THE CLINICAL LABORATORY WORKFORCE

The Changing Picture of Supply, Demand, Education and Practice

DEPARTMENT OF HEALTH & HUMAN SERVICES • USA

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Executive Summary

Overview

For a number of years there has been a growing concern among educators and the health care industry, primarily hospitals, that there is a shortage of clinical laboratory workers. These workers perform critical functions in health care delivery through the collection and analysis of bodily fluids and tissues. Yet the profession has suffered from a lack of public recognition, declining enrollment and education program closures, relatively little real wage growth, and a lack of career development opportunities within and outside the laboratory setting. To study these issues, the U.S. Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, National Center for Health Workforce Analysis issued a grant to the University of California, San Francisco, Center for California Health Workforce Studies.

Study Goals

The objective of the study was to produce a report to inform the health professions educational community, the health care community, and the public about issues related to the clinical laboratory workforce. Research questions addressed the size of the workforce, demographic characteristics, role of various types of clinical laboratory workers, educational requirements, scope of practice, magnitude of any workforce shortage, key factors impacting the supply of and demand for workers, and issues that are expected to influence the future of the workforce.

Methods

The research team partnered with the American Society for Clinical Pathology, a professional organization that has studied clinical laboratory workforce issues for several years and has longitudinal data on wage and vacancy rates, educational programs, and job tasks. The research team utilized quantitative and qualitative approaches including a literature search and review, an analysis of secondary labor market data, a wage and vacancy survey, an online survey of educational programs, key informant interviews, and an analysis of longitudinal data from a cohort of clinical laboratory workers.

Summary of Major Findings

1. Qualitative and quantitative data suggest a shortage of clinical laboratory workers in the past several years although the most recent data indicate that the shortages may be easing at least for some types of workers and in some settings and geographic areas.
2. Increasing wages and the use of sign-on bonuses indicate that the market is responding to a shortage of clinical laboratory workers. The increased use of per diem and contract workers and overtime may conceal the severity of the current shortage.
3. Though the pipeline to employment in the clinical laboratory sciences has deteriorated – mostly due to closures in hospital-based training programs – student interest is rising. Local or regionally driven efforts to restart training programs, or develop new ones, in locations currently experiencing labor shortages, have capitalized on renewed student interest to meet local workforce demand.
4. New and developing technology, including the automation of many common tests, will have an impact on the demand for clinical laboratory workers; yet much of that change is emerging more slowly than once predicted.
5. Medical technologists (MTs) will not move into consultative roles on clinical teams without a strategy to make this happen.

Introduction

The clinical laboratory workforce plays a vital, but often overlooked, role in the health care system. Clinical laboratory practitioners help in detecting and diagnosing disease or pre-disease states, as well as in monitoring the progress and results of treatment. General job responsibilities include the collection, examination, and analysis of body fluids, tissues, and cells for signs of infections, chemicals, abnormalities, and other indications of disease or precursors to disease.[1,2,3] Most consumers are familiar with the person who draws their blood but are not aware of the personnel who analyze those specimens behind the scenes, using techniques ranging from automated machines to complex visual analysis and report the findings back to medical personnel.

In recent years there has been a growing concern among employers, educators, professional associations, and policymakers that there is a significant shortage in the number of clinical laboratory workers. The perception that the shortage will worsen in the next decade as older workers retire, and vacated and new positions are not filled due to an insufficient number of new graduates, is of even greater concern. The Bureau of Labor Statistics (BLS) projects about 138,000 openings for medical technologists (MTs) and medical laboratory technicians (MLTs) by 2012.[4] Many hospitals, which had been the primary site of educational programs in the clinical laboratory sciences, closed their programs during the 1970s and 1980s due to both declining reimbursements and enrollments.

In response to these concerns, the Bureau of Health Professions, National Center for Health Workforce Analysis, issued a grant to the University of California, San Francisco (UCSF), Center for California Health Workforce Studies, to study issues of education, scope of work, supply and demand, and the impact of technological changes on the clinical laboratory workforce. For this study, the Center for California Health Workforce Studies developed a partnership with the American Society for Clinical Pathology (ASCP), a professional organization whose Board of Registry certifies laboratory workers, as well as surveys and collects data on the laboratory workforce, employers, and educational programs on an ongoing basis.

Project Objective and Research Questions

The goal of the study was to address 10 major research questions, including an assessment of educational requirements and a scope of practice for each of six types of clinical laboratory practitioners, a description of the size and demographic characteristics of the workforce, key factors influencing the current and future supply of and demand for workers, an assessment of the magnitude of any shortage and its impact on the health care system, and suggestions for addressing an imbalance between supply and demand. Research questions included the following:

1. What are the roles and activities of various clinical laboratory workers and what is the potential for substitution of workers and tasks?
2. What are the educational requirements for each type of position?
3. How is the scope of practice (job duties and responsibilities) of different clinical laboratory workers affected by the type of education (diploma, associate degree, on-the-job training)?
4. What are the demographic characteristics of the clinical laboratory workforce in the U.S. and regionally?
5. What are the key factors influencing current and future demand for key clinical laboratory sciences personnel?
6. What are the key factors influencing current and future supply of clinical laboratory sciences personnel?
7. What is the current and future utilization of key laboratory sciences workers in their primary work settings?
8. To what extent can the magnitude of any shortages among clinical laboratory workers be quantified?
9. What is the impact, if any, on the health care system of any shortages of key clinical laboratory personnel?

10. What recommendations from the clinical laboratory professions address supply/demand imbalance and underlying factors?

Report Outline

In this report we first describe the clinical laboratory workforce, its primary roles and responsibilities, educational pathways to the field, and certification and licensure processes. We then discuss the supply of and demand for clinical laboratory workers, using data from the project surveys and key informant interviews. In the final section, we present major findings of importance to educators, industry, government, and policymakers.

Methods

We utilized quantitative and qualitative approaches to study the clinical laboratory workforce. The collaboration between UCSF and the ASCP allowed us to utilize existing surveys and respondent databases. Because these surveys have been conducted by the ASCP for a number of years, we were able study longitudinal data from the same cohort of individual practicing clinical lab technologists. The following specific data sources were employed in this study.

1. Wage and Vacancy Survey

The ASCP Wage and Vacancy Survey of Medical Laboratories is a biennial survey conducted by the ASCP of clinical laboratory directors throughout the U.S. The 2002 survey was sent to 9,349 clinical laboratories in hospitals, private clinics, and industry from a mailing list maintained by the ASCP. There were 1,788 surveys returned for a response rate of 19 percent. Survey items address current vacancy rates and wages for certified and non-certified personnel in a variety of clinical laboratory settings. The ASCP 2002 Wage and Vacancy Survey of Medical Laboratories was conducted in collaboration with UCSF and Morpace International.[5] In the 2002 version of the survey, items were added for the purpose of collecting information on the number of lost positions, difficulty in filling positions, and strategies used to recruit new workers.

2. Survey of Educational Programs

A survey of educational program directors is conducted annually by the ASCP and is addressed to directors of all educational programs in the ASCP database. The 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs was sent to 632 directors of educational programs for medical technologists and medical laboratory technicians, specialists in blood banking, histotechnologists and histotechnicians, cytotechnologists, and phlebotomists. There were 491 completed surveys for a response rate of 77.7 percent. The 2002 Program Survey was changed in two important ways from previous years. First, the survey was expanded to include items on student recruitment, the number of faculty full time equivalents (FTE), faculty hiring and turnover, and curriculum changes. Second, the survey was conducted online rather than by mail. Program directors were contacted via e-mail with a link to the survey and a password, along with instructions on how to complete the survey. It was estimated that the survey took about 15 minutes to complete online.

3. Analysis of Longitudinal Cohort Survey Data

The ASCP conducted a longitudinal study of a cohort of medical technologists from 1993 to 2002. The survey began in 1993 with an initial mailing of the survey to 1,797 medical technologists. There were 1,156 responses for the initial survey, a response rate of 64 percent. The survey was conducted annually with a set of items that varied somewhat from year to year but included questions about job responsibility, job mobility and advancement, job satisfaction, and basic demographic information. By 2002, 186 respondents had remained in the cohort the full 10 years. These respondents are included in the analysis for this report.

4. Key Informant Interviews

Project staff researched and identified prominent organizations and professionals in the field of clinical laboratory science and identified individuals who were recognized experts in the field to contact for key informant interviews. These individuals represent a variety of perspectives on the field, including those of educational programs, the health care industry, professional associations, certifying bodies, accrediting bodies, regulatory agencies, and health care systems. We then sent letters to these potential informants describing the study and its purposes, and followed up with telephone calls to obtain verbal consent and schedule interviews. We identified and contacted 36 subjects, and conducted in-depth structured interviews with 31 (86 percent) of them. There were two refusals and three individuals with whom we made, but subsequently lost, contact with and thus were unable to interview. Interviews lasted from 30 minutes to 1.5 hours.[1]

Description of the Clinical Laboratory Workforce

The clinical laboratory workforce includes several categories of laboratory science practitioners, who have various levels of education and training ranging from on-the-job training to associate, baccalaureate, and graduate degrees. The general job responsibilities of clinical laboratory workers involve the collection and analysis of body fluids, tissues, and cells in order to diagnose and monitor diseases and medical conditions.[6,7,8] Through these processes, clinical laboratory practitioners help in detecting and diagnosing diseases, or pre-disease states, as well as in monitoring the progress and results of treatments.

[1] The perspectives of the individuals interviewed do not necessarily represent the views or positions of key stakeholder agencies, organizations, and institutions with which these individuals are affiliated.

The clinical laboratory professions addressed in this report include phlebotomists (PBT), generalist medical laboratory technicians (MLT) [also called clinical laboratory technologists (CLT)], and medical technologists (MT) [also called clinical laboratory scientists (CLS)], as well as specialized practitioners such as histotechnologists (HTL) and histotechnicians (HT). These latter two practitioners specialize in the preparation of thin slices of body tissues such as bone or organs for analysis.[9,10] There are also specialists in blood banking (SBB), who are trained in the functions of blood banks and transfusion services, and cytotechnologists (CT), who specialize in the study of cells for infections and abnormalities.[11] For example, CTs screen and analyze the Pap smear test for cervical cancer. Table 1 contains descriptions of the different types of clinical laboratory workers, their general job responsibilities, and typical work settings in which they are found.

Table 1

Types of Clinical Laboratory Workers

Medical Technologists (Clinical Laboratory Scientists) and Medical/Clinical Laboratory Technicians[2]
MTs and MLTs perform laboratory tests on tissues, blood, and other body fluids that range from simple to complex, they work as generalists, in an increasing variety of specializations, from infection control to genetic testing or biomedical research and development. Work Settings: Hospitals, Private Reference Laboratories, Blood Banks, Industry
Cytotechnologists
CTs prepare and analyze cell samples taken from various sites on the body. Abnormalities at the cellular level can reveal evidence of disease much earlier than other diagnostic methods can. Primarily, cytotechnologists analyze the Pap smear test. Work Settings: Hospitals, Private Reference Laboratories, Specialty Cytotechnology Laboratories
Histotechnologists and Histotechnicians
HTLs and HTs process very thin slices of body tissues for examination by a pathologist. The processing makes tissue structures visible under a microscope. A primary function of histological techniques is the identification of tumors. Work Settings: Hospitals, Private Reference Laboratories
Specialists in Blood Banking
SBBs are medical technologists with 12 to 24 months additional education and training in the functions of blood centers and transfusion services, such as the identification of blood group antigens and compatibility, analysis of abnormalities of the blood, transfusion therapy, and blood collection and processing. Work Settings: Blood Banks, Hospitals, Private Reference Laboratories
Phlebotomists
PBTs collect and process blood samples in a clinical environment, usually under the supervision of a MT. Phlebotomy is fundamental to all types of health care settings. Work Settings: Hospitals, Public Health Clinics, Physician Offices, Private Reference Laboratories, Blood Banks

Sources: American Medical Association, Health Professions: Career and Education Directory, 30th Edition, 2002-2003; AMA Press. Bureau of Labor Statistics, Occupational Outlook Handbook, 2004-05 Edition.

