Are New CLS Practitioners Prepared to Stay?

SUSAN BECK, KATHY DOIG

OBJECTIVE: This study assessed the relationship between the educational preparation and career expectations of CLS students and their subsequent retention in the laboratory profession.

DESIGN: Survey participants were given a list of 32 tasks that may be expected of early career professionals. Participants were asked to rate their educational preparation for and how frequently they performed each task in their current job using a four point Lickert scale. Additional questions addressed the participants' preparation for their current jobs, career satisfaction, plans for staying in the profession, and factors that influence retention.

PARTICIPANTS: The survey sample consisted of 972 Clinical Laboratory Scientists who passed the National Credentialing Agency for Laboratory Personnel (NCA) CLS examination between June 2002 and June 2004.

MAIN OUTCOME MEASURES: The mean rating for the level of preparation and the frequency of use for each of the 32 competencies was calculated. The mean ratings were used to assess the educational preparation in each competency and identify areas in which the level of preparation did not match the need for that skill in current practice. Using analysis of variance, respondents' answers to questions on their number of years of experience, their plans to stay in the profession, and their job satisfaction were compared based on their perceived level of preparation and the degree to which they felt their current jobs matched their career expectations at graduation.

RESULTS: The response rate was 31%. Most of the respondents felt that they were well prepared for the responsibilities of their current laboratory position. There was a good match between the respondents' ratings of their preparation in each competency and the frequency with which they were required to perform that competency. Phlebotomy and flow cytometry appeared to have more preparation than respondents felt they needed. Troubleshooting, resolving problems, and performing multiple tasks were identified as areas in which more preparation was needed. The mean number of years that respondents planned to stay in the profession was 15.5 years and the factors that were most important in keeping them in the profession included interesting work, good salaries, and advancement opportunities. The respondents who rated the match between their career-entry expectations and their current job the highest were more satisfied and planned to stay in the profession the longest.

CONCLUSION: Early career laboratory professionals felt well prepared for their jobs, though teaching of some tasks could be improved to better prepare graduates for the work environment. Most respondents indicated that they were prepared to stay in the profession for at least ten years; however they indicated that interesting work, good salaries, and opportunities to advance in the profession would be important in their decision to stay. A good match between laboratory employees' career expectations at the time of graduation and their work environment appears to improve their satisfaction with their careers and their desire to stay in the profession.

ABBREVIATIONS: ASCLS = American Society for Clinical Laboratory Science; ASCP = American Society for Clinical Pathology; CLS = clinical laboratory science; NAACLS = National Accrediting Agency for Clinical Laboratory Sciences; NCA = National Credentialing Agency for Laboratory Personnel.

INDEX TERMS: clinical laboratory science; education; medical technology; personnel retention; workforce attrition.

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Susan Beck PhD CLS(NCA) *is of the* ***Division of Clinical Laboratory Science, the University of North Carolina at Chapel Hill,*** *Chapel Hill NC.*

Kathy Doig PhD CLS(NCA) CLSp(H) *is of the* ***Biomedical Laboratory Diagnostics Program, Michigan State University,*** *East Lansing MI.*

Address for correspondence: *Susan Beck PhD CLS(NCA), Division of Clinical Laboratory Science, 4100 Bondurant Hall, CB#7145, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599-7145. (919) 966-3033, (919) 966-5200 (fax). sbeck@med.unc.edu.*

The clinical laboratory continues to face a shortage of personnel, particularly at the baccalaureate degree level. In the 2005 Wage and Vacancy survey by the American Society for Clinical Pathology (ASCP), nearly 44% of laboratories reported difficulty in recruiting or hiring laboratory personnel.[1] The vacancy rates were not as high as the 2002 levels for some positions including clinical laboratory technician (CLT) practitioners; however the vacancy rate increased for clinical laboratory science (CLS) practitioners. The shortage of baccalaureate level practitioners has been exacerbated by a decline in number of CLS programs over the past ten years.[2] Enrollments in existing CLS programs are improving; however, the number of graduates continues to lag well behind the projected demand.[3]

In addition to recruiting and educating new CLS practitioners, retaining existing employees is essential to meet personnel needs in the clinical laboratory. Recent studies of laboratory personnel emphasize the importance of salary, job challenge, and a feeling of being appreciated in retaining staff.[3,4] These same studies indicate that attrition is highest in the first five years after job entry. As laboratory professionals struggle to address the workforce shortage, understanding the perspective of laboratory employees in the early years of their careers becomes extremely important.

