve literature searching and discussion with ARUP medical directors • Knowledge base for the pathologist on call service. Consideration has long been given to the potential for a knowledge base (possibly in a Wikipedia-style format) on ARUP’s network that would support residents and fellows as they take call. This would involve compiling “frequently asked questions” that come up on call into an easily searchable format. Residents and fellows could then add to this over time as new topics come up, knowledge evolves, and so on. The IT aspects of this project would not be complicated—the software is off the shelf—but the AMD could help organize and review content as it went into the application

and 8). Two AMDs in informatics (Tables 2 and 3) afford opportunities to participate primarily in postanalytic activities, including the development of enhanced laboratory result reports, laboratory utilization management, and knowledge content development to aid laboratory users, particularly health-care providers, in more informed use of laboratory services. Given the growing interest in and use of digital imaging in pathology, the digital pathology AMD activities involve the resident in projects directed at integrating digital imaging into educational activities as well as process workflow improvements and patient-directed uses. The AMD in hematologic flow

Table 3. Assistant Medical Director: Website Medical Content Management, Assistant Editor.

General description: Moonlighting opportunity for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting, to assist with the development and review of content for ARUP Consult

Time commitment: Negotiated in advance but not to exceed allowable limits set by the graduate medical education office and the department of pathology

Reporting: Directly to the managing editor of the informatics decision support team and indirectly to the medical director of informatics

Responsibilities include

- Interact with ARUP medical directors and other staff to assist in identifying information needs with respect to laboratory testing
- Review medical literature, particularly with regard to practice guidelines and evidence-based medicine related to laboratory testing
- Assist with research to the study the effectiveness of ARUP information services

Table 4. Assistant Medical Director, Automated Core Laboratory.

General description: Moonlighting opportunity in the chemistry division for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting

Time commitment: Negotiated in advance but not to exceed allowable limits set by the graduate medical education office and the department of pathology

Reporting: Medical director of the automated core laboratory

Responsibilities include

- Read, evaluate, and summarize the scientific literature pertaining to specific issues identified by the medical director or arising from clinician requests, problems, or recommendations
- Review validation data of new assays and instruments
- Review standard operating procedures and modify, when appropriate, with supervision of the medical director
- Plan and supervise the evaluation of new assays and instrumentation in the laboratory, as assigned by the medical director
- Review CAP proficiency testing results
- Review the monthly QC summary and suggest any needed improvements
- Attend the ARUP Chemistry Division QA meetings when other rotation responsibilities permit
- Attend the ARUP Automated Core Laboratory meetings when other rotation responsibilities permit
- Contribute to continuing education efforts for the automated core laboratory staff

Abbreviations: CAP, College of American Pathologist; QA, quality assurance; QC, quality control.

cytometry affords the resident the opportunity to participate in graduated responsibilities in clinical service. Here, the AMD integrates into the weekend (generally every fourth weekend, Saturday and Sunday) sign-out schedule with the fellows in hematopathology in their support of the attending hematopathologist who covers that weekend. The anatomic pathology (AP) slide photographer for outside departments is uniquely

Table 5. Assistant Medical Director, Endocrinology Laboratory.

General description: Moonlighting opportunity in the chemistry division for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting

Time commitment: Negotiated in advance but not to exceed allowable limits set by the graduate medical education office and the department of pathology

Reporting: Medical director of the endocrinology laboratory

Responsibilities include

- Laboratory responsibilities may include testing performed in the following laboratories: automated endocrinology, manual endocrinology, electrophoresis and manual endocrinology, mass spectrometry 1 & 2, and automated core laboratory. Responsibilities may be adjusted based on individual interests
- Read, evaluate, and summarize the scientific literature pertaining to specific issues identified by the laboratory director or arising from clinician requests, problems, or recommendations
- Review standard operating procedures identified by the annual review process and suggest improvements or clarifications
- Plan and supervise the evaluation of new assays and instrumentation in the laboratory, as assigned by the medical director(s). Evaluate data generated premove and postmove if instrumentation has been moved within a laboratory
- Review CAP, New York State Department of Health and other agency proficiency testing results
- Review monthly QC summaries and suggest any needed improvements
- Attend ARUP Chemistry Division QA meetings as able
- Attend endocrinology laboratory staff meetings as able
- Contribute to continuing education efforts for the Endocrinology laboratory staff