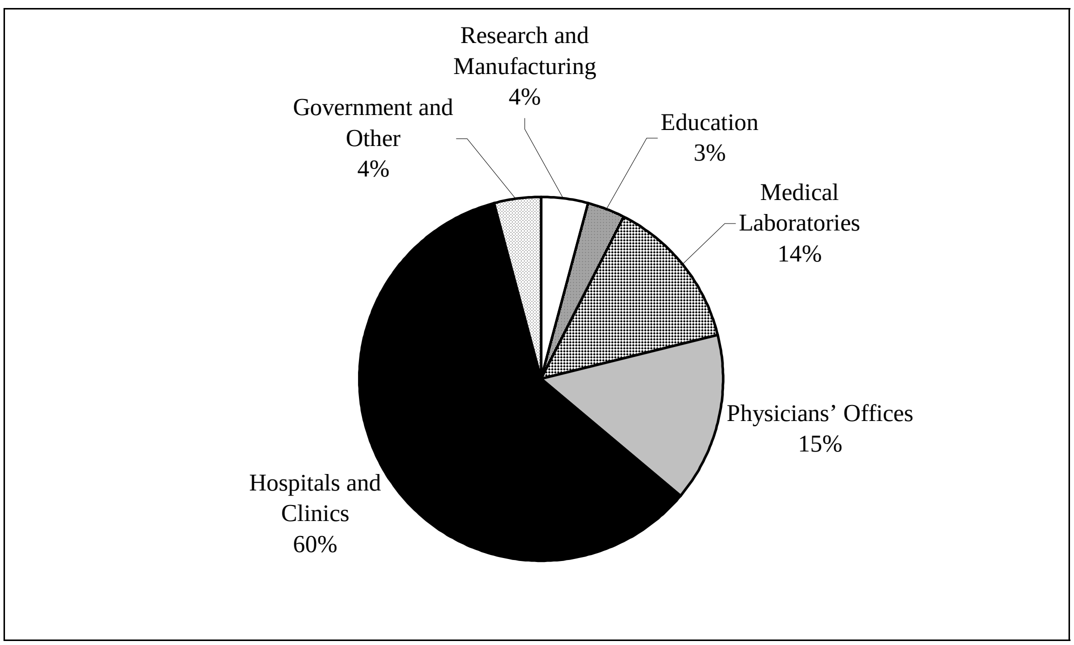
[2] The two largest groups of clinical laboratory workers are each referred to with two interchangeable titles by practitioners, educational programs, and professional organizations. The higher-educated group is known as both “medical technologists” (MTs) and “clinical laboratory scientists” (CLSs). The lesser-educated group is known as both “medical laboratory technicians” (MLTs) and “clinical laboratory technicians” (CLTs). For the purposes of this paper, we will primarily refer to MTs and MLTs, unless otherwise indicated (i.e., unless in the context of a direct quote or in reference to an institution/organization that employs the other titles).

Work Setting

Clinical laboratory practitioners work in a variety of settings, most often hospitals, but also in physicians' offices, independent laboratories, universities, colleges, community colleges, and the biotechnology industry.[12] Figure 1 presents Bureau of Labor Statistics (BLS) data showing the percent of clinical laboratory workers who work in each type of setting.[13]

Figure 1

National Employment of Laboratory Workers by Industry Setting, 2002



Source: Bureau of Labor Statistics, Occupational Employment Statistics, 2002 National 4-digit NAICS Industry-specific estimates, 2002

These data are for both medical laboratory technologists[3] and medical laboratory technicians, which are the only categories of clinical laboratory workers represented in the BLS. Not surprisingly, a majority of these workers are in hospital settings, with the remainder found primarily in physicians' offices and medical or dental laboratories. Only 12 percent of these

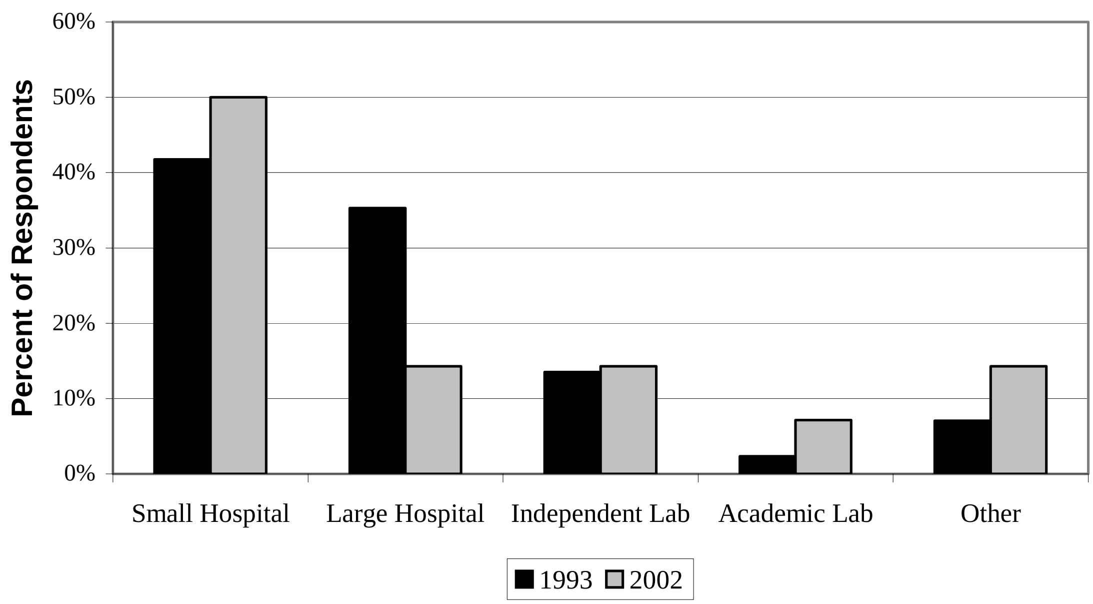
[3] The BLS uses the non-standard classification "medical laboratory technologist" rather than the more commonly used "medical technologist."

workers are in non-medical settings, such as industry (research and manufacturing), education, or government.

Figure 2 shows a comparison of employment setting for a cohort of ASCP-certified medical technologists, certified with the ASCP in 1993. This cohort was surveyed annually from 1992 through 2002, and the data presented here are for a subset of individuals who participated in each round of the survey.[4] The categories of laboratory setting in the survey included small and large hospitals, independent laboratory, academic laboratory, and other.

Figure 2

ASCP Cohort Data: Employment of Laboratory Science Workers by Industry Setting in 1993 and 2002[5]



Source: American Society for Clinical Pathology, Longitudinal Study of Medical Technologists, 1993, 2002

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[4] Due to possible biases related to self-selection into this subset of the original cohort, generalizations from these data should be made with caution.

[5] Small hospitals are defined as those with 300 or fewer beds; large hospitals are defined as those with 301 or more beds. Independent laboratories are privately owned clinical laboratories that provide outsourcing services to hospitals, physicians, and health care facilities, and direct testing to consumers. Academic laboratories are those found in university hospitals. Laboratories in the "other" category would tend to be found in doctors' offices, or in industrial research facilities.

Within this cohort, overall employment in hospitals decreased between 1993 and 2002, while it increased in academic labs and the “other” category. Employment in independent laboratories has remained roughly the same. Neither biotechnology nor industry were included in the response categories on the survey, therefore these employment settings are included in the “other” category.

Historical Growth of the Workforce

The clinical laboratory science professions arose from the science of clinical pathology.[14] In the early 1900s, during outbreaks of infectious diseases such as tuberculosis and typhoid, laboratories began to hire bacteriologists to detect the presence of pathogens in samples of sputum, throat cultures, and feces.[15] The work was low paying and offered little opportunity for advancement, thus it was regarded as most suitable for women. As medical technology became more sophisticated, the need for these workers increased and their numbers began to rise. These laboratory assistants or technicians trained on the job to perform routing testing procedures.

In 1920, the American College of Surgeons began requiring trained technicians to supervise hospital laboratories. At this time, clinical pathology itself was an undefined medical science, hardly acknowledged by the American Medical Association. Yet its practitioners foresaw that laboratory testing could potentially revolutionize the power and scope of medical diagnosis.[16] The first formal recognition of the profession came in 1922, when a group of 39 physicians laid the foundation for the American Society for Clinical Pathology (ASCP) with the objective “to promote the practice of scientific medicine by a wider application of clinical laboratory methods to the diagnosis of disease.”[17] A primary goal of the ASCP was to create a formal program to ensure the competence of laboratory workers through certification. In 1928, the ASCP established a Registry of Medical Technicians (later renamed the Board of Registry, or

BOR) and solicited technicians to apply for certification. Initially, applicants were certified on a case-by-case basis, but by 1933 the ASCP-BOR began to require that applicants meet educational prerequisites and pass both written and practical examinations to obtain certification.

The field of clinical laboratory science has grown remarkably since its beginnings, and continued growth is assured. In 1930, the first year that the ASCP issued certificates, just over 400 technicians were certified.[18] There were 2,453 MTs newly-certified in 1960 by the ASCP, and the number certified each year grew steadily throughout the 1960s likely due in part to the advent of Medicare in 1965, and increases in other third party payments for laboratory testing (see Figure 3). Growth in the profession led to the development of other professional and certifying agencies such as the National Credentialing Agency, which was founded in 1978. The NCA certifies laboratory professionals including clinical laboratory scientists and technicians, and phlebotomists. In terms of overall employment in the field, in 2001, there were approximately 150,000 MTs and 147,000 MLTs employed in the United States.[19] The Bureau of Labor Statistics projects that there will be 179,000 MTs and 176,000 MLTs employed by 2012, which in both cases represents an increase of about 19 percent from 2002.[20]

Demographic Characteristics

The clinical laboratory professions are female-dominated and, in the aggregate, are representative of the U.S. population with regard to ethnic or racial background.[21] However, given the general tendency for minorities to be underrepresented in higher income health professions, it is likely that, in fact, ethnic or racial minorities are underrepresented among the higher skilled, higher paid clinical laboratory science professions such as cytotechnologist or clinical laboratory scientist.[22] Despite the frequently cited concern in the clinical laboratory science field that a critical number of workers will retire from the field over the next 5-10 years, Current Population Survey (CPS) data show that the median age of clinical laboratory workers[6] in 2002 was 41.[23]

Table 2

Race/Ethnicity and Sex of Laboratory Science Workers and the U. S. Population in 2001

	Laboratory Workers		**Population**	
Race/Ethnicity	**Percent**	**N**	**Percent**	**N**
White, Non-Hispanic	71%	372	74%	291,670
Hispanic/Latino	6%	30	10%	38,356
Black, Non-Hispanic	15%	78	10%	41,348
Asian/Pacific Islander	7%	39	4%	16,213
Other	1%	3	2%	7,250
Sex				
Male	21%	110	48%	190,977
Female	79%	412	52%	203,860

Source: Current Population Survey, Bureau of the Census, Outgoing Rotations, 2001

Wages

Nationally, hourly wages for clinical laboratory workers range from a low of $10.55 for staff phlebotomists to $29.00 for cytotechnology supervisors, who are followed closely by MT managers at $28.50. Hourly wages by job category, therefore, demonstrate a relationship between compensation and both educational level and job experience. The educational requirements for different categories of workers are discussed in more detail in the section on pathways to becoming a clinical laboratory science worker.

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[6] The OES category used for the CPS is "clinical laboratory technologists and technicians," and CPS does not provide details about which workers fall into this category. Thus, for MTs and MLTs there may be measurement error associated with this statistic.

Table 3

Median Hourly Wage by Job Category, 2002

Position	Median Hourly Wage	Range of Hourly Wage
MT – Staff	$19.32	($16.00-$22.00)
MT – Supervisor	$23.00	($20.00-$25.76)
MT – Manager	$28.50	($24.37-$30.00)
CT – Staff	$24.00	($19.93-$26.25)
CT – Supervisor	$29.00	($22.50-$30.56)
Histotechnician	$16.61	($13.66-$18.59)
Histotechnologist	$19.77	($16.00-$22.00)
HT/HLT –Supervisor	$24.08	($19.55-$25.69)
MLT – Staff	$15.35	($13.00-$17.20)
MLT – Supervisor	$19.00	($16.00-$20.00)
PBT – Staff	$10.55	($9.00-$12.10)
PBT – Supervisor	$16.10	($13.50-$18.00)

Source: ASCP Annual Wage and Vacancy Survey, 2002

Geographic Concentration of the Workforce

Table 4 displays the State ratios per 100,000 persons medical laboratory technologists and technicians, expressed as a percentage of the national ratio of these workers to the population. This measure describes the concentration of workers by State, compared to their concentration nationally. The table also contains values for registered nurses and radiation technologists and technicians, allowing comparisons to be made across health care professions.