New employees are influenced by their educational experiences as well as their current work environment. Retention factors in the clinical laboratory work environment have been studied; however, the relationship between educational preparation and employee retention has not been explored. Does the educational process help or hinder the retention of laboratory practitioners, particularly in their first few years of practice? It is possible that the educational preparation of new CLS graduates is not a good match with the tasks they are asked to perform in the work place. For example, educational programs may be preparing students well in the scientific skills that appeal to many entering students, but neglecting the non-technical skills that are essential to laboratory operations. New employees may find they spend more time complying with regulations for a test than performing the test or analyzing results. It is also possible that educational programs set unrealistic expectations and students become discouraged when those expectations are not met in their first jobs. In compliance with National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) standards, CLS curricula include management and education components and this may set the expectation that graduates will be in supervisory or educational roles early in their careers. If the expectations of new CLS graduates do not match the "real world", new employees may be frustrated and more likely to leave the profession. This appears to be true in the teaching profession where studies have identified a mismatch between the educational experience and the reality of the classroom as contributing to attrition among early-career schoolteachers.[5,6]

This study was undertaken to assess the relationship between the educational preparation and the career expectations of CLS students and their subsequent retention in the laboratory profession. It is hypothesized that if CLS students' educational preparation and career expectations match the work environment they encounter upon graduation, they are more likely to stay in the profession. If this is true, there may be ways that both educators and employers can make changes to enhance satisfaction and retention. The study addressed the following research questions:

1. How do new laboratory professionals view their educational preparation in scientific and non-technical areas?
2. What competencies are new laboratory professionals required to use in their current laboratory positions?
3. Does the educational preparation of laboratory professionals match the competencies required for their current laboratory positions?
4. Do their current jobs match the career expectations that CLSs had when they completed their educational programs?
5. How long do new laboratory professionals plan to stay in the profession and what factors will influence their decision to stay or leave?
6. What is the relationship between retention and laboratory professionals' views on their preparation and their career expectations?

METHODS

In 2005, the researchers prepared a written survey and accompanying cover letter to be distributed by postal mail to early career professionals. The subjects were recruited from the database of the National Credentialing Agency for Laboratory Personnel (NCA). All CLS examinees from June 2002 to June 2004 were selected to provide responses from individuals who typically would have been practicing for one to three years at the time the survey was distributed.

The survey prepared by the researchers included questions in five categories. The first was demographic information including geographic region, facility type, job function, gender, ethnicity, years in the profession, years in current job, academic degrees, and type of laboratory science education.

The second category of questions included general opinion items related to career satisfaction and longevity. Using Likert scales, subjects were asked how well their education prepared them for job entry, how well their job met their expectations, and their degree of satisfaction in their job. They were then asked whether they would recommend the career to others as well as how long they intended to stay in their current job and in the laboratory profession. Based on prior studies, they were given a list from which to select factors contributing to retention or reasons they planned to leave or have left.[3,4]

The third and fourth sets of questions were based on a single set of items. The researchers relied on the examination content outline of the clinical laboratory scientist examination from the NCA, the competency statements for clinical laboratory scientists from NAACLS, and other institutional lists of entry-level job tasks to compile an abbreviated list of 32 job tasks that may be expected of early career professionals.[7,8] The task list encompassed technical, managerial, instructional, interpersonal, regulatory, and ethical tasks including those demanding application of knowledge and problem-solving. This set of tasks was used to create two sets of questions. The subjects were first asked how well their educational program prepared them for the tasks. They rated each task using a scale on which 1 = not prepared and 4 = very well prepared. They were then asked how frequently they performed each task in their current job. They rated each item on a scale on which 1 = not used and 4 = regularly used.

Finally, in an open ended format, subjects were asked to mention any additional skills they used frequently but were not taught in their educational programs. They were also asked to identify content that was covered in their educational programs that was not necessary in their current jobs. The study design, including subject selection, cover letter content, and survey content, was approved by the University Committee on Research Involving Human Subjects of Michigan State University, East Lansing MI.