Abbreviations: CAP, College of American Pathologist; QA, quality assurance; QC, quality control.

different from the other AMD assignments in that it was designed to fill the need in meeting slide photography requests from outside the department of pathology, particularly from faculty and house staff from other clinical departments. The assistant medical director reviews these requests, clarifies their purpose (eg, for publication or lectures), and provides the photographs to the requestors. For photography not related to publication, requestors are charged a fee for each photography session prior to release of the photographs. If intended for publication, the resident will ask to be included on the manuscript as the pathologist-of-record with appropriate content review responsibilities. In doing so, the requestor is provided the photographs at no fee, and the resident becomes a cited author on the manuscript. Of note, a number of AMD positions stress the management competencies outlined in phase II of the NAS inspection program of the ACGME.¹³ Examples of multiple milestones and management competencies that map to the AMD assignments in the automated core laboratory, endocrinology laboratory, and surgical pathology in our program are described in Table 9.

Moonlighting Status and Compensation

Assistant medical directorships are considered to be moonlighting activities by the graduate medical education (GME) office.

Table 6. Assistant Medical Director, Surgical Pathology.

General description: Moonlighting opportunity for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting, who is interested in surgical pathology and who has demonstrated outstanding performance during their anatomic pathology rotations

Time commitment: Estimated 4 hours per week but not to exceed allowable limits set by the graduate medical education office and the department of pathology

Reporting: Medical director, surgical pathology

Responsibilities include

- Perform a QA review of 20 negative biopsy cases per week. Rank each case as (1) no discrepancy, (2) minor discrepancy (no difference in clinical management), (3) major discrepancy (unknown effect on clinical management), or (4) major discrepancy (significant effect on clinical management)
- Review all frozen section diagnoses and compare them with the final diagnoses. Rank each case 1 to 4, as above and review with the medical director
- Review all corrected reports, deciding if any of these should have resulted in report addenda and reviewing these with the medical director
- Review all addenda reports for any clinically significant errors, deciding if any of these should have been directly reported to the clinician and reviewing these with the medical director
- Review all overread diagnoses and rank each case 1 to 4, as above and review with the medical director
- Compile a list of “prior outside pathology not reviewed” cases and review with the medical director.
- Compile a list of all “major discrepancies” identified above and document their appropriate follow-up by the responsible pathologist(s) and ensure that follow-up occurs
- Attend the monthly QA meeting

Abbreviation: QA, quality assurance.

Table 7. Assistant Medical Director, Digital Pathology.

General description: Moonlighting opportunity for a pathology resident, subject to standard departmental and institutional requirements governing moonlighting

Time commitment: Negotiated in advance but not to exceed the allowable limits by the graduate medical education office and the department of pathology

Reporting: Medical director of digital pathology

Responsibilities include

- Works with the medical director to integrate, educate, promote, and improve the use of digital technologies within the diagnostic services of anatomic pathology, microbiology, chemistry, hematopathology, genetics, and other pathology sciences.
- Works with the medical director to identify and coordinate the resolution of problems in order to improve pathologist, scientist, and laboratory professional staff satisfaction regarding digital pathology issues
- Be actively involved in research and development projects related to digital imaging, in advising students and faculty, and in participating in academic activities related to digital imaging
- Be involved in the initiation and development of continuing education programs for laboratory professional staff within the department of pathology as well as outside the institution through invited seminars, symposia, and teleconferences

Table 8. Assistant Medical Director, Transfusion Services.

General description: Moonlighting opportunity in transfusion medicine for a pathology resident, subject to the standard departmental and institutional requirements governing moonlighting

Time commitment: Negotiated in advance but not to exceed allowable limits set by the graduate medical education office and the department of pathology

Reporting: Medical director, transfusion services

Responsibilities include

- Daily duties: Check departmental voice mail and e-mail for requests for assistance and carry a pager at all normal duty times in case of blood drive questions or blood donor questions
- Weekly: Contact blood donors, review all donor reactions and donor deferrals, meet with the management staff of Transfusion Services, review all AABB faxnet communications and relevant FDA guidance documents as soon as possible, and contact the therapeutic apheresis staff to review scheduled procedures
- Quarterly: Provide educational presentation to other house staff, students, and nursing staff and attend the Transfusion Committee meeting
- At least annually: Review all SOPs and QA documentation for the blood donor collection and donor processing departments
- Other activities: These may include a review and evaluation of any new workflow processes and/or methodologies/ instrumentation as well as any new software implementations in the department

Abbreviation: FDA, Food and Drug Administration; QA, quality assurance.