Table 4

Clinical Laboratory Science Workers per 100,000 People: State Ratios Compared to the National Ratio, 2001

State*	Medical Lab Technologists and Technicians	Registered Nurses	Radiation Technologists and Technicians
Nevada	61%	79%	73%
Idaho	63%	97%	100%
Alaska	63%	96%	81%
New Hampshire	65%	121%	94%
Montana	**68%**	107%	127%
Puerto Rico	**70%**	45%	43%
California	**74%**	76%	76%
Delaware	78%	103%	136%
Michigan	81%	100%	96%
Hawaii	**81%**	86%	121%
Wyoming	83%	96%	122%
Virginia	85%	88%	101%
Connecticut	87%	119%	140%
Washington	88%	92%	77%
Oklahoma	89%	75%	85%
Oregon	90%	96%	82%
Colorado	92%	87%	77%
Ohio	93%	122%	115%
New Mexico	94%	78%	65%
Kentucky	95%	71%	65%
Utah	97%	77%	82%
Vermont	99%	107%	104%
Indiana	99%	104%	114%
Louisiana	**99%**	103%	120%
Arkansas	100%	88%	126%
Alabama	100%	102%	102%
Mississippi	100%	102%	96%
New York	100%	110%	98%
Texas	101%	81%	95%
Pennsylvania	102%	120%	108%
Florida	**103%**	115%	126%
Georgia	**103%**	86%	89%
New Jersey	105%	108%	104%
Illinois	105%	107%	82%
West Virginia	**107%**	115%	115%
North Carolina	107%	105%	124%
Maine	109%	123%	112%
Iowa	110%	120%	101%

State*	Medical Lab Technologists and Technicians	Registered Nurses	Radiation Technologists and Technicians
Wisconsin	110%	115%	126%
South Carolina	111%	88%	117%
Arizona	113%	74%	100%
Minnesota	114%	128%	95%
Nebraska	124%	126%	122%
Kansas	127%	107%	98%
Maryland	131%	108%	105%
Rhode Island	**132%**	141%	138%
Massachusetts	134%	151%	127%
South Dakota	134%	144%	205%
Missouri	139%	118%	112%
North Dakota	**158%**	131%	100%
Tennessee	**161%**	115%	121%
Washington, DC	210%	182%	159%

*States that require licensure of MTs are in bold

Sources: Bureau of Labor Statistics, Occupational Employment Statistics, 2001; Bureau of the Census, State & County Quick Facts, http://www.census.gov

Washington, DC has the highest concentration of medical laboratory technologists and technicians in the Nation, at over two times the national average. North Dakota and Tennessee have the highest ratios of all the States, at 58 percent and 61 percent higher than the national average, respectively. Nevada has the least workers per population of all the States, at only 61 percent of the national average.

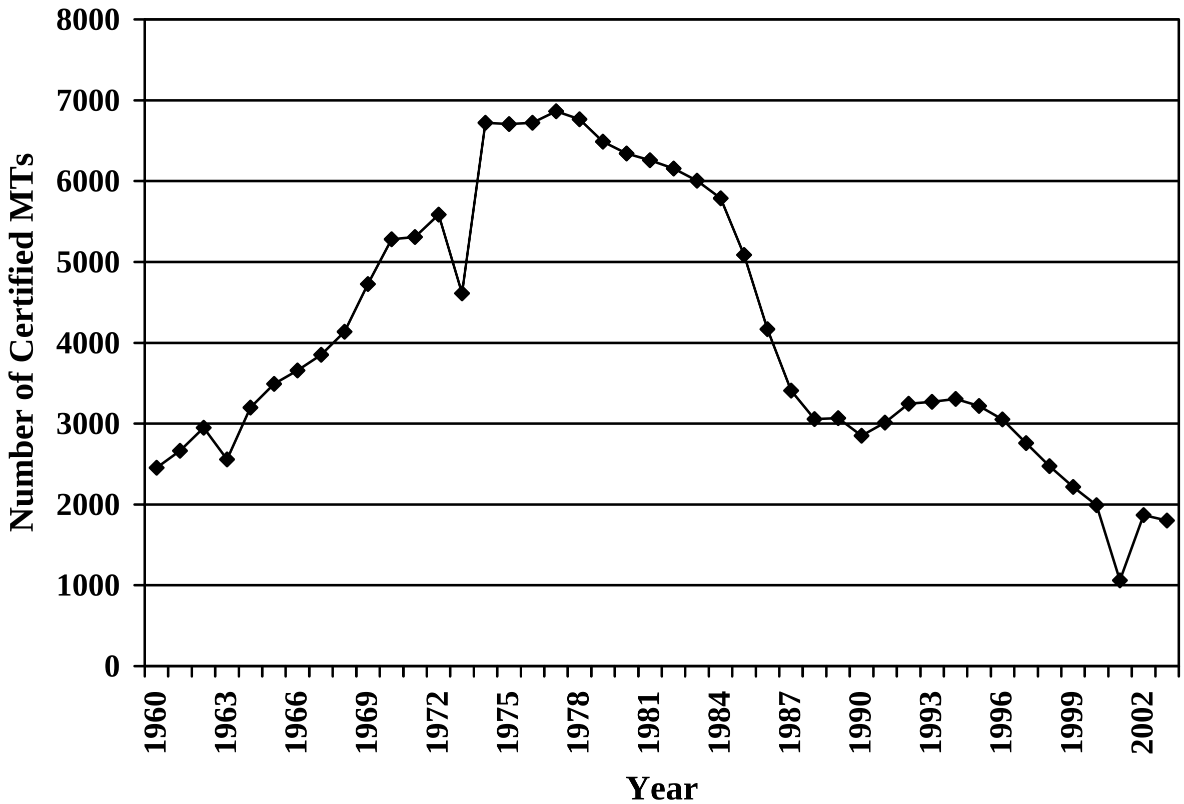
The requirement for licensure may be related to the number of workers in each State in that licensure could be perceived either as a barrier to entry or an attraction to workers if licensure offers the benefits of recognition and higher wages. However, the concentration of laboratory workers per 100,000 State population does not appear to be related to licensure, according to these data. Of the 11 States/territories requiring licensure of these workers, five fall below the national average, and the remaining six States fall above it (States and territories requiring licensure are bolded in Table 4).

Comparing across professions by State reveals that few States' exhibits are consistent with respect to the concentration of the three types of workers. Among the most consistent are California, which is 24-26 percent below the national average for all three professions; and Alabama, which is at the national average in its concentration of laboratory science workers, and 2 percent above the national average in its concentration of registered nurses, radiation technologists and technicians. A few States show wide variation across professions. For example, Montana is 32 percent below average in its concentration of laboratory science workers, but 27 percent above average in its concentration of radiation technologists and technicians. South Dakota is 34 percent above average in its concentration of laboratory science workers, and 105 percent above average in its concentration of radiation technologists and technicians.

Somewhat surprisingly, these ratios support a possible negative correlation between wages and concentration of laboratory science workers when analyzed relative to the ASCP's wage data.[24] The ASCP data show that the highest hourly wages for MTs is in the Western Region of the country. The 13 States in this region – Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming – are all shown in Table 4 to have lower than average concentrations of laboratory science workers. This finding should be interpreted with caution as an indicator of workforce shortage in the Western Region, both because the data are from different sources, and because the generally higher cost of living in certain States (particularly California and Hawaii) might account for the higher wages in the region. Wages are discussed in more detail later in this report.

Figure 3

ASCP Certified MTs, 1960-2003



Source: American Society for Clinical Pathology

Pathways to Becoming a Clinical Laboratory Science Worker

The different types of clinical laboratory workers described previously are distinguished both by their areas of specialization and the degree of education and training required for employment in a particular field, with technologists having the most education, training, and ability to perform the most complex testing. Generally, becoming a MT requires a baccalaureate degree in medical technology, clinical laboratory science, or a closely related discipline and an additional year of specialized training or on-the-job experience.[25] Cytotechnology also requires a baccalaureate degree and a year of laboratory training.[26] To be employed as a MLT generally requires an associate degree or a certificate, in addition to one year of specialized training or work experience.[27] However, having a high school diploma with the necessary scientific coursework and two years of on-the-job training with an appropriately certified clinical laboratory scientist or medical technologist can lead to employment as an MLT in some States.[28]

Clinical laboratory workers are educated in a variety of settings, including colleges and universities, community colleges, adult schools, and on-the-job training programs. The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) accredits programs in MT/CLS, CLT/MLT, HT, and HTL, and approves programs in PBT throughout the country. The Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredits SBB and CT programs.

Regulation of the Laboratory Science Professions

Laboratory personnel may be licensed, certified, and registered. The definitions that follow are based on definitions of the Council on Licensure, Enforcement, and Regulation (CLEAR)[29] and the Bureau of Labor Statistics, U.S. Department of Labor.[30]

Licensure is the most restrictive form of professional and occupational regulation and is usually granted by States. Licensure is often referred to as right-to-practice. State licensure laws define the scope of practice and who may practice based on State standards. These standards may include a required course of study, and clinical practice requirements, as well as written, oral, and practice examinations.

Certification is often referred to as title protection, or right-to-title, which is granted to persons whose professional competence meets prescribed standards. Certification requirements may include educational and experience requirements, as well as an examination.

Registration in many health professions is the least restrictive form of regulation. Registration usually takes the form of requiring individuals to file their names, addresses, and qualifications with a government agency or be registered with a national professional organization before practicing the occupation. However, as registration applies to laboratory personnel, it usually refers to the registration of personnel who have met requirements for certification.

Licensure

Currently 11 States license laboratory personnel (California, Florida, Georgia, Hawaii, Louisiana, Montana, Nevada, North Dakota, Rhode Island, Tennessee, and West Virginia plus Puerto Rico).[31] Most States that require licensure also require documentation of certification from an acceptable certification agency.[32] Many laboratory professional associations actively advocate for legislation to require licensure in additional States. The last State to license laboratory personnel was Montana in 1993. Legislation introduced more recently in Illinois and Michigan has not passed.[33] The New York State legislature recently passed a bill that will require licensure of MTs and CTs, and certification of MLTs; however, as of this date, the bill has not gone before the governor and it is unclear if it will be signed into law.[34]

There have been no studies of the effect of licensure on supply or salaries of laboratory workers. A study by researchers at the University of Alabama at Birmingham found that there was a positive association between State regulation and the salaries of respiratory therapy workers, but no consistent association between State regulation and vacancy rates. However, the effect on salaries was small in comparison to the effects of other factors, such as credentials, education, and region of the country.[35]

Certification

Voluntary certification is the chief professional standard-setting mechanism among laboratory personnel. Several organizations offer voluntary certification for laboratory personnel: the American Association of Bioanalysts (AAB), American Medical Technologists (AMT), the American Society for Clinical Pathology (ASCP), the National Credentialing Agency for Laboratory Personnel (NCA), the National Registry of Clinical Chemistry (NRCC), the National Registry of Microbiology (NRM), and others.

The ASCP and the NCA are the most widely recognized credentialing organizations with regard to MT/CLSs and MLT/CLTs.[7] Among first-time test takers, the ASCP certifies approximately 2,000 MTs and 1,300 MLTs annually, while the NCA certifies approximately 655 CLSs and 200 CLTs annually.[36] The NCA will accept some training and educational backgrounds that the ASCP will not accept. However, their pathways to certification are similar enough that general routes can be identified.

Table 5 displays the ASCP and NCA routes to certification as an MT/CLS. These general routes vary primarily in terms of the number of hours of training and education that the organizations require and the window of time in which this training must occur. In both organizations, Route 1 requires a BA/BS degree in a scientific discipline with one year of additional training in a NAACLS-accredited program. For Route 2, the basic requirement for both organizations is certification at the MLT/CLT level. The requirements for Route 2 differ in that NCA will accept MLT (ASCP) credentialing as a prerequisite to taking their CLS certification exam, but the ASCP will not accept the CLT (NCA) as a prerequisite to taking their MT certification exam. Other differences in the criteria for Route 2 are specified in Table 5, along with the criteria for Routes 3 through 5.

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[7] The terminology these organizations use to refer to MTs and MLTs differs: The ASCP uses the terms MT and MLT, while the NCA uses the terms CLS and CLT. MT and CLS are equivalent; MLT and CLT are equivalent.