The survey was pilot-tested with a convenience sample of recent graduates from the educational programs directed by each of the researchers. The results of the pilot test suggested modest changes to wording of questions that were made before the survey was finalized. The final survey, cover letter, and stamped self-addressed return envelopes were distributed by postal mail to the 972 subjects selected as described above.

RESULTS

Data analysis

SPSS 11.5 was used to analyze data including frequencies, means, and analysis of variance. Qualitative responses were grouped into categories of similar comments and tabulated.

Response rate

Usable results were obtained from 299 out of 972 possible respondents (31% response rate). Forty-nine of the surveys came from practitioners who had been working for more than three years and these surveys were excluded from the analysis. Six respondents did not attend a CLS program but qualified for certification based on their experience and they were also excluded from the analysis.

Demographics

The respondents came from all geographic regions of the country. The lowest percent of respondents (4.1%) was from the American Society for Clinical Laboratory Science (ASCLS) Region IV (MI, IN, OH, KY) and the highest percent of respondents (18.9%) was from ASCLS Region III (FL, GA, MS, NC, PR, SC, TN, AL). Most of the respondents (83.5%) worked in a hospital setting. Other work settings included independent laboratories (7.9%) and group practices (2.1%). The remaining 6.5% of the respondents were working in industry, blood centers, public health laboratories, research and development, military hospitals, or cancer centers.

The majority of the respondents (63.8%) indicated that their primary job function was a CLS generalist. Sixty-four respondents (25.9%) said they worked as CLS specialists. Their areas of specialization, in order of decreasing frequency, were microbiology, blood bank, chemistry, hematology, immunology, DNA, laboratory information systems, hemostasis, toxicology, cytogenetics, virology, and histocompatibility. Eleven

respondents (4.5%) described their primary job function as a supervisor or director, 2.1 percent worked in research, and 1.6 percent of the respondents were not working. Other job functions listed by 2.1 percent of the respondents included point of care testing, proficiency testing, reference coordinator, and scientist in a pharmaceutical company.

Seventy-seven percent of the respondents completed a university-based CLS program and 23 percent completed a hospital-based CLS program. Respondents had worked an average of 2.2 years as certified clinical laboratory scientists. The respondents were primarily female (82.7%) and Caucasian (78.1%). The other ethnic groups represented by these respondents included Asian (7.9%), African American (7.9%), Hispanic (2.5%), International (2.5%), Native American (0.8%) and mixed race (0.4%).

Preparation

In response to the question on how well their educational programs prepared them for the responsibilities in their current laboratory position, most respondents indicated that they were "extremely well prepared" (39.5%) or "very well prepared" (43.6%). Thirty-six respondents (14.8%) felt that they were "adequately prepared." Very few respondents felt that they were "poorly prepared" (1.6%) or "very poorly prepared" (0.4%). The respondents' mean ratings of their level of preparation in 32 competencies are shown in Table 1. Competencies for which the respondents felt they were best prepared (mean ≥ 3.0) were:

1. Perform laboratory testing including QA procedures in major areas of clinical laboratory practice (chemistry, hematology, microbiology, blood banking)
2. Perform phlebotomy
3. Resolve problems encountered in performing routine laboratory tests
4. Perform multiple tasks at the same time
5. Perform laboratory math (e.g. solutions, dilutions, hemacytometer counts, QA/QC statistics)
6. Evaluate patients' laboratory results and determine the need for additional actions
7. Explain specimen requirements and technical aspects of laboratory testing to other healthcare providers
8. Explain the significance of laboratory results to other healthcare providers
9. Apply ethical principles in performing job responsibilities
10. Relate to patients and colleagues with cultural backgrounds different than your own
11. Comply with governmental processes and policies that affect the healthcare industry and the clinical laboratory (e.g., CLIA, HIPAA, OSHA)
12. Read new procedures and perform them accurately

Respondents indicated that they were not as well prepared (mean ≤ 2.0) in the following competencies:

1. Perform laboratory tests and analyze results in flow cytometry
2. Conduct performance appraisals and disciplinary procedures
3. Prepare staff schedules
4. Use knowledge of reimbursement procedures to make decisions (e.g., CPT codes, medical necessity)

Practice

Respondents' mean ratings of the frequency with which they were required to use each of 32 competencies in their current work are shown in Table 1. The most frequently used competencies (mean ≥ 3.0) were:

1. Perform laboratory testing including QA procedures in major areas of clinical laboratory practice (chemistry, hematology, microbiology, blood banking)
2. Resolve problems encountered in performing routine laboratory tests
3. Perform multiple tasks at the same time
4. Perform laboratory math (e.g., solutions, dilutions, hemacytometer counts, QA/QC statistics)
5. Evaluate patients' laboratory results and determine the need for additional actions
6. Troubleshoot instruments and equipment
7. Explain specimen requirements and technical aspects of laboratory testing to other healthcare providers
8. Explain the significance of laboratory results to other healthcare providers
9. Apply ethical principles in performing job responsibilities
10. Relate to patients and colleagues with cultural backgrounds different than your own
11. Comply with governmental processes and policies that affect the healthcare industry and the clinical laboratory (e.g., CLIA, HIPAA, OSHA)
12. Read new procedures and perform them accurately

The competencies that were required the least for the respondents' current jobs were (mean ≤ 2.0):

1. Perform laboratory tests and analyze results in flow cytometry
2. Perform laboratory tests and analyze results using molecular methods
3. Apply the results of research studies to current laboratory practice

Table 1. Respondents' preparation in competencies and frequency of use of competencies in current practice

Competency	Preparation	Practice	Difference
1. Perform laboratory testing including QA procedures in major areas of clinical laboratory practice (chemistry, hematology, microbiology, blood banking)	3.6	3.8	-0.2
2. Perform laboratory tests and analyze results in flow cytometry	2.0	1.4	0.6
3. Perform laboratory tests and analyze results using molecular methods	2.1	1.7	0.4
4. Perform phlebotomy	3.0	2.2	0.8
5. Resolve problems encountered in performing routine laboratory tests	3.2	3.7	-0.5
6. Perform multiple tasks at the same time	3.5	4.0	0.5
7. Perform laboratory math (e.g., solutions, dilutions, dilutions, hemacytometer counts, QA/QC statistics)	3.4	3.3	0.1
8. Evaluate patients' laboratory results and determine the need for additional actions	3.3	3.5	0.2
9. Troubleshoot instruments and equipment	2.8	3.6	-0.8
10. Decide whether new methods should be adopted	2.3	2.1	0.2
11. Perform method evaluation / validation studies	2.4	2.1	0.3
12. Apply the results of research studies to current laboratory practice	2.2	1.7	0.5
13. Manage inventory of supplies and reagents	2.4	2.8	-0.4
14. Teach laboratory procedures to students, new employees, or other health care employees	2.8	2.8	0.0
15. Coordinate or present continuing education for laboratory personnel	2.5	1.7	0.8
16. Develop and implement programs to document employee competency in the laboratory	2.1	1.6	0.5
17. Write procedures for laboratory assays or safety protocols	2.4	1.7	0.7
18. Conduct performance appraisals and disciplinary procedures	1.9	1.4	0.5
19. Use principles of leadership and delegation to supervise staff	2.2	1.9	0.3
20. Prepare staff schedules	1.8	1.4	0.4
21. Participate on laboratory committees or task forces	2.3	1.9	0.4

Table 1 continued on next page

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Competency	Preparation	Practice	Difference
22. Participate on committees or task forces outside the laboratory	2.2	1.5	0.7
23. Participate in decisions regarding laboratory instrumentation or equipment purchases	2.2	1.8	0.4
24. Monitor costs and participate in efforts to reduce laboratory costs	2.2	1.9	0.3
25. Explain specimen requirements and technical aspects of laboratory testing to other healthcare providers	3.2	3.3	- 0.1
26. Explain the significance of laboratory results to other healthcare providers	3.1	3.1	0.0
27. Apply ethical principles in performing job responsibilities	3.4	3.6	- 0.2
28. Relate to patients and colleagues with cultural backgrounds different than one's own	3.1	3.5	- 0.4
29. Comply with governmental processes and policies that affect the health care industry and the clinical laboratory (e.g., CLIA, HIPAA, OSHA)	3.5	3.9	- 0.4
30. Use knowledge of reimbursement procedures to make decisions (e.g., CPT codes, medical necessity)	2.0	2.0	0.1
31. Read new procedures and perform them accurately	3.6	3.4	0.2
32. Perform workflow analysis	2.7	2.2	0.5