Table 9. Examples of Pathology Milestones and Competencies Addressed in Assistant Medical Directorships.

Automated Core Laboratory; Endocrinology Laboratory AMD

SBP4: Laboratory management: quality, risk management, and laboratory safety. Levels 2-4

SBP6: Laboratory management: technology assessment. Levels 1-4

ICS1: Intradepartmental interactions and development of leadership skills. Levels 1-3

ICS2: Interdepartmental interactions and communications. Levels 1-3

Surgical Pathology AMD

SBP4: Lab management: quality, risk management, and laboratory safety. Levels 2-4

PBLI1: Recognition of errors and discrepancies. Levels 2-4.

ICS1: Intradepartmental interactions and development of leadership skills. Levels 1-3

Abbreviations: ICS, interpersonal communication skill; PBLI, practice-based learning improvement; SBP, systems-based practice.

Moonlighting is considered patient care activities external to the educational program that residents engage in at sites used by the educational program and other health sites. As such, residents must have permission to participate from both the relevant medical director and the residency program director. They must also have a valid Utah medical license. Moonlighting activities cannot take place while the residents are on call, must be entered into the E*Value tracking system, and must count toward the duty hour limitations of the ACGME and participating institution. The length of moonlighting activities,

including the AMD, usually runs on the academic year calendar, but shorter time intervals can be considered. Each new resident participating in an AMD must complete the Moonlighting Authorization Form for the GME office and the department of pathology.

Compensation for these AMD activities falls under the guidelines of the GME office and the department of pathology. Specific compensation is determined by the responsible faculty member and may be provided on a continuous or as-needed basis. Rates include those on a per-request basis (photography, US\$30 per request), an hourly basis (US\$40/hour for the informatics AMD duties), or on a fixed basis per pay period (range: US\$165-US\$375/pay period).

Survey of Previous Assistant Medical Directors

We contacted 39 former residents who served in AMDs at the University of Utah and ARUP Laboratories, Inc, over the past 10 years. We surveyed them (Table 10) regarding their experience in an AMD and the impact that the AMD program had on their practice of pathology, with an eye toward using their feedback to improve the experience for future AMDs and to describe their collective experience for others in academic pathology.

We queried the former assistant medical directors regarding their experience in AMDs, whether the AMD helped them secure a fellowship or attending pathologist position, whether the AMD prepared them for the laboratory management portion of in-service and board examinations, and whether the position prepared them to perform their duties as fellows and practicing pathologists. We also asked the former assistant medical directors to assess the perceived influence that their participation in an AMD had on those interviewing them for fellowship and practice positions and the perceived role the AMD played in them acquiring these positions.

Results

Of the 39 former assistant medical directors contacted, 23 replied for a response rate of 59.0%. The most common AMDs were hematologic flow cytometry (7 respondents) and AP (6 respondents). Four respondents had served in AMDs in the automated core laboratory and 3 each had served in AMDs in informatics and transfusion services. Fewer respondents served in AMDs in slide photography (2), infectious disease laboratory (1 and no longer offered), and website medical content management (1). Most respondents served in AMDs during their third year of residency (19 of 23, 83%), although some served during their fourth (15 of 23, 65%) and second years (3 of 23, 13%). More than half (13 of 23, 56%) of the respondents had served in AMDs during more than 1 year of residency, most commonly during both their third and fourth years. Although most of these respondents served in the same AMD during both years, there were 3 respondents who served in different AMDs during the course of their residencies.

We asked the former assistant medical directors about how their experience prepared them for their future roles as fellows and practicing pathologists. More than two-thirds (18 of 22, 82%) of the respondents were satisfied or very satisfied that the goals of their AMD had been achieved, and a similar number (18 of 23, 78%) felt that the AMD improved their management skills. Despite the fact that most respondents felt that serving in an AMD improved their management skills, a minority (approximately one-third) felt that the experience helped prepare them for the laboratory management portions of American Society for Clinical Pathology (ASCP) Residency In-Service Examination (RISE) and board examinations (Table 11).