Table 5

Routes to Professional Certification as a MT/CLS with the Major Certifying Bodies

Routes	**Criteria**	**Certifying Bodies**	
		ASCP	**NCA**
1	BA/BS with required science coursework	✓	✓
	In addition, 1 year training in NAACLS-accredited program	✓	✓
2	MLT (ASCP)	✓	✓
	CLT (NCA) or equivalent		✓
	In addition, 16 hours biology, 16 hours chemistry, 1 semester math	✓	
	In addition, 36 hours medical/chemical/biological science with no math requirement		✓
	In addition, 3 years of experience in previous 5 years, 2 of which were under appropriate supervision*	✓	
	In addition, 2 years of experience in previous 4 years with no supervision requirement		✓
3	MLT (ASCP)	✓	✓
	CLT (NCA) or equivalent		✓
	In addition, 16 hours biology, 16 hours chemistry, 1 semester math	✓	
	In addition, 36 hours medical/chemical/biological science with no math requirement		✓
		ASCP	**NCA**
	In addition, 5 years of experience in previous 10 years, 2 of which were under appropriate supervision	✓	
	In addition, 4 years of experience in previous 8 years with no supervision requirement		✓
4	MLS certification with the Canadian Society for Medical Laboratory Science		✓
	In addition, 2 years of clinical laboratory experience in previous 4 years		✓
5	Certification as an Advanced Registered Technologist (ART) with the Canadian Society for Medical Laboratory Science		✓

*Must be supervised by pathologist who is certified or eligible to be certified by the American Board of Pathology, or by an appropriately board certified medical scientist and a certified medical technologist.

**CLA (ASCP) certification was discontinued in 1982. Only applicants previously certified as CLA (ASCP) may apply under Route 3.

Sources: American Society for Clinical Pathology (http://www.ascp.org); National Credentialing Agency (http://www.nca-info.org/index.asp)

Recertification

Historically, certification renewal has not always included continuing education as a requirement. In 1980, however, the NCA began requiring recertification, either through continuing education credits or re-examination. Certification maintenance was introduced in 2004 at the ASCP, which now requires first-time certificants from 2004 onward to attain continuing education credits to maintain their certification with the organization.[37] Laboratory professionals certified with the ASCP prior to 2004 have lifetime certification. Employers may or may not specify certification (or certification by a particular certifying agency) as a job requirement for the initial hiring of laboratory personnel. Since certification maintenance is a new practice for ASCP certificants, it remains to be seen if employers will require it as a condition of continued employment. However, some employers do require that their certified employees keep their memberships current in their certification organizations. Vacancy data indicate that the shortage is somewhat more severe for certified workers. In the 2002 Wage and Vacancy Survey, the overall vacancy rate was 7.0 percent for certified MTs and 4.1 percent for non-certified, non-licensed MTs.[38]

Rather than setting competency-based standards for specific types of laboratory personnel, Federal and State laboratory regulators set quality standards for laboratories by the complexity of tests performed in the laboratories. Laboratory tests are categorized by their complexity as high, moderate, or waived.[8] The provisions of the Clinical Laboratory Improvement Amendments (CLIA),[9] which are the basis for Federal regulation of laboratory quality, focus on qualifications of directors and supervisors of laboratories that perform high-complexity testing.

Summary of Educational Pathways, Certification, and Licensure

In summary, there are multiple educational pathways to becoming a clinical laboratory worker. These pathways range from a baccalaureate or higher degree requirement for the technologists who perform more complex testing and analysis to on-the-job training for those workers who draw blood or collect specimens. In contrast to other similar professions in health care, clinical laboratory workers may begin with broad educational backgrounds such as a degree in biology or science. Clinical laboratory training has a large component of practical, hands-on learning through performing laboratory analyses under the direct supervision of an instructor. This teaching method explains why classes are relatively small and the cost of training is high. After completing educational programs, graduates may or may not seek licensure and/or certification depending upon the State and type of setting in which they wish to work. Professional certification is common, particularly for the higher-level technologists. Licensure is relatively rare, with only 11 States currently requiring licensure to practice. Certification is offered by multiple organizations although two organizations, the ASCP and the NCA, certify most of the workers.

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[8] Waived tests are those determined by the FDA to be so simple that there is little risk of error and little risk of harm to the consumer if the results are inaccurate. Waived tests are also approved for home use. See http://www.phppo.cdc.gov/clia/regs/toc.aspx for the categories of tests by complexity and pertinent regulations.

[9] The Clinical Laboratory Improvement Amendments of 1988, Public Law 100-578. This act applies to all entities that perform health-related tests on human specimens. Administration of CLIA is the responsibility of the Center for Medicare and Medicaid Services (CMS.) The Clinical Laboratory Improvement Advisory Committee (CLIAC) provides scientific and technical guidance for the implementation and enforcement of CLIA.

The link between licensure and certification requirements and the workforce shortage is not clear, although survey data suggests that the shortage of certified workers is more severe. There is a perception among technologists in the field that certification and licensure requirements in some States present barriers to attracting workers who might migrate from other States or countries. Unfortunately, data on the migration of clinical laboratory workers between States, or the immigration of foreign clinical laboratory workers, is unavailable.

Factors Related to Supply of Clinical Laboratory Science Workers

There has been a growing concern among clinical laboratory workers, managers, and educators that there is a shortage of clinical laboratory workers and that the shortage will increase in the next decade. The aging of the population, increases in health care technology, and increases in the number of available clinical laboratory tests are expected to increase the demand for clinical laboratory workers. Unfortunately, there are little data available illustrating trends in the number and utilization of laboratory tests. Much of the impact of new technology and widespread automation has not yet been realized. The BLS projection of 138,000 job openings by 2012 for MTs and MLTs is supported by data on vacant positions. Vacancy rates range from 7 percent to 13 percent in clinical laboratories around the country.

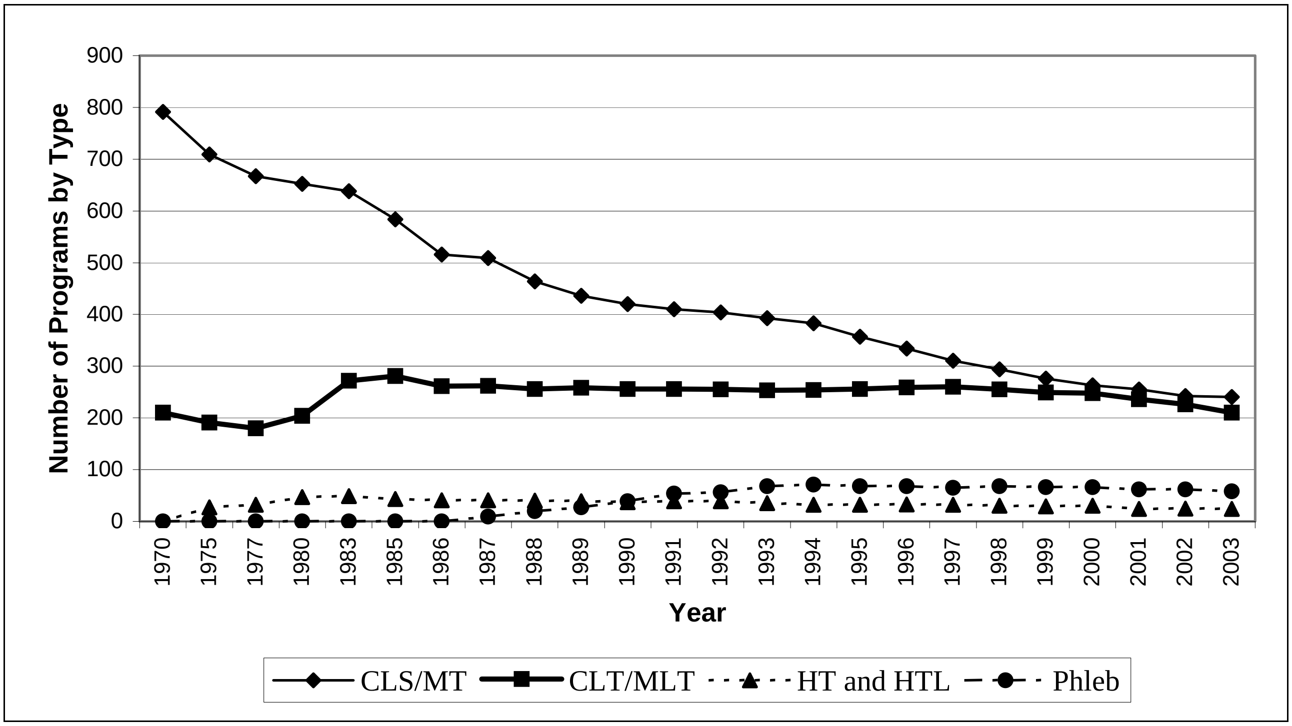
The number of new student graduates is a major factor influencing the supply of clinical laboratory workers. Each year, students who complete baccalaureate and associate degree programs, certificate programs, and on-the-job training programs add to the supply of workers who are available to take new jobs or replace workers who are leaving.

Decline in Number of Educational Programs

Educational programs in clinical laboratory science programs have been declining since 1975 (overall program enrollment is discussed in a later section). Figure 4 displays the number of NAACLS approved educational programs from 1975 through 2003 (28 years) for medical technologist (MT), medical laboratory technician (MLT), histotechnology (HT), and phlebotomy (PBT) programs.[39]

Figure 4

NAACLS-Accredited Educational Programs in Clinical Laboratory Sciences



Source: Data supplied by NAACLS

In 1970 there were 791 MT programs. By 2003 about 70 percent of these programs had closed, leaving only 240 programs in the country. The number of MLT programs (associate degree or less) increased from 210 in 1970 to a peak of 281 in 1985; and subsequently declined to 210 in 2003. Histotechnology programs also peaked in 1985 at 43 programs, and diminished to 24 programs by 2003. Data on the number of approved phlebotomy programs is available from 1987 to 2003 (16 years) showing growth from 9 to 58 programs. Program closures are due to many factors including decreased attractiveness of MT as a career choice, the advent of prospective payment systems, and managed care and budget cuts, coupled with an increase in the expense of running a clinical laboratory training program.[40]

Declining Hospital Reimbursement and the Closure of Hospital-Based Programs

Most of the closed MT programs were hospital-based. Data from NACCLS indicates that nearly 25 hospital-based programs closed each year from 1995 to 1997.[41] The advent of prospective payment systems (PPS) for hospitals, which changed their basic cost and revenue functions, is the most cited reason for the decline of hospital-based clinical laboratory training programs.[42,43] Prior to PPS, clinical laboratory tests were allowed costs under Medicare cost-based reimbursement and hospital laboratories were an important revenue center for hospitals. In such a fiscal environment, in which reimbursement for each test performed was ensured, more testing per patient was promoted. As the shift from fee-for-service to prospective payment took place, the revenues generated for hospitals by their clinical laboratories decreased.

In the current environment of reimbursement on a per case rather than a per test basis, more laboratory testing per patient can result in a financial loss for hospitals. The resulting fiscal strain has lead to difficulty maintaining hospital-based clinical laboratory science programs because revenue that previously was used to support training is no longer available. With overall decreases in hospital revenues, paying for the staff needed to support training programs is a burden.

Competing Opportunities Available to Students

Student recruitment has become more of a challenge in recent years for the clinical laboratory science field. The MT profession has traditionally been female dominated; yet with expanded opportunities for women interested in science and medicine, potential entrants to the field may be more apt to choose other professions. In general, a career in clinical laboratory technology offers few opportunities for promotion and salaries have been relatively flat. For example, data from the BLS (Occupational Employment Survey) indicate the median average wage for RNs in 2003 was about $24.00 per hour compared to an hourly rate of about $21.00 for clinical laboratory workers (all categories combined).[44] In addition, several key informants expressed the opinion that little attention has been given to increasing public awareness of health care careers in the clinical laboratory setting.