Preparation = Mean of respondents' ratings of their level of preparation in each competency (1 = not prepared, 2 = minimally prepared, 3 = moderately prepared, 4 = very well prepared); **Practice** = Mean of respondents' rating of the frequency with which they are required to use each competency in their current work (1 = not used, 2 = rarely used, 3 = sometimes used and 4 = regularly used); **Difference** = Mean of preparation – mean of practice

4. Coordinate or present continuing education for laboratory personnel
5. Develop and implement programs to document employee competency in the laboratory
6. Write procedures for laboratory assays or safety protocols
7. Conduct performance appraisals and disciplinary procedures
8. Use principles of leadership and delegation to supervise staff
9. Prepare staff schedules
10. Participate on laboratory committees or task forces
11. Participate on committees or task forces outside the laboratory
12. Participate in decisions regarding laboratory instrumentation or equipment purchases
13. Monitor costs and participate in efforts to reduce laboratory costs
14. Use knowledge of reimbursement procedures to make decisions (e.g., CPT codes, medical necessity)

Preparation versus practice

The mean response to each competency in the practice column in Table 1 was subtracted from the mean response for each competency in the preparation column. The differences between the means for "preparation" and "practice" are shown in Table 1. When the difference between the preparation and practice mean was 0.5 or greater, the competency was classified as one in which there may be more preparation for that competency than is needed for practice. Competencies in this category were:

1. Perform laboratory tests and analyze results in flow cytometry

2. Perform phlebotomy
3. Apply the results of research studies to current laboratory practice
4. Coordinate or present continuing education for laboratory personnel
5. Develop and implement programs to document employee competency in the laboratory
6. Write procedures for laboratory assays or safety protocols
7. Conduct performance appraisals and disciplinary procedures
8. Participate on committees or task forces outside the laboratory
9. Perform workflow analysis

When the difference between the preparation and practice means was -0.5 or less, the competency was classified as one in which there may be less preparation than is needed for current practice. The competencies in this category were:

1. Resolve problems encountered in performing routine laboratory tests
2. Perform multiple tasks at the same time
3. Troubleshoot instruments and equipment

Further information on the comparison between preparation and practice was obtained in open-ended questions. When asked to list competencies that were taught in their programs but were not needed in practice, respondents cited microbiology and phlebotomy more than other competencies. In response to the question on the competencies that are needed in their current positions but were not taught in their educational programs, molecular biology and instrument troubleshooting were mentioned most often.

Career expectations and satisfaction

Only 10.7 percent of the respondents indicated that their current position was a "poor" or "very poor match" with the career expectations that they had when they graduated from their CLS program. Most respondents felt that their laboratory positions matched their expectations "extremely well" (12.3%), "very well" (47.3%), or "adequately" (29.6%).

The mean level of satisfaction was 2.2 (SD = 1.13) or "somewhat satisfied" when respondents rated their level of satisfaction with their clinical laboratory science career on a 5 point scale on which 1 = very satisfied and 5 = very dissatisfied. Half of the respondents (51%) said they would recommend the clinical laboratory profession to a friend or family member with reservations. Thirty-two respondents (13.2%) would not recommend the profession and 35.8% of the respondents would recommend the profession with enthusiasm.

Retention

The mean number of years that respondents plan to stay in the profession was 15.5 years (SD = 12.4). Approximately 17% of the respondents did not answer this question or said they didn't know how long they would stay. Most respondents (79.5%) plan to stay for at least three more years and 62.5% plan to stay for five more years. Approximately half the respondents (51.5%) indicated that they planned to stay in the profession for at least ten more years and approximately 26% of the respondents plan to stay for at least 25 more years.

Respondents were asked to select the single factor that was most important in keeping them in the clinical laboratory profession. The factors selected most often by the respondents were "interesting work" (37%), "good salary" (25.5%), "advancement opportunities" (7.4%), "flexible hours" (5.1%) and "job security" (4.6%). Respondents were also asked to consider the factors that would most influence their decision to leave the profession. The factors chosen most often were "seek a better salary" (27.7%), "plan to enter another health profession" (16.2%), "lack of growth opportunities" (9.4%), "lack of professional recognition" (9.4%) and "plan to go to graduate school" (9.4%). Some respondents to this survey (7.8%) indicated that they had already left the laboratory profession. The major reasons for leaving described by this group of respondents were "chose another health profession" (26.3%), "lack of growth opportunities" (10.5%), "wanted different hours" (10.5%), and "moved to a new location" (10.5%).