There was almost universal agreement among former assistant medical directors that their experience made them more competitive fellowship and job applicants (Table 11). Respondents felt that the AMD was an important to very important factor in helping them secure fellowship and practicing pathologist positions. Similarly, the majority of respondents felt that the AMD experience was helpful in allowing them to perform their duties as fellows and practicing pathologists. Areas in which the AMDs were rated as deficient included preparation for leadership roles in professional societies, preparation for acting as a mentor to trainees, and, for those residents who did not participate in the informatics AMD, preparation for medical informatics duties.

Finally, the majority of respondents noted that fellowship program directors and job interviewers commented favorably on their participation in an AMD (Table 11). Although most respondents reported that participation was rarely a deciding factor in being offered a position, 2 respondents reported that their participation in an AMD was mentioned by fellowship program interviewers as a deciding factor in being offered a position and more than a quarter of former AMDs reported that their participation in an AMD was mentioned by job interviewers as a deciding factor in being offered a position.

Discussion

Having identified laboratory management and leadership skills as a necessary, but a generally deficient, aspect of residency training, numerous strategies arose to introduce laboratory management curricula into residency training programs.¹⁴⁻¹⁶ These strategies ranged from informal interactions with laboratory medical directors during required rotations to formal management courses. Approaches included management rotations, lectures from laboratory managers and business people, assigned textbook and procedure manual reading assignments, and formal examinations. Other programs chose to use more involved methods such as requiring trainees to participate in laboratory management research and/or quality improvement projects, participation in laboratory inspections, or shadowing medical directors or laboratory managers during some or all of their daily activities.

In addition to institution-specific training programs, several tools are currently available to encourage the use of a more

Table 10. Survey of Previous Assistant Medical Directors.

1. Did you participate in an assistant medical directorship (AMD)?
Yes/No (If no, please skip to question #31)
2. If yes, in which of the following did you participate? (select all that apply)
Anatomic pathology
Automated core laboratory
Hematologic flow cytometry
Informatics (joint with consult editor)
Medical content management, assistant editor for ARUP consult
Hourly analytic client work
Transfusion services
Slide photographer (for outside departments)
Endocrinology
Digital pathology
Other (please specify)
3. In which year of residency did you participate? (select all that apply)
PGY1
PGY2
PGY3
PGY4
PGY5
4. How satisfied were you that the goals of the AMD were achieved?
5—Very satisfied, 4—Satisfied, 3—Neutral, 2—Dissatisfied, 1—Not at all satisfied
5. Do you feel that participation in an AMD improved your management skills?
Yes/No
6. If yes, by how much?
5—Very much, 4—Some, 3—Neutral, 2—Very little, 1—Not at all
7. Do you feel that participating in an AMD prepared you for the management portion of the RISE and/or board exams?
Yes/No (If no, skip to question #9)
8. If yes, by how much?
5—Very much, 4—Some, 3—Neutral, 2—Very little, 1—Not at all
9. Do you feel that participating in an AMD made you a more competitive fellowship applicant?
Yes/No/Not applicable
10. Do you feel that participating in an AMD helped you secure a fellowship position?
Yes/No (If no, please skip to question #12)/Not applicable (If not applicable, please skip to question #14)
11. If yes, how important a factor do you believe the AMD was in helping you secure a fellowship position?
5—Very important, 4—Important, 3—Neutral, 2—Not that important, 1—Not at all important
12. Do you feel that participating in an AMD helped you perform your duties as a fellow?
Yes/No (If no, please skip to question #14)/Not applicable (If not applicable, please skip to question #14)
13. If yes, by how much?
5—Very much, 4—Some, 3—Neutral, 2—Very little, 1—Not at all
14. Do you feel that participating in an AMD made you a more competitive job applicant?
Yes/No (If no, please skip to question #17)/Not applicable (If not applicable, please skip to question #17)
15. Do you feel that participating in an AMD helped you secure a job?
Yes/No (If no, please skip to question #17)/Not applicable (If not applicable, please skip to question #17)
16. If yes, how important a factor do you believe the AMD was in helping you secure a job?
5—Very important, 4—Important, 3—Neutral, 2—Not that important, 1—Not at all important
17. Do you feel that participating in an AMD helped you perform your duties as a pathologist?
Yes/No (If no, please skip to question #19)/Not applicable (If not applicable, please skip to question #19)
18. If yes, by how much?
5—Very much, 4—Some, 3—Neutral, 2—Very little, 1—Not at all
19. How well did the AMD prepare you to act as a medical director in the following areas:
Administrative/leadership 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Educational responsibilities 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Delegation of tasks 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Regulations and liabilities 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
20. How well did the AMD prepare you for quality assurance/quality control activity?
5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
21. How well did the AMD prepare you for medical informatics?
5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all