Working Conditions

Working conditions for clinical lab workers, particularly in hospitals, are also often cited as a reason for high turnover rates and difficulties in recruiting new workers.[45,46,47] With decreasing hospital revenues and cuts in full-time equivalent positions, remaining workers may be required to work harder and process more tests while maintaining the same quality standards. Highly trained medical technologists may find themselves processing more routine tests and being under-utilized for their higher level competencies due to the cost saving strategy of cutting middle level laboratory personnel. In addition, relatively flat wages and the impact of overall staffing reductions in laboratories have been associated with the intent of MTs to leave their current organizations, and therefore may contribute to turnover of highly skilled and experienced workers.[48,49]

Data from the Educational Program Survey

The ASCP has conducted an annual survey of educational programs since 1984.[50] In 2002 an in-depth survey was launched using a Web based methodology. Surveys were sent electronically (via e-mail) to 632 educational programs in medical technology, medical laboratory technician, cytotechnology, histotechnology (histotechnologist and histotechnician programs), blood banking, and phlebotomy. There were 491 surveys completed for a response rate of 77.7 percent. Response rates varied by type of program, ranging from a high of 88.9 percent for histotechnologist programs to a low of 52.1 percent for phlebotomy programs. In 2002, phlebotomy programs were included for the first time in the program survey and the response rate may have been lower because the program directors were less familiar with the ASCP organization and how the data has been used in the past.

Program Status

Most of the programs surveyed (97 percent) had remained active educational programs since the last survey in 2000. Nine programs had closed, representing about two percent of programs surveyed. Another percent reported becoming inactive, meaning that no students were currently enrolled.

Program Type by Program Setting

As shown in Table 6, most medical technology programs continue to be based in hospitals (49 percent of surveyed programs), despite the closure of many hospital programs over the past two decades. Educational programs for histotechnologists and histotechnicians were also primarily located in hospital settings. Medical laboratory technician programs (74 percent) and phlebotomy programs (63 percent) were most commonly found in community colleges because these programs are certificate or associate degree based. Cytotechnology programs were primarily based in university settings (51 percent), while blood bank specialist programs were primarily offered in blood centers (46 percent) or in hospitals (36 percent).

Table 6

Percent of Program Type by Setting, 2002

	CT	HT	HTL	MLT	MT	PBT	SBB
Blood Center	0	0	0	0	0	0	5
Community College	1	6	2	122	0	22	0
Hospital	10	7	4	1	102	5	4
Other	6	1	0	15	10	3	0
University / College	18	4	2	28	97	5	2
Total	35	18	8	166	209	35	11

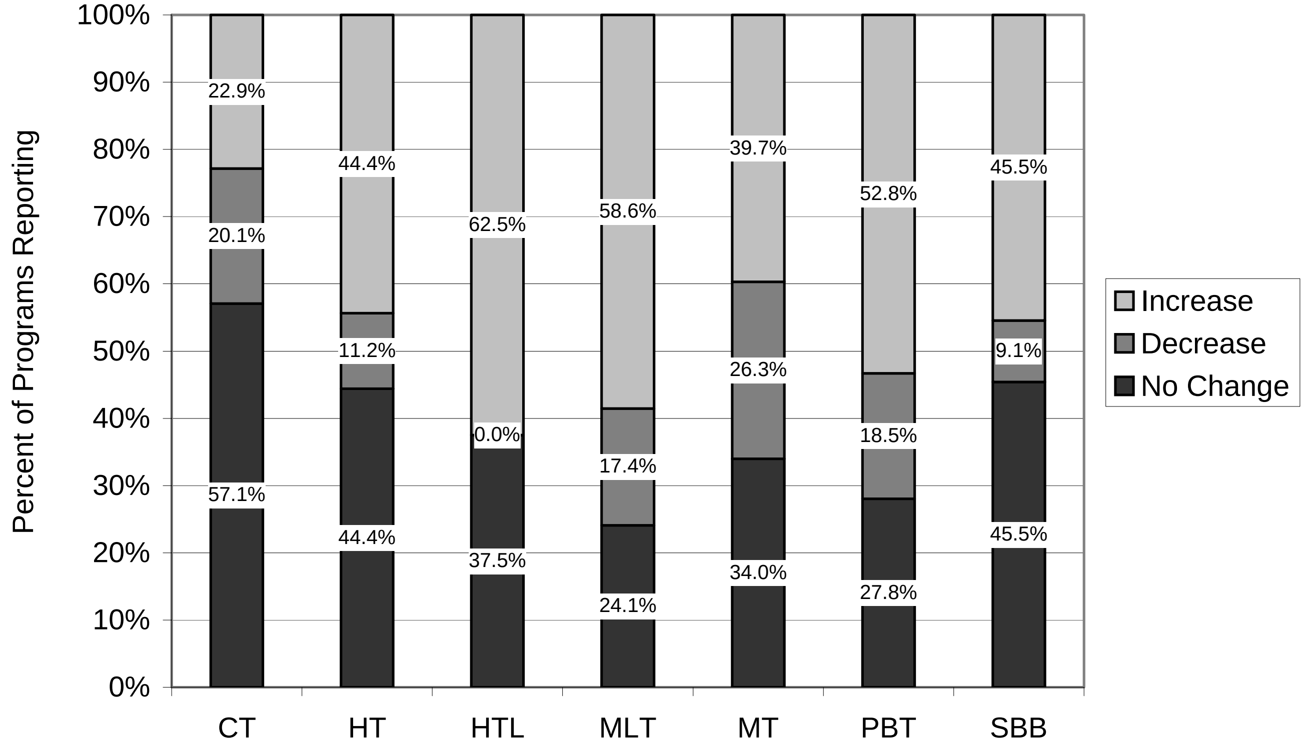
Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Number of Applicants

Figure 5 displays information on whether the number of applicants increased, decreased, or stayed the same for each type of educational program. This measure reflects the subjective impression of program directors rather than empirical data. The survey does not track the precise number of applicants from year to year. Survey results indicate that more than half of the directors of medical laboratory technician, histotechnology, and phlebotomy programs perceived increases in applicants from 2001 to 2002. About 25 percent of programs reported a decrease in applicants, with medical technologist programs reporting the greatest declines.

Figure 5

Changes in Number of Applicants*



Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs
*Percent indicates percent of program directors reporting.

Quality of Applicants

Program directors were also asked about changes in the quality of applicants from 2001 to 2002. Again, this is a subjective question since quality is self-defined by the respondent. Most programs reported no change or an increase in the quality of applicants. Over 80 percent of the histotechnologist programs reported an increase in the quality of programs. These programs tend to be smaller so they may be more aware of changes in the overall applicant pool from year to year.

Enrollment, Graduation, and Attrition

Table 7 displays information on the number of new program enrollees and graduates in 2002 in various types of training programs. These programs vary in length from less than 1 year (phlebotomy) to 2 years or more. Most educational programs are relatively small, with the average number of students ranging from 4 in the SBB programs to 28 in the MLT programs. By far, the MLT programs have the highest number of new students, though they also have the highest attrition rate at 18.5 percent. The SBB programs attract the fewest students, with only 25 new enrollees overall for 2002, but the overall attrition rate for these programs is the lowest of all these categories, at 2.5 percent. While the MT programs have a high number of new students, the overall attrition rate for these programs is low, at 5.5 percent.

Table 7

New Students, Graduates, and Attrition by Program, 2002[10]

	New Students	Graduates	Overall Attrition
CT	188	202	6.9%
HT	189	133	7.7%
HTL	65	43	18.0%
MLT	2,604	1,402	18.5%
MT	1,924	1,683	5.5%
PBT	572	694	16.6%
SBB	25	19	2.5%
Total	5,567	4,176	12.6%

Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Program Faculty

Tables 8 and 9 display information on the mean number of faculty per program and the faculty to student ratios by type of program. As these tables illustrate, most programs have a small number of faculty and low student to faculty ratios because clinical training requires

[10] It should be noted that Table 7 presents only the number of incoming students and outgoing students in the academic year 2001-2002; the total enrollment is not presented because it varies by semester or quarter.

intensive supervision and oversight. Program directors were asked about the number of faculty openings and difficulty in recruiting faculty. Generally, there were few openings for faculty and recruiting was not a problem, although it often took several months to fill faculty positions. There is currently a shortage of faculty in many allied health professions, thought to be due to the disparity in salary with academic salaries being lower than those in clinical practice. In addition, there is a lack of doctorally prepared faculty in many allied health professions. While this does not appear to be a problem currently in the clinical laboratory workforce, it may become an issue as older current faculty retire.

Table 8

Full-Time Equivalent Faculty by Program Type

	Mean	Number of Programs
CT	2.2	34
HT	3.6	15
HTL	1.5	5
MLT	2.2	159
MT	5.0	192
PBT	5.6	34
SBB	2.5	9
Total	3.7	448

Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Table 9

Student-Faculty Ratio by Program Type

	Mean	Number of Programs
CT	2.1	35
HT	9.2	12
HTL	1.2	5
MLT	2.2	156
MT	2.1	193
PBT	2.4	36
SBB	1.5	7
Total	2.1	444

Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Student Recruitment

In the 2002 survey, programs were asked for the first time about strategies and materials used to recruit students. The data are displayed in Table 10. About half of the programs had staff dedicated to recruiting students, though the survey did not specify that these staff members were faculty. Key informants also indicated that programs hired non-faculty to work as student recruiters. About 30 percent of the programs had a budget for recruiting. The individual programs generally developed their own recruitment materials. Only 4 percent of programs reported using government-produced recruiting materials, but 57 percent reported using materials produced by other organizations, such as professional associations. Other common strategies included advertisements and participating in both high school and college career fairs. Few of the programs paid student stipends or used stipends as a recruitment tool.

Table 10

Recruiting Strategies and Materials

	Programs Using	
Strategies and Materials	**Number**	**Percent**
Government Materials	13	4.1
Stipends	18	5.6
Alliances with Employers	68	21.5
Health Career Opportunity Program	81	24.5
Scholarships	87	27.3
Financial Aid	90	28.3
Recruiting Budget	145	31.2
Dedicated Staff	161	50.6
Other Organization's Materials	180	57.0
Advertisements	194	60.8
College Career Fairs	204	64.0
High School Career Fairs	223	69.9
College Career Fairs	204	64.0
Other Strategies	77	24.2

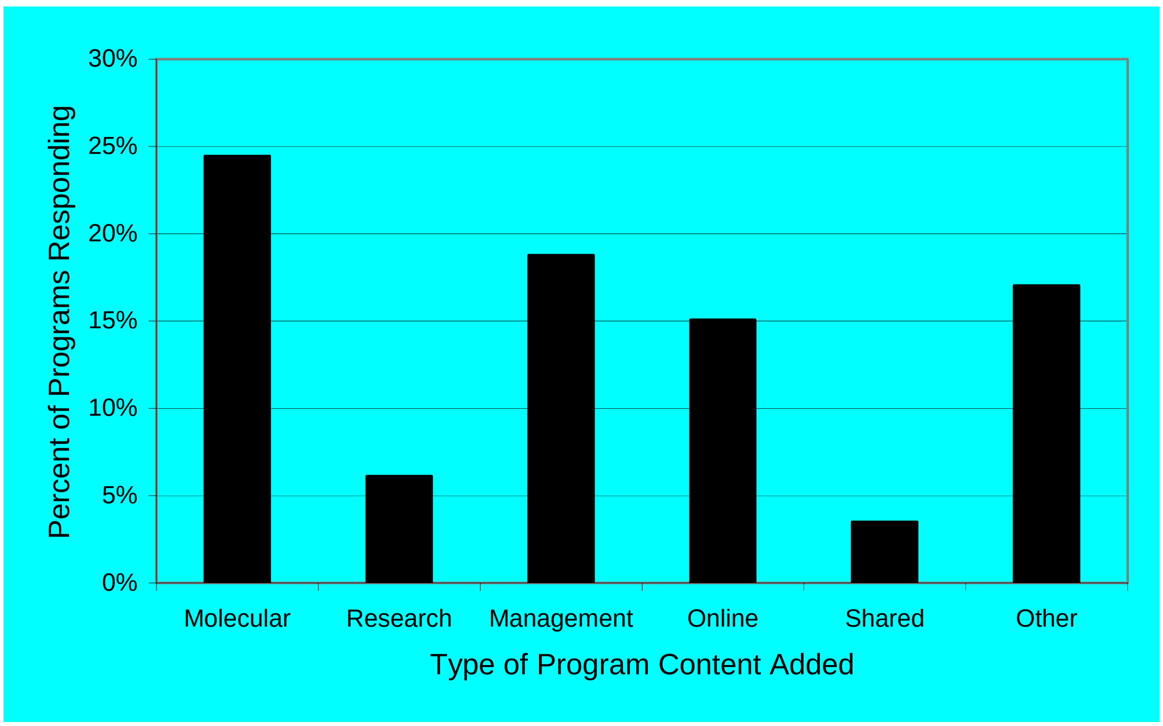
Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Changes in Curriculum

Over half of the programs (55 percent) stated they changed curricula during the past year. Among programs that reported curricular changes, Figure 6 illustrates that molecular content, management skills, and online content were the most frequent additions to curricula. These data provide evidence that educational programs are adapting to new or expected future tests and technology. However, new material is being added to a curriculum that is already quite full. Few programs (4.8 percent) reported that they had deleted any content from their curricula.