To understand the relationship between the respondents' perceptions of their educational preparation and retention, the respondents were grouped into those who felt they were "extremely well prepared" and "very well prepared" (Group 1) and those who thought they were "adequately prepared", "poorly prepared" or "very poorly prepared" (Group 2). Analysis of variance was used to compare these two groups of respondents' years of experience, years they plan to stay in the profession, and satisfaction with their careers (see Table 2). There were no significant differences in the two groups in the number of years of experience, the number of years they planned to stay in the profession, or their satisfaction with their careers.

The relationship between the respondents' career expectations at the time of graduation and retention was tested by grouping the respondents into two groups. Group 1 included the respondents who felt that their current job matched their

career expectations "extremely well" and "very well." Group 2 included the respondents who thought that their current job matched their career expectations "adequately", "poorly", or "very poorly." Analysis of variance was used to compare these two groups of respondents' years of experience, years they plan to stay in the profession, and satisfaction with their careers (see Table 3). There were no differences in the two groups in the number of years they had worked. Group 1, those who rated the match between their career expectations and their current job the highest, were planning to stay in the profession longer and were more satisfied than respondents in Group 2.

DISCUSSION

Demographics

This study used the NCA mailing list to gain access to laboratory practitioners who were recently certified. Approximately 300 laboratory employees with three years of experience or less responded to the survey. This response rate of 31% is typical of an unsolicited mail survey of laboratory professionals. [9] The respondents came from all geographic regions of the country and appeared to be typical laboratory employees in many ways; they were primarily female, Caucasian, and worked in hospital laboratory settings.

Preparation

Most of the respondents felt that they were "extremely well prepared" or "very well prepared" for the responsibilities of their current laboratory position. This is consistent with previous studies in which laboratory practitioners indicated that they felt well prepared in the science and technical skills needed for entry level practice.[10,11] The areas in which laboratory practitioners rated their preparation the highest included performing routine laboratory tests, resolving problems, using laboratory math, multi-tasking, evaluating results, troubleshooting routine tests, explaining specimen requirements, explaining the significance of laboratory tests, applying ethical principles, relating to patients and colleagues with cultural differences, complying with governmental policies, and reading and performing new procedures. This list of competencies describes a competent, effective clinical laboratory scientist who would be an asset to any clinical laboratory.

In general, there was a good match between the respondents' ratings of their preparation in each competency and the frequency with which they were required to perform that competency. Most of the competencies for which the respondents felt best prepared (mean $\geq$ 3.0) were also the competencies used most frequently in their current jobs. There were two exceptions to this match between preparation and practice. Phlebotomy was included in the list of competencies for which the respondents felt best prepared but it was not one of the competencies most frequently used. Troubleshooting instrument problems was listed as one of the most frequently used competencies but it was not identified as one of the competencies for which the respondents felt best prepared.

Another way to assess the match between the preparation of laboratory professionals and the competencies required for practice is to compare the preparation mean and the practice mean for each competency (see Table 2). There were nine competencies for which the difference between the preparation mean and the practice mean was

Table 2. Comparison of respondents' perception of their preparation and the number of years they had worked, the number of years they plan to stay in the profession, and their level of satisfaction

Variable	Group	N	Mean	Standard deviation	F	Significance
Years worked	Group 1	202	2.19	0.05	1.66	0.19
	Group 2	41	2.36	0.12		
Stay in profession	Group 1	166	16.18	12.50	2.49	0.12
	Group 2	34	12.52	11.61		
Satisfaction	Group 1	202	2.15	1.12	3.45	0.07
	Group 2	41	2.51	1.14		

Group 1 = Respondents who felt they were extremely well prepared and very well prepared

Group 2 = Respondents who felt they were adequately prepared, poorly prepared or very poorly prepared

N = Number of respondents in each group who provided information

0.5 or greater, indicating that there may be more preparation for that competency than is needed for early career practice. At first glance, it may appear that there is "over-preparation" for these competencies and they could be deleted from or de-emphasized in the CLS curricula; however, a closer look at each competency is needed. For example, respondents indicated that their preparation in flow cytometry exceeds the frequency with which they use that skill in their current jobs. Most of the respondents were generalists, so it makes sense that they were not spending a great deal of time in the flow cytometry section of the laboratory. However, flow cytometry is used in many different laboratory instruments and a solid foundation in the principles and application of this method seems appropriate. With the increased use of flow cytometry principles in many new laboratory instruments, this sense of "over-preparation" may change in the future. Phlebotomy was also identified as an area in which preparation may exceed the need for that skill in current practice. Unlike flow cytometry, the need for phlebotomy skills for CLSs does not appear to be growing and some CLS programs may wish to use the results of this study to re-evaluate the amount of phlebotomy instruction in their curricula.