(continued)

22. How well did the AMD prepare you to act as a mentor to trainees?
5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
23. How well did the AMD prepare you for a leadership role in professional societies?
5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
24. How well did the AMD prepare you for the following:
Management of and communication with staff 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Communication with leadership 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Involvement in departmental/institutional meetings 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Communication with clients 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Development of strategic goals 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
Project management 5—Very well, 4—Well, 3—Neutral, 2—Poorly, 1—Not at all
25. When applying for fellowship positions, did interviewers comment on your participation in an AMD?
Yes/No (If no, please skip to question #27)/Not applicable (If not applicable, please skip to question #27)
26. If so, were the comments favorable?
Yes/No
27. If offered a position, did program directors or interviewers specifically mention the AMD as a deciding factor?
Yes/No/Not applicable
28. When applying for jobs, did interviewers comment on your participation in an AMD?
Yes/No/Not applicable
29. If so, were the comments favorable?
Yes/No
30. If offered a position, did program directors or interviewers specifically mention the AMD as a deciding factor?
Yes/No/Not applicable
31. Please feel free to include any additional comments about the Assistant Medical Director program at the University of Utah/ARUP Laboratories.
(Free-text response)

Abbreviations: PGY, postgraduate year; RISE, Residency In-Service Examination.

standardized curriculum approach to laboratory management.¹⁷ In 2013, the ASCP and the American Pathology Foundation introduced Laboratory Management University (LMU), a successful, self-paced certificate program wherein participants learn practical laboratory management and leadership skills through a series of online modules and quizzes.¹⁸ The LMU is now used in a number of pathology residency training programs, including our own, to supplement instruction and firsthand experience in laboratory management techniques. The American Association for Clinical Chemistry also offers an online certificate program in laboratory management.¹⁹ These programs allow laboratories and training programs (in clinical laboratory sciences and pathology) to tailor the courses to their needs. The College of American Pathologists offers the Clinical Pathology Improvement Program, which teaches the principles of laboratory management through 12 involved case studies.²⁰

Beyond training in the fundamentals of laboratory management, pathology residency programs can also use graduated responsibility to reinforce these knowledge and skill sets. Mentor-based teaching is a cornerstone of clinical medicine and surgery, with bedside rounds and participation in surgical cases a staple in medical student rotations and medical/surgical residencies. However, students entering residencies in pathology often fall into a passive learning style with diminished clinical responsibilities and patient contact.² Passive training environments can lead participants to lack confidence, diminish their expertise, and affect their lifelong learning skills. Well-designed graduated responsibility systems can do much to counter these difficulties. However, graduated responsibility

is often difficult to achieve in pathology residency programs, given restrictions on billing as well as ACGME rules and regulations regarding supervision. All resident activities relating to patient care must ultimately be reviewed by attending faculty, lessening the ability of pathology residents to engage in decision-making.

Pathology faculty in academic institutions should continue to seek opportunities for residents to take responsibility for diagnostic decisions with progressively less oversight.²¹ Rotations in specific laboratories should emphasize graduated responsibility for clinical consultations and interpretation of unusual results, with residents serving as junior practitioners. Pathology residents should have the opportunity to both see and practice the application of management principles they learn.¹⁰

Creating graduated responsibility opportunities for pathology residents is an important means to augment more traditional approaches to knowledge and skills development in AP and clinical pathology (CP).²¹ This includes clinical laboratory management training. As our health-care delivery system undergoes medical, technological, and structure changes, pathologists new to practice are in a better position to enter practice with necessary knowledge and skill sets for all aspects of their practice and better prepared to meet the challenges of future medical practice. With laboratory management, in particular, a recent workforce analysis by the CAP presented survey data that showed that 44% of pathologists younger than 40 years and 32% of those older than that “expect to devote more of their time to medical direction of clinical laboratories in the immediate future.”²²

Table 11. AMD Survey Results.