Figure 6

New Content of Educational Program Curricula



Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Perspectives on Supply from Key Informants

Key informant respondents identified multiple factors that are influencing the current and future supply of clinical science workers, including: (1) a perceived decrease in overall number and quality of applicants to fill slots in MT, CT, HTL, and SBB educational programs; (2) the high operating costs of educational programs and the relationship to program closure; and (3) difficulties in worker recruitment and worker retention

Student Recruitment and Student Quality

Despite the stability of student enrollment indicated by the program survey, respondents from accrediting agencies, certifying agencies, professional and trade associations, laboratory regulatory agencies, and educational programs expressed concerns about the declining number and quality of applicants to clinical laboratory science programs and rising attrition rates.

Respondents to the survey specifically commented on these concerns. One respondent from a professional association observed that there has been a “strikingly diminished number of students entering educational programs in the past 5 to 10 years.” An educator in a university with both a BS CLS and a BS Cytology program pointed to a “dramatic decline in student quality…in every way you can measure it.” More than one respondent said that, in recent cohorts, the number of students needing remediation to Master-level basic coursework has increased.

Respondents also expressed concern about student attrition from programs. One program director said attrition rates in his program had increased from about 5 percent to about 78 percent over 28 years. As 78 percent is an extremely high rate, this program should be regarded as an outlier. In addition, attrition rates may be on the decline. Data from the 2002 ASCP Program Survey indicate lower attrition rates across the types of laboratory science programs, with attrition for all MT programs at 5.5 percent, for all CT programs at 6.9 percent, and for all types of clinical laboratory science programs at 12.6 percent.

Indeed, the trend may already be changing with regard to student recruitment and enrollment in general. Several respondents have seen a slight upturn in both applicants to their programs and student quality over the past one to two years. Some directors spoke of demographic changes among recent cohorts. One noted that “more minorities, more males, and more second-career candidates” are applying to clinical laboratory science programs. At some programs, this shift is attributed to targeted recruiting. A program director stated, “There is a change in the sociodemographics of our applicant population — it’s older, more male, more diverse. We’re reaching out to minorities and to [the] socioeconomically disadvantaged.”

Some respondents pointed to a lack of educational program infrastructure, such as access to laboratory space and networks for securing clinical rotations as presenting significant barriers to educating enough clinical laboratory workers to meet future demand. “There are formidable structural problems,” said a professional association respondent. “Some talk about ‘grow your own,’ but there are problems for hospitals and labs, including cost containment. Distance learning and corporate education may be the answer. Many folks can’t go to community college. Large hospital systems like Kaiser can develop the support structure.”

Several respondents cited the cost of education to students as a barrier to recruitment into clinical laboratory science programs. While the cost of education is a systemic issue that transcends the laboratory science field, clinical laboratory science programs at the BS level are generally 5 years in length. Respondents indicated that students with 4-year science degrees could command higher salaries in other fields, making such degrees more competitive. A program director at an institution located in the southern region of the country described how students at high school career fairs who appeared interested in clinical laboratory science displayed “visual grimaces” upon hearing the average salary range for careers in clinical laboratory science. In 2002, the average hourly wage for MTs in the South ranged from $15.24 to $21.56.[51]

Program Cost

The expense of operating clinical laboratory educational programs as well as the threat of program closure were frequently cited concerns among our key informants. An educational program director in a university setting said: "Our…programs are the most expensive programs in the College of Arts and Sciences…the programs must be justified to the institution." Universities and community colleges are looking closely at the costs of running laboratory science programs, particularly the high expense of providing laboratory space. Clinical laboratory science programs typically have small class sizes, and bring in little in terms of tuition. Therefore, these programs may run at a loss and be viewed as fiscally unjustifiable by college administrations.

Worker Recruitment and Retention

Key informants identified numerous factors influencing worker recruitment and retention. Some respondents pointed to the lack of a career ladder for laboratory professionals, due to the relatively flat hierarchies that exist in hospital laboratories. Other respondents noted the lack of career mobility opportunities for laboratory professionals, which, after their high level of educational investment, would enable them to advance in related fields such as public health, biotechnology, and pharmaceuticals, or into government as consultants or technical and administrative supervisors.

Many respondents pointed to a lack of "meaningful work" for highly trained laboratory practitioners who continue to do routine testing after many years of experience in the field. Some informants offered the perspective that the lack of an adequate number of MLTs is one of the reasons that MTs continue to do most of the routine testing, including tests that are allowed to be performed by MLTs. One educator said, "CLSs are doing MLT work; it's boring for some, okay for others. There are not enough MLTs." Another educator said, "We need to provide more meaningful jobs. Many of the tasks are menial and routine. We'll get better retention if we get greater enrichment on the job, get people to work at greatest capacity."

Data from the ASCP's longitudinal cohort study support this contention. After 10 years in the field, 64 percent of their cohort of medical technologists reported that they perform routine tests "frequently," and the same percentage reported that they "never or rarely" perform specialized tests. Furthermore, the percentage of these workers who reported being "very satisfied" with the level of challenge in their jobs declined from 37 percent to 17 percent between 1993 and 2002.

Some respondents saw worker recruitment and retention problems as endemic within the health care professions. One respondent noted, "The same factors [as those impacting the clinical laboratory workforce] are influencing the supply of all health care professionals. A declining number of people are going into health care careers. A declining number see it as a good workplace, a good environment. It's seen as a hectic, disjointed, stressful environment."

Summary of Factors Related to Supply

In summary, concern about the inadequate supply of clinical laboratory workers was the major impetus for this study. For the past two decades the number of educational programs and graduates has been shrinking. Factors thought to be related to program closures include: difficulties in student recruitment; the high cost of training programs combined with shrinking revenues for hospital laboratories; low wages relative to other health careers; and the lack of career growth and opportunity. Key informants expressed concerns about the quantity and quality of students applying to clinical laboratory educational programs although data from the program survey suggest that the quantity of students may have stabilized and student quality has remained largely unchanged. There is concern about the image of the clinical laboratory worker, particularly compared to more highly visible occupations such as nursing. This factor contributes to the difficulty that both educational programs and employers face in recruiting bright and capable students. Finally, there is concern that the aging of the U.S. population and increases in technology will increase the number of laboratory tests and will create the need for even more workers.

Factors Related to Demand for Clinical Laboratory Workers

Current and future demand for clinical laboratory workers and for specific types of laboratory personnel influenced a complicated set of factors. These factors include changing demographics, changing biomedical and information technologies, and changes in the health care and public health sectors.

The effect of these factors over the short term will be to drive up demand for some clinical laboratory workers, drive down demand for others, and create new opportunities for laboratory workers with specialized skills. The combined effect of these factors over the longer term is likely to result in broad, industry-wide changes in terms of the types and methods of testing, settings for testing, how laboratory work settings are structured, how laboratories are staffed, and what workers do.

Respondents believed that the volume of laboratory tests is growing and will continue to grow, although data showing the trend in the volume of testing are not available. Key informants predicted that future testing will be performed in a variety of settings including: consumer homes; physician offices; at the patient’s bedside; in core laboratories of individual hospitals; in regional hospital laboratories; in public health laboratories; in large reference laboratories in the U.S. and other countries; and in small specialty or “niche” laboratories. While most of the testing in clinical laboratories will continue to be performed by MTs, MLTs, and other clinical laboratory workers, some tests may be performed by other members of the health care team or by consumers themselves.

Respondents discussed how new tests and new testing technologies (e.g., molecular, genomic, proteinomic, pharmacogenomic, and immunohistochemical) are contributing to increases in the volume of tests. Laboratory tests to detect markers of disease, to predict disease progression, and to monitor treatment are among the new tests. The increased use of “point of care” testing at the bedside, “direct testing” initiated by consumers to monitor their health without physician orders, and “waived tests,” many of which require no personnel qualifications to perform except the ability to read and follow manufacturers’ instructions, are other developments that are adding to the total volume of testing. Public awareness of genetic testing, fertility testing related to assisted reproduction, and “wellness” related tests are increasing the demand for these types of tests. In addition, emerging infectious diseases such as SARS, West Nile virus, monkey pox, and the avian virus, are driving the demand for tests in public health laboratories. Recent bioterrorist events have brought to light the importance of having a sufficient number of well prepared clinical laboratory workers to immediately respond to any such future events. This is an issue of training in bioterrorism preparedness as well as merely having enough workers to process and analyze a large volume of tests in public health laboratories. One key informant stated that recent CDC funding contributed to preparedness in building infrastructure, new technology, and teaching new skills to the laboratory workers, but that ongoing funding will be important.

New testing methods and processes, including miniaturization, hybridization testing, platform testing, robotics, and artificial intelligence are expected to shape the demand for clinical laboratory workers. Some key informants expect continuing development of automated testing processes to reduce the need for workers. Many tests that are in wide use are already automated. Others, including proteinomics, microbiologic and histologic testing, and testing for infectious diseases are less amenable to automation. However, the degree to which automation will reduce the need for certain types of laboratory personnel, particularly MTs, and increase the need for others, such as MLTs and clinical laboratory assistants (CLAs), is not clear.

According to some of our respondents, there has not been widespread adoption of automated testing processes in hospital based laboratories, possibly because of the large up front investment required for equipment and redesign of the laboratory. Increased “point of care” testing appears to have a limited potential to reduce the volume of testing done in core hospital laboratories.

Point of care testing done by health professionals other than laboratory personnel (e.g., nurses) also increases the need for training, supervision, and quality control by laboratory personnel. However, the shortage of nurses and concern about quality control has hampered the adoption of point of care testing. “Direct testing” is a growing phenomenon, both online and at private laboratories in the community. The rate of growth of this phenomenon, and its effect on demand for different types of laboratory personnel, are unknown. Some professional and laboratory trade associations are responding by offering online consultative services to consumers about the usefulness of tests and interpretation of test findings.

In large academic health centers and regional hospital laboratory centers the challenges of medical informatics will create a demand for laboratorians with new interests and new skills.

Medical informatics involves integrating a growing number of databases to meet multiple needs, for example: (1) systems that provide microbiologists with access to databases; (2) clinical databases that aggregate information from ancillary hospital settings, including laboratories, which are "islands" of information; and (3) patient-specific data to provide information for clinical decision-making.[52]

Findings on Demand from the ASCP Wage and Vacancy Survey

Vacancy Rates

The ASCP has been conducting a biennial wage and vacancy survey since 1988. This national survey is directed to clinical laboratory directors at labs in hospitals, reference labs, private clinics, and industry. The purpose of these surveys is to document the trends in wages and vacancy rates in 10 key laboratory staff positions.[53]

The ASCP has used consistent survey design and methodology from 1988 to 2000. In 2002, the survey instrument and the sample size were expanded. The goals of the changes in methodology were to increase the types of laboratories participating, add new staffing categories, and solicit information on recruitment and hiring practices.

The ASCP 2002 Wage and Vacancy Survey of Medical Laboratories results indicate that overall vacancy rates were 7.0 percent for certified/licensed medical technologist (MT) staff and 4.1 percent for non certified/non-licensed MT staff.[54] Vacancy rates varied by both type of laboratory worker and by region of the country. Table 11 displays vacancy rates for MTs by type of laboratory setting, hospital size, practice setting, and region of the U.S.