In addition to flow cytometry and phlebotomy, there were seven other competencies in which the comparison of means indicates possible "over-preparation". These seven competencies were all in the education and management areas of the curriculum. They included coordinating or presenting continuing education for laboratory personnel, documenting employee competency, writing procedures for laboratory assays or safety protocols, performance appraisals, participating in decisions regarding laboratory instrumentation or equipment purchases, and performing workflow analysis. Should the preparation of CLS students in these areas be de-emphasized? It appears that these respondents do not need these skills in their current jobs, but it is possible that they will be using them soon. In a 2002 survey of educators, managers, and practitioners, the competencies expected at entry-level and with three to five years of experience were identified.[12] In that study, writing procedures, participating in purchasing decisions and participating on committees outside the laboratory were all expected of CLSs within three to five years of graduation without additional education. The respondents in this study may find that they use these competencies more with each additional year of experience.

A third approach to assessing the match between preparation and practice used in this study was an open-ended question asking respondents about areas taught in their educational programs but not needed for current practice. In response to this question, microbiology and phlebotomy were listed most often as areas in which preparation exceeded the need for those skills in the practice environment. The number of respondents who listed phlebotomy was consistent with the responses on other parts of the survey. The suggestion that the respondents did not need microbiology, however, was surprising. It is likely that the respondents who gave that answer were not currently working in microbiology and answered the question quite narrowly, overlooking the contribution of their microbiology knowledge to the correlation of results in other laboratory departments. This does not suggest that preparation in microbiology is not needed for generalists, but rather that some respondents were not thinking broadly about how they use their generalist knowledge base.

To assess possible areas of "under-preparation" the study compared the difference between the preparation mean and the practice mean and the responses to open-ended questions. In comparing the preparation means and the practice means, the competences for which the level of preparation appeared to be less than needed for current jobs included resolving problems encountered in performing routine laboratory tests, performing multiple tasks at once, and troubleshooting instruments. The fact that the respondents said they performed these tasks frequently indicates that employers are using the CLS-level practitioners appropriately to respond to problems encountered in the clinical laboratory. For educators, providing more preparation in these competencies presents a challenge because they are best taught in the clinical setting. Although students can learn a great deal in lectures and student labs, it is in the real world of the clinical laboratory where they learn the most about resolving problems and troubleshooting instruments. The results of this study can be used to encourage clinical instructors to involve students in resolving problems and troubleshooting instruments. Laboratory managers may use the results of this study to improve new employee training programs by placing a greater emphasis on the troubleshooting aspects of the job.

In the open-ended question, respondents again identified troubleshooting instruments as an area in which they felt they needed more preparation than they received and they also mentioned molecular biology. This is an area that has grown rapidly in the past few years and it has been a topic at national meetings of educators and in NAACLS publications.[13,14] It is likely that the level of preparation will increase as more and more CLS programs offer courses and clinical rotations in molecular testing.

Retention

One of the surprising findings of this study was the number of respondents who said they intend to stay in the clinical laboratory profession. Over half of the respondents said they planned to stay for at least ten more years. That does not match the experience of employers who report that most of the employees who leave do so in the first five years.[3] These new employees plan to stay, but they also listed the factors that will influence that decision. The respondents indicated that the most important factors that would keep them in the profession are interesting work and a good salary. This is consistent with other surveys of practitioners including those with more years of experience.[4]

The respondents also said they would be most likely to leave to seek a better salary, enter another health profession, or because they lacked growth opportunities in their current job. So, new employees seem prepared to stay if the conditions are favorable. Providing new employees with these favorable conditions is not easy for laboratory managers when most institutions are looking for ways to cut costs rather than raise salaries. Growth opportunities can also be difficult to identify in the flat administrative structure of current laboratories. Employers may find suggestions for enriching the jobs of new CLS graduates by looking at the competencies for which they are prepared, but are not currently practicing. Giving new CLS graduates opportunities to use management skills (e.g., participate on a committee or task force; perform test cost analysis for new/prospective assays, sit on a staff search committee to conduct interviews), or instructional skills (e.g., lead instructor for students, residents, or new staff in a certain area) may contribute to their sense of career growth and to their retention.

