THE CENTER
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The Clinical Laboratory Workforce in California

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Overview/Description of Workforce

The clinical laboratory workforce comprises a critical sector of the healthcare workforce, and as with other types of healthcare workers such as registered nurses and pharmacists, there have been documented shortages of these workers for several years. In 2000, the American Society for Clinical Pathology's (ASCP) annual Wage and Vacancy Survey showed vacancy rates ranging from 11% to 21% for different types of clinical laboratory workers, up from about 5% to 9% in 1996.[1] Recent data suggest that while vacancy rates might be declining, the shortage continues to be a concern for smaller hospitals, in rural areas, and in certain regions of the country.[2]

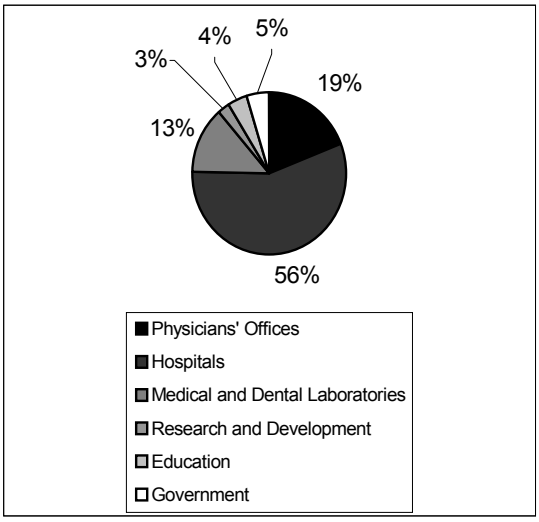
The clinical laboratory workforce includes several categories of laboratory science practitioners. These are phlebotomists (PBT), generalist medical laboratory technicians (MLT), and generalist clinical laboratory scientists (CLS), also called medical technologists (MT), as well as specialized practitioners such as histotechnicians (HT), or histotechnologists (HLT). These two latter practitioners specialize in the preparation of thin slices of body tissues such as bone or organs for analysis.[3] 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.[4] For example, CTs screen and analyze the Pap smear test for cervical cancer.

Clinical laboratory workers fulfill functions that are crucial in the health care system, yet their importance is not well understood by the general public. This is likely because, with the exception of phlebotomists, who draw and label blood samples, clinical laboratory practitioners have little to no direct contact with patients. Instead, the work of clinical laboratory practitioners takes place behind the scenes, in clinical laboratories.

The general job responsibilities of clinical laboratory workers involve the preparation, examination, and analysis of body fluids, tissues, and cells for signs of bacterial or viral infections, parasites or other micro-organisms, chemicals