Table 11 *Vacancy Rates for Certified/Licensed and Non-Certified/Non-Licensed MT Staff*

Employer Group	Certified/Licensed MT Staff		Non-certified/Non-licensed MT Staff	
	Percentage	**N**	**Percentage**	**N****
Laboratory Type				
Hospital	7.2	832	4.2	103
Private clinic/reference	4.8	129	*	
Private physician office	6.1	140	*	
Outpatient clinic	8.4	52	*	
Hospital Size				
Less than 100 beds	11.1	378	0.0	33
100 – 299 beds	11.7	266	12.6	31
300 – 499 beds	7.1	121	*	
500+ beds	4.8	67	*	
Practice Setting				
Rural	10.4	434	12.4	36
Suburban	6.3	117	*	
Small/medium size city	6.8	422	1.2	41
Large city	6.1	162	*	
Region[11]				
Northeast	8.3	128	1.4	34
South	6.6	267	*	
Employer Group	**Certified/Licensed MT Staff**	**Non-certified/Non-licensed MT Staff**		
	Percentage	**N**	**Percentage**	**N**
North Central	6.7	181	*	
Midwest	6.3	167	*	
South Central	10.2	168	*	
West	6.0	242	*	
Total	7.0	1,153	4.1	124

[11] Key for regions:
Northeast – Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont
South– Alabama, Delaware, District of Columbia, Florida, Kentucky, Georgia, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia
North Central – Illinois, Indiana, Michigan, Ohio, and Wisconsin
Midwest – Iowa, Kansas, Minnesota, Nebraska, Missouri, North Dakota, and South Dakota
South Central – Arkansas, Louisiana, Oklahoma, and Texas
West – Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

*Sample size too small for statistically valid comparisons
**N = number of laboratories represented

Vacancy rates were highest in hospitals, particularly small hospitals under 300 beds, for certified MTs (11.1 percent) and in the southern region of the country (10.2 percent) including Arkansas, Louisiana, Oklahoma, and Texas.[55] There were shortages in other clinical laboratory workforce categories including certified/licensed histotechnicians (8.7 percent), histotechnologists (10.0 percent), non-certified/licensed medical laboratory technicians (11.9 percent), and phlebotomists (11.1 percent).[56]

Survey findings indicated that laboratories are hiring temporary and registry workers to fill vacant positions. Respondents reported that positions which have remained vacant for long periods of time are being eliminated, thus the reported vacancy rate may be understated.

The survey asked respondents to list the most common strategies used to retain workers, attract new workers, or fill vacancies. The most common strategies cited were increasing salaries, using per diem or temporary staff, paying educational expenses, offering sign-on bonuses, and covering relocation expenses.[57]

About half of the survey respondents stated that they had difficulty in hiring new workers. Larger hospitals in the Northeast and Midwest sections of the country reported the most hiring difficulty. Nearly all laboratories (91 percent) reported difficulty hiring for at least one shift. For MT staff, night shifts were most difficult to fill (82 percent) and for MLT positions, evening shifts were most difficult to fill (72 percent).[58]

Wages

Wages for clinical laboratory workers have increased somewhat. Findings from the 2002 Wage and Vacancy Survey indicate that, across most categories of clinical laboratory workers, wages increased at a rate equal to or slightly more than inflation.[59] Salaries for all the different categories of clinical laboratory workers increased between 6.2 percent to 11.3 percent between 2000 and 2002 and another 3 percent for most categories of workers between 2002 and 2003.[60,61]

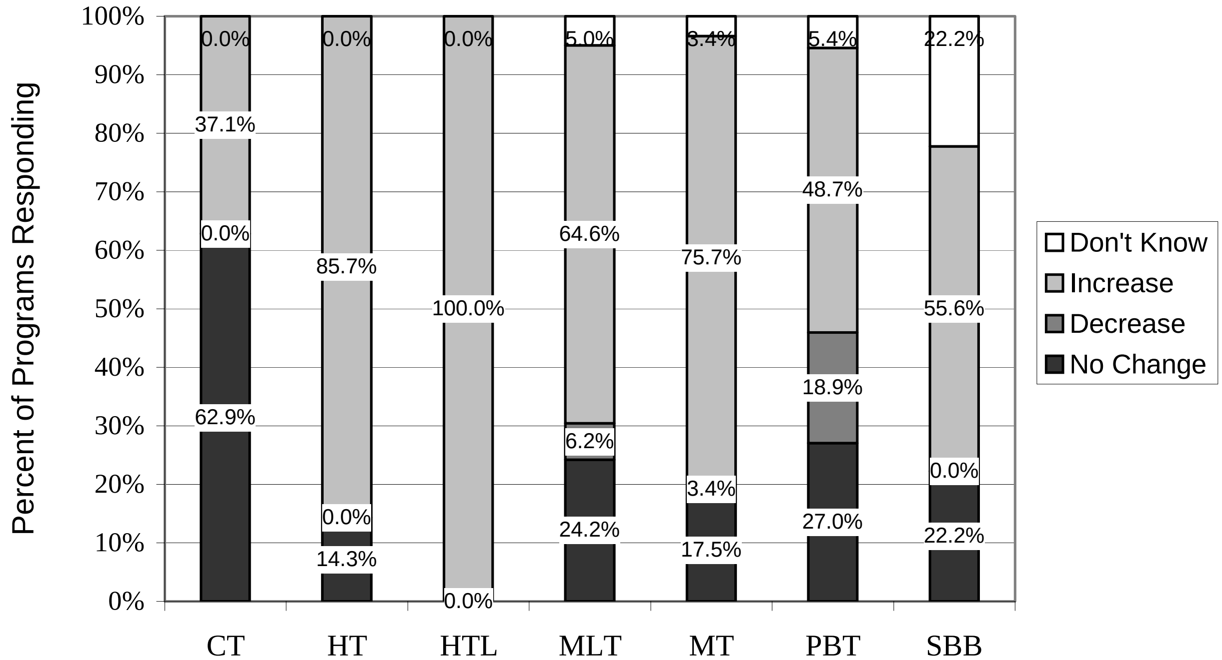
Not surprisingly, the greatest wage gains were seen in the categories with the highest reported vacancy rates: cytotechnology staff and supervisors, and histotechnology supervisors. Employers used other strategies to attract workers during this period. For example, nearly 25 percent of employers used sign-on bonuses, 20 percent used relocation assistance, and almost 30 percent offered financial aid for continuing education.[62] Across all positions, there was great variation in wage rates by position, setting, and region of the country. The lowest wage rate reported was $9.00 per hour for phlebotomist staff and the highest reported was $30.56 per hour for cytotechnology supervisor.[63] Nationally, cytotechnology supervisors are the highest paid among these workers, at $29.00 per hour, followed closely by MT managers at $28.50 per hour.

Changes in the Number of Job Openings from 2001 to 2002

Figure 7 displays information on changes in the number of job openings for graduates as reported by the program directors in the survey of educational programs. In general there was an increase in the number of job openings for most of the types of training. Most program directors in medical technology, medical laboratory technology, histotechnology, and blood banking reported an increase in the number of job openings for graduates. All directors of histotechnology programs reported an increase in the number of jobs. Not surprisingly, histotechnology is one of the areas with the greatest reported shortages. Only phlebotomy programs saw a decrease of greater than 10 percent in job openings.

Figure 7

Changes in Job Openings for Program Graduates



Source: 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs

Perspectives on Demand from Key Informants

Key informants described a number of factors they perceive as key influences on the demand for laboratory workers. Most of these findings are perceptions from experts in the field; data to support these factors is lacking. These factors include: (1) the increased volume of clinical testing; (2) the growing menu of tests, including new categories and methods of testing; (3) increased emphasis on quality assurance in the laboratory, as well as on information systems needed to monitor safety and quality of patient care; (4) increased utilization of clinical laboratory workers in public health laboratories and other settings; and (5) new roles for laboratory workers, for example, as consultants on clinical care teams.

Increased Volume and Types of Testing

The increased volume of clinical testing and the growing menu of available clinical tests, often utilizing new methods of testing, were cited by many respondents as likely to affect the demand for clinical laboratory science workers. Unfortunately, there are little data available on a national level that illustrates the growth in laboratory testing or the number of new tests available. Respondents noted that the interaction of these two factors is likely to be complex and the outcomes are not easily predictable because new technologies might increase the demand for certain types of workers while decreasing the demand for others. However, there was general agreement that there will be greater demand for MLTs and less demand for MTs. One educator noted that there would be an increased demand for CLSs as managers and predicted that, with increasing automation, there will be an increased need to manage data. The implication in terms of knowledge and skills is that MTs will need to have classes in medical informatics as part of their education and training.

There is less agreement about the roles that MTs will play. There were many visions among informants of the demand for MTs in different roles or using new skills. Some saw the MT of the future as a “supertech” handling only analytical tasks. Others saw MTs with advanced degrees and skills as patient advocates, as health care team “consultants” similar to pharmacist consultants, as technical consultants or supervisors to small labs, as specialists (e.g., molecular, genetics, fertility), and as managers involved in general technical supervision, and training. Another educator predicted less change in the roles of MTs, stating that “CLSs will still be bench techs in 3-5 years.”

Some respondents noted that potential roles for MTs would be influenced by the availability of MLTs/CLTs. A professional association representative said, “The vision is to have CLTs do most of the routine work but this… model is contingent on having enough CLTs and we don’t.” One professional association respondent offered this analysis:

> Over the short term, there will not be a huge change in utilization. In 5-8-10 years, if we don’t recruit, we will have a loss of MTs. We will experience a talent drain, a gradual shift in talent. We’ll put MTs in critical roles, oversight roles, deplete roles in testing. We’ll use as many MLTs as we can; we may go to non-certified CLAs/laboratory assistants. With automation, they may do well.

Clearly, there are many alternative views of the future for MTs, CTs, and HTLs, as well as for other laboratory workers. “Lab workers can’t just jump up to other levels of testing. They need to learn skills that will be transferable over time,” pointed out one educator. “More automation will drive demand for workforce down. Micro can only be minimally automated; immunology requires greater skills… . More molecular diagnostic tests will increase demand for MT experts,” predicted a hospital trade association respondent. “New testing technologies will drive demand for methodologists, molecular scientists,” said a laboratory trade association respondent. “There will be increased demand for fertility specialists, andrologists and assistants, genetic scientists,” said a laboratory regulator. There will be “more and more sophisticated tests, more interpretation management.” said another regulator.

Public health laboratories also were perceived by some informants to play an increased role in testing, performing genetics testing, newborn screening, TB testing, susceptibility testing, and food/environment reference testing. Some informants anticipated that public health laboratories will become more closely linked with clinical laboratories and will participate in more training for the clinical laboratory workforce.

Many informants predicted opportunities for clinical laboratory science workers in a greater variety of work settings (e.g., pharmaceutical laboratories, veterinary research laboratories, public health laboratories, private histology laboratories). Respondents also saw clinical laboratory personnel working in an increasing variety of specialties (e.g., fertility specialists, genetic scientists, molecular scientists).

Summary of Factors Related to Demand

In summary, addressing the factors related to the future demand for clinical laboratory workers is complex. Estimates developed by the Bureau of Labor Statistics and State employment departments indicate a continuing need for more workers and growth of the profession at least through the next decade. However, these are rough estimates based on current hiring practices and vacancy rates (the number of open positions). Key informants and the literature indicate that several other factors listed previously will influence the future demand for workers and some of those factors are difficult to quantify. For example, the enduring expectation about automation clinical laboratories has been that many tasks currently performed on a manual basis will disappear. This change implies that more workers with less training will be needed to run automated processes. However, the implementation of automation has been slower than expected. On the other end of the complexity spectrum is the development of new and more complex testing that requires the highest level of skills. These factors make it difficult to project a long-term demand for clinical laboratory workers. However, regardless of these factors, key informants generally agreed that there is a strong, and likely continuing, demand for more workers trained at the technician level.

Imbalance Between Supply and Demand of Clinical Laboratory Science Workers

Findings from the Key Informant Interviews

All 31 key informants interviewed for this study reported that they perceived shortages among one or more types of clinical laboratory science personnel. Few were able to provide quantitative evidence of shortages, primarily because most of their agencies or organizations do not collect and analyze workforce supply and demand data. Instead, findings from the key informant interviews represent the views of individual experts, who are considered national and State leaders in laboratory science. While data from the ASCP survey show that the shortage is easing and program enrollments are stable or increasing, these are fairly recent changes that have not been widely shared in the field. Nevertheless, these individuals have a broad base of current knowledge and experience related to the field that lead them to believe that in the long term there will be shortages of clinical laboratory workers.

Shortages by Types of Workers

Respondents generally agreed that there are shortages across all types of clinical laboratory workers except phlebotomists. Some noted that there is also a shortage of adequately trained laboratory assistants. As one laboratory trade association respondent noted, “We have concerns about every type, every level of personnel.” However, respondents added many qualifying statements about shortages among different types of workers, including the severity of shortages. Some recognized that shortages had eased somewhat during the past year or two.