Table 3. Comparison of respondents' perception of the match between their career expectations and their current laboratory position with the number of years they had worked, the number of years they plan to stay in the profession, and their level of satisfaction

Variable	Group	N	Mean	Standard Deviation	F	Significance
Years worked	Group 1	145	2.27	0.72	1.23	0.27
	Group 2	98	2.16	0.79		
Stay in profession	Group 1	122	18.68	11.98	21.77	0.00*
	Group 2	78	10.69	11.53		
Satisfaction	Group 1	145	1.72	0.77	92.58	0.00*
	Group 2	98	2.94	1.19		

Group 1 = Respondents who felt their current job matched their expectations at graduation "extremely well" and "very well"

Group 2 = Respondents who felt their current job matched their expectations at graduation "adequately","poorly", or "very poorly"

N = Number of respondents in each group who provided information

*Significant, $p < 0.05$

Preparation, expectations, and employee retention

A high percent of the respondents (83.1%) thought that they were "very well prepared" or "extremely well prepared" and this study identified only a few areas in which more preparation might be needed. There was no significant relationship between the respondents' perception of their preparation and the number of years they had worked, their satisfaction with their career, or the number of years they plan to stay in the profession. It does appear, however, that career expectations are important in employee satisfaction and retention. Respondents who thought their current job matched their graduation expectations "extremely well" or "very well" were more satisfied than respondents who thought the match was "adequate", "poor", or "very poor". The respondents who rated the match between their career expectations and their current job the highest also plan to stay in the profession longer than those who thought match was not as good. This study did not probe further into the details of the relationship between career expectations and retention, but it does provide some direction for educators and employers. It suggests that creating a good match between students' expectations and the reality of the work environment can lead to employees with better career satisfaction and longer retention. Suggestions for facilitating this match include:

- Providing clinical experiences that include solving problems in routine testing and troubleshooting instruments
- Providing early clinical experiences so that students can begin to develop accurate expectations or can change their career goal
- Decreasing the educational emphasis on skills that CLSs rarely use such as phlebotomy
- Increasing the emphasis on emerging skills such as molecular testing and clearly explaining the need to learn these skills even if they are not used in all areas of the laboratory at this time
- Developing educational activities (i.e. case studies) that frame content in more realistic situations including how information is used to judge whether test results are valid or whether additional laboratory tests are needed
- Using the results of studies such as this to inform CLS students about the skills and competencies they will be using most often in the early years of their careers
- Providing each new graduate with a mentor who can help with the transition from the academic setting to the "real world" of the clinical laboratory. The mentor should not be the new employee's supervisor so the employee will feel free to share frustrations and disillusionments, as well as satisfactions. A mentor can also help the early career CLS find professional rewards and colleagues outside of the work site through professional societies such as ASCLS.

CONCLUSIONS

The problem of employee retention in the clinical laboratory is complex and critical. If young, talented, laboratory professionals continue to leave the field for jobs that are more personally and financially rewarding, the laboratory profession will not be able to provide the services and leadership needed to meet the healthcare needs of the public. This study provides some good news in that early-career professionals are prepared to stay in the clinical laboratory beyond the first five years; both in terms of their competency and their intention. The study also shows that educators have the opportunity to influence retention and satisfaction by fostering a good match between students' career expectations and the work environment. New employees appear to be prepared to stay if the work remains interesting and they feel that their salary is commensurate with their education and experience. Those factors along with good management and family-friendly schedules have been identified as important in previous studies of retention.[4] Resolving the problem of retention of laboratory professionals requires the best efforts of educators and employers. Educators need to ensure that students' educational preparation is congruent with the work environment so that they will have realistic expectations upon graduation. If employers then provide work that is challenging and well-compensated, new employees will be more likely to be satisfied with their careers and stay in the profession.

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