Do you feel that participation in an AMD improved your management skills?	Yes	No				
	18	5				
If yes, by how much?	Very much	Some	Neutral	Very little	Not at all	
	7	0	0	0	1	
Do you feel that participating in an AMD prepared you for the management portion of the RISE and/or board exams?	Yes	No				
	8	15				
If yes, by how much?	Very much	Some	Neutral	Very little	Not at all	
	5	0	0	0	1	
Do you feel that participating in an AMD made you a more competitive fellowship applicant?	Yes	No	NA			
	22	1	0			
Do you feel that participating in an AMD helped you secure a fellowship position?	Yes	No				
	14	8				
If yes, how important a factor do you believe the AMD was in helping you secure a fellowship position?	Very important	Important	Neutral	Not that important	Not important at all	
	5	0	2	0	0	
Do you feel that participating in an AMD helped you perform your duties as a fellow?	Yes	No	NA			
	13	2	6			
If yes, by how much?	Very much	Some	Neutral	Very little	Not at all	
	6	0	0	0	0	
Do you feel that participating in an AMD made you a more competitive job applicant?	Yes	No	NA			
	17	2	4			
Do you feel that participating in an AMD helped you secure a job?	Yes	No	NA			
	12	5	3			
If yes, how important a factor do you believe the AMD was in helping you secure a job?	Very important	Important	Neutral	Not that important	Not important at all	
	7	0	1	0	0	
Do you feel that participating in an AMD helped you perform your duties as a pathologist?	Yes	No	NA			
	19	1	3			
If yes, by how much?	Very much	Some	Neutral	Very little	Not at all	
	7	0	2	0	0	
How well did the AMD prepare you to act as a medical director in the following areas:	Very well	Well	Neutral	Poorly	Not at all	NA
Administrative/leadership	5	0	5	0	1	1
Educational responsibilities	3	1	6	0	2	0
Delegation of tasks	2	0	6	0	3	1
Regulations and liabilities	6	0	3	0	2	1
How well did the AMD prepare you for quality assurance/quality control activity?	Very well	Well	Neutral	Poorly	Not at all	NA
	8	0	3	0	2	1
How well did the AMD prepare you for medical informatics?	Very well	Well	Neutral	Poorly	Not at all	NA
	3	0	5	0	9	2
How well did the AMD prepare you to act as a mentor to trainees?	Very well	Well	Neutral	Poorly	Not at all	NA
	3	0	5	0	8	2
How well did the AMD prepare you for a leadership role in professional societies?	Very well	Well	Neutral	Poorly	Not at all	NA
	1	0	8	0	7	2
How well did the AMD prepare you for the following:	Very well	Well	Neutral	Poorly	Not at all	NA
Management of and communication with staff	7	0	3	0	1	1
Communication with leadership	5	1	3	0	1	1
Involvement in departmental/institutional meetings	6	0	5	0	1	1
Communication with clients	3	1	3	1	5	4
Development of strategic goals	3	0	4	0	5	2
Project management	2	0	5	0	4	2
When applying for fellowship positions, did interviewers comment on your participation in an AMD?	Yes	No	NA			
	13	6	4			
If so, were the comments favorable?	Yes	No				
	13	0				
If offered a position, did program directors or interviewers specifically mention the AMD as a deciding factor?	Yes	No	NA			
	2	16	4			
When applying for jobs, did interviewers comment on your participation in an AMD?	Yes	No	NA			
	14	6	3			

(continued)

Table 11. (continued)

If so, were the comments favorable?	Yes 13	No 1	
If offered a position, did program directors or interviewers specifically mention the AMD as a deciding factor?	Yes 5	No 13	NA 5

Abbreviations: AMD, assistant medical director; NA, not applicable; RISE, Residency In-Service Examination.

With this view in mind, our training program has combined formal, didactic training in laboratory management with optional opportunities to function as “assistant medical directors” in very specific disciplines and under the guidance/mentorship of the faculty medical directors. Though viewed as moonlighting by the GME office, as the experience is not part of the formal residency curriculum, an assistant medical directorship is, nevertheless, an educational as well as a service opportunity.