There was general agreement among respondents that there is a shortage of MTs. However, some respondents noted that the shortage is impacted by certification and licensure requirements. Large urban hospitals may have certification and education requirements in addition to governmental laboratory regulations. The Wage and Vacancy Survey data support the statement that vacancy rates were higher for certified versus non-certified MTs. One respondent said:

> When an MT must be an MT BS certified by a particular board, this eliminates people certified by other boards, trained in the military, and those with other educational pathways.

Other respondents noted that shortages of MTs are hard to quantify and document for a number of other reasons. Some of the solutions to fill vacant positions ultimately obscure the actual "shortage" of workers. Unfilled positions eventually are removed from the budget and registry workers, temporary workers, and overtime is used to meet the demand for more workers. Key informants generally agreed that there is a shortage of "MLTs/CLT", HTLs, and HTs, although there were mixed perceptions regarding whether there is a shortage of CTs.

Shortages by Type of Work Setting

Respondents generally agreed that the great majority of MT shortages are in hospital settings, often in community hospitals, and in independent laboratories, particularly large reference laboratories. Results from the Wage and Vacancy Survey support this perception. Some respondents perceived shortages in work settings to be related to salaries, with laboratory workers transitioning out of hospitals, both large and small and into industry (e.g., biotech and pharmaceutical). In one academic health center, a respondent reported that 33 positions were lost because they had not been filled over the past 2.5 years. However, as stated previously, elimination of a position does not necessarily mean that a worker is no longer needed.

Shortages by Geographic Area

There was little or no agreement among respondents about shortages of laboratory science personnel in different regions of the U.S. Some respondents indicated that both the East and West Coasts have more shortages than do the Midwest and South because workers will most likely remain in these areas; others said that shortages are worse in the Southeast and the South. The ASCP 2002 Wage and Vacancy Survey found shortages for MTs to be greater in southern States (Louisiana, Texas, Arkansas, and Oklahoma) and the Northeast. For MLTs, the highest vacancy rates were found in the same southern States but not the Northeast.[64]

Several respondents agreed that both MT and MLT positions are very difficult to fill in rural and remote areas, but some respondents noted that retention is less of a problem because of a high probability that workers will remain in these areas. On the other hand, CTs may have difficulty finding jobs in rural areas, noted one respondent, because less populated communities might not be large enough to support a full time cytologist; they primarily perform analyses of Pap smears. Other respondents noted that metropolitan areas such as Boston, Detroit, Newark, New York City, and Washington, DC have shortages because urban hospitals are burdened by indigent care, problems with reimbursement for care, and have lower pay scales. Respondents in these areas tend to believe that clinical laboratory science workers are leaving hospitals to go into the biotech industry, though there are no hard data to support this contention.

Impact of the Shortage of Clinical Laboratory Science Workers on the Health Care System

Findings from the Key Informant Interviews

Key informants' views on the impact of clinical laboratory workforce shortages varied. Some asserted that the impact of the shortage is "a public health issue." Others noted the impact on hospital care:

> Hospitals curtail services, provide less timely services, have decreased quality of care, have increased errors, and have delays in diagnosis. There is also an increased volume of testing outside the hospital and increased operational costs for recruitment and hiring.

Some informants noted that it is difficult to make the connection between workforce shortages and impact on the health care system or the connection between quality, staffing levels, and outcomes. Data on errors is not yet publicly available. The only existing study on the accuracy of laboratory test results evaluates the effect on accuracy of having ASCP-certified MTs versus non-ASCP-certified MTs in the laboratory.[65] The study compared laboratories with all ASCP-certified MTs to those with no ASCP-certified MTs, and also compared laboratories based on the proportion of ASCP-certified to non-ASCP-certified MTs. It found that laboratories with all ASCP-certified MT staff had significantly higher accuracy in their test results compared with laboratories having no ASCP-certified MTs on staff. The study also found that, among laboratories having some ASCP-certified and some non-ASCP-certified MTs, accuracy of test results was positively related to the proportion of ASCP-certified MTs on staff.

However, this study does not address a possible association between staffing levels and the accuracy of test results. Associating errors with clinical laboratory staffing levels is difficult because specimens are handled at several different points in the pre-analytic, analytic, and post-analytic stages. One laboratory regulatory agency respondent stated:

> The agency doesn't have information on outcomes of workforce shortage in terms of laboratory performance. The direct impact on quality of patient care is very difficult to provide. What we can do is look at accuracy of testing, potential risk of harm or impact on patient care, measure competency of workers through proficiency testing, keep training workers as an intervention, keep good records, and look at patient's history.

Key Findings

The following key findings are based on data collected from both the qualitative and quantitative approaches used in this study. Those data include two surveys conducted by the research team in conjunction with the ASCP: the ASCP 2002 Wage and Vacancy Survey of Medical Laboratories, and the 2002 ASCP Board of Registry Annual Survey of Medical Laboratory Science Programs; an analysis of a 10-year cohort study of MTs; collection and analysis of numerous other secondary data; and the key informant interviews.

1. **Qualitative and quantitative data suggest a shortage of clinical laboratory workers in the past several years, although the most recent data indicate that the shortages may be easing at least for some types of workers, and in some settings and geographic areas.**

There was consensus among educators, employers, and other experts in the clinical laboratory field that there is currently a shortage of clinical laboratory workers and that the shortage will worsen in the future as the population ages and demands more services, and as the current workforce reaches retirement age. The Bureau of Labor Statistics projects the need for 138,000 workers due to job growth and replacement of workers between 2002 and 2012.[66] This projection is supported by data from the 2002 Wage and Vacancy Survey, which indicated an overall vacancy rate ranging from 7 percent to 9.1 percent for certified/licensed staff positions, and 3.7 percent to 11.9 percent for non-certified/non-licensed positions.[67]

However, there are indications that the shortage, as measured by vacant positions, may have declined somewhat over the past year. Data from the 2003 Wage and Vacancy Survey indicate overall vacancy rates between 3.6 percent to 6.6 percent for certified licensed staff positions.[68] The vacancy rates declined in 2003 for each type of position. The vacancy rates in each survey year varied by type of worker, setting of work, and geography (State), as well as type of industry. Survey data from 2002 indicated higher vacancies in small hospitals, rural settings, and in the northeast and central southern States.[69] These settings continued to have higher vacancy rates in the 2003 survey although overall the vacant positions declined.[70]

2. Increasing wages and the use of sign-on bonuses indicate that the market is responding to a shortage of clinical laboratory workers. The increased use of per diem and contract workers and overtime may conceal the severity of the current shortage.

Recent data indicate that wages of clinical laboratory workers are increasing and outpacing inflation in recent years.[71] Salary increases for all categories of clinical laboratory staff positions increased from 6.2 percent to 11.3 percent between 2000 and 2002 and another 3 percent between 2002 and 2003.[72],[73] Increasing starting salaries was the most frequently used employee recruitment tool, being used by 65 percent of the respondents to the 2002 Wage and Vacancy Survey. In addition to salary increases, the use of other financial incentives to recruit new staff indicates a shortage of available workers. About 25 percent of respondents used sign-on bonuses, nearly 20 percent used relocation assistance, and nearly 30 percent provided tuition and continuing education assistance.[74] Strategies used to address the current shortage may be shielding clinical laboratories from the full impact of a workforce shortage. Laboratory managers reported that the use of per diem, contract workers, and overtime were strategies used to address the need for workers to fill vacant positions. These practices may not be sufficient to address the long-term need for workers particularly if there is an increased demand for services as predicted by the experts. Thus, overall, easing of the shortage may be temporary because these stop-gap measures do not address the long term need to increase the supply of workers.

3. Though the pipeline to employment in the clinical laboratory sciences has deteriorated – mostly due to closures in hospital-based training programs – student interest is rising. Local or regionally driven efforts to restart training programs, or develop new ones, in locations currently experiencing labor shortages have capitalized on renewed student interest to meet local workforce demand.

The 66 percent decline in MT programs between 1975 and 2003 represents, to some extent, a market-generated right-sizing of the supply of workers in this category. However, those areas that have experienced persistent shortages of medical technologists can alleviate shortages by rebuilding the structures necessary to educate students and move them into the laboratory science workforce. Student interest in clinical laboratory science careers waned during the economic boom of the late 1990s, but more recent data on applicants to medical technology programs suggest that student interest has been increasing.[75] Interview data from educators in the field also indicate that there has been a recent upturn in the number of students expressing interest in their programs. This rise in interest on the part of students presents an opportunity for hospitals and educational institutions to collaborate on fulfilling the need for clinical laboratory workers on a local or regional level.

4. New and developing technology, including the automation of many common tests, will have an impact on the demand for clinical laboratory workers yet much of that change is emerging more slowly than once predicted.

Evidence of the impact of new technology and automation comes primarily from interviews with experts in the field who have had first hand experience with emerging technology and changing practice. New and developing technology in the clinical laboratory will have an unknown impact on the type and number of clinical laboratory workers needed. Increasing automation of existing routine testing is expected to reduce the need for more highly training, skilled workers and increase the need for technicians. Yet interview information suggests that automation is emerging more slowly than expected partly due to the cost of new equipment and reconfiguring the laboratory. Other new technology and new molecular and genetic tests are expected to increase the demand for skilled clinical laboratory workers. Point of care testing at the bedside is also expected to impact demand for clinical laboratory workers. Yet this type of testing has not been widely adopted due to the concerns about quality control and a shortage of RNs, who would have a primary role in point of care testing.

5. **MTs will not move into consultative roles on clinical teams without a strategy to make this happen.**

Although several key informants cited movement out of the laboratory and into more direct patient care as a likely new role for MTs, it is not yet clear that there is a demand for a new type of "clinical scientist" to fill this role. According to the experts interviewed, the emerging role for MTs is as consultants on the patient care teams. These consultants would actively and visibly participate with other clinical team members (physicians, nurses, and pharmacists) to educate the team about available tests and recommend testing, or be available for consultation. MTs must work with professional associations, educational programs, and other stakeholders to identify necessary skills and methods of developing these skills in academic and work settings in order to move in this direction. They must also present a case for experimenting with the role to hospital administrators and physicians. This will require targeted efforts based on long-term strategic planning.

Conclusion

The intent of this study of the national clinical laboratory science workforce was to address concerns within the community of clinical laboratory workers, educators, professional organizations, and regulatory agencies that the Nation is experiencing a shortage of clinical laboratory workers. There is particular concern that an existing shortage may increase in severity as the demand for laboratory testing increases, due both to advances in medical testing technology and the demographic shift associated with the aging baby boom generation. The demographic shift is expected to further exacerbate a perceived workforce shortage because medical laboratory practitioners who are members of the baby boom cohort will be retiring from work at the same time that their generation demands more health care services. It is anticipated that a deepened shortage will have negative consequences for the quality of health care in this country. Clearly, efforts to recruit young students to the health professions will be important as these population demographic shifts continue.

We found conflicting data on the shortage of clinical laboratory workers. Increases in salary in the clinical laboratory professions over the past several years provide evidence that there has been a shortage of available workers. Recent survey data indicate that the number of vacant positions is decreasing, although the true extent of laboratory workforce needs may be obscured by the use of temporary measures, which encourage lateral mobility among existing laboratory workers rather than increases in overall supply, to fill positions.

More promising is the apparent increase among students in the field of clinical laboratory science. Program enrollments are steady or increasing in some cases, and programs are capitalizing on this trend by pursuing new strategies, such as targeting for recruitment of non-traditional students, displaced workers, and ethnic groups that are currently represented at very low levels among laboratory science workers. After a long cycle of closing educational programs, there is evidence of new or reopened programs in settings where employers play a partnership role in supporting these programs.

Data on the impact of clinical laboratory workforce shortages on the health care system are sorely lacking, as are data on the prevalence and impact of laboratory errors in general. It was therefore not possible to reach any reliable conclusions regarding the impact of staffing shortages on the health care system. A highly focused study on laboratory errors and the relationship of staffing variables such as size and composition of staff (i.e., education level, certification status, clinical specialty) would be a valuable addition to the body of research on the clinical laboratory science professions.

Another important question raised in this study, also difficult to resolve, is in regard to the future roles and utilization of clinical laboratory workers. It seems clear that, with ongoing implementation of automation in the laboratory, there will be an increased demand for MLT-level workers in the clinical laboratories. Future demand for MT and higher level workers is a more complicated issue, and much depends on the degree of cohesiveness that the clinical laboratory community develops with regard to its goals for the MT profession, and on the degree of acumen with which this community pursues its goals with hospitals, educational institutions, regulatory institutions, and policymakers.

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