In order to assess the perceived value of an AMD opportunity, a survey was conducted with 39 former graduates of the University of Utah Department of Pathology residency training program who had served in AMD’s during their training. Feedback was sought on both the experience itself and the perceived impact that it had on their subsequent employment and practice. With a response rate of 59% (23 of 39), most respondents served in AMDs during their third or fourth year of training, with some doing so for both years. A few also served in more than 1 AMD capacity. Eighteen (82%) of 22 respondents were satisfied with the experience and with the achievement of the position’s goals. Seventy-eight percent (18 of 23 respondents) felt that the experience improved their overall management skills. Not unlike the conclusions of other authors, management training and experience (including the AMD) did not necessarily result in perceived improvements in our resident scores on the ASCP’s RISE or prepare them for laboratory management questions on subsequent board examinations. The RISE for its first 20 years of use focused on both resident self-assessment and residency program evaluation.²³ With introduction of the ACGME’s Outcome Project in 2000, the RISE was refocused on residency program accomplishments. A review of the mean increase in RISE scores by topic from the first to the last year of residency revealed that laboratory administration scores showed the lowest level of mean increase (49.8%) for all topics examined (all topic range: 49.8%-114%).

In today’s competitive job market, prospective employers may view residents and fellows who have had significant graduated responsibility during their training as having more favorable medical knowledge and interpersonal skills than those who have not.^{6,21} This may be particularly important for those jobs where the practicing pathologist will need demonstrated skills in laboratory test utilization management or digital imaging, for example. Residency training programs have for years employed a variety of approaches to meeting these training needs in management knowledge and skills.^{10,14-15,24} Techniques range from didactic lectures, to commercially available curricula like the LMU, to mandatory rotations in management. In 1 example of the latter approach, the Department of Pathology of Hofstra Northwell School of Medicine combines observational and

active participation into a 1-month rotation.²⁵ The authors describe a rotation in which residents are not only exposed to departmental leaders and managers in real-time management situations but are required to engage in a project of strategic value to the department and its role in the health system. In this form of graduated responsibility, the majority of the residents surveyed felt that the experience enabled them to compete successfully for fellowships and their first employment.

In addition to improving their laboratory management skills, nearly all of the respondents to our survey indicated that participation in the University of Utah AMD program made them more competitive for fellowships or jobs. More than two-thirds noted that fellowship program directors and prospective employers commented favorably on their participation in an AMD during their training. While only 2 respondents noted that the AMD was a deciding factor in being offered a fellowship position, 28% (five of 13) of respondents were told that the AMD was described as a deciding factor in the offer of a job. Although not an overwhelming endorsement of the value of the AMD-graduated responsibility opportunity by future employers, the fact that it was considered favorably by some of them during the application process is noteworthy and encourages support for the program.

Finally, many respondents felt that the AMD experience improved their ability to perform their duties as fellows or practicing pathologists. The experience was credited with helping to prepare them for administrative responsibilities and leadership roles, to improve their interpersonal skills and their understanding of regulatory requirements in the laboratory, and to perform quality assurance activities in the laboratory. Opportunities for the design of future AMD experiences that respondents cited included a lack of adequate preparation for leadership roles in professional societies, a lack of focus on mentorship of others, and a lack of preparation for the needs of medical informatics duties.

In 2014, pathology joined other residency specialties in phase II of the NAS inspection program of the ACGME.¹³ The NAS includes 27 pathology milestones in AP and CP residency training. Included in these are 7 SBP milestones directly related to patient safety management, laboratory management, and informatics (SBP1-SBP7). Additionally, there are several related milestones in practice-based learning improvement (PBLI), PROF, and interpersonal communication skills (ICSs) that share some management-related knowledge and skill sets in error and discrepancy assessment (PBLI1), behavior (PROF2), performance feedback (PROF4), leadership skills (ICS1), and interdepartmental and team interactions (ICS2). Milestone levels 1 to 3 competencies generally focus on knowledge acquisition and understanding, whereas levels 4 and 5

require skill demonstrations. Over the course of one's residency, graduated responsibility should help to foster solid levels 4 and 5 competencies.¹³ As mentioned previously, a number of the AMD positions, notably those in the automated core laboratory, the endocrinology laboratory, and surgical pathology, emphasize management competencies that correspond to ACGME milestones (Table 9).

Conclusion

This article has described an innovative program that partially addresses the need for improved pathology residency education in laboratory management skills. The University of Utah Assistant Medical Directorship Program at ARUP Laboratories offers a unique experience for residents to gain skills in quality assurance techniques, personnel management, interdepartmental communication, test management, informatics, administrative experience, and laboratory utilization. The acquisition of these skills is thought to better prepare pathologists in training to enter the workforce by reinforcing subjects felt by the practitioners in many pathology groups to be lacking. Pathology residency programs are encouraged to incorporate some of these methodologies into their curriculum to augment their education in laboratory management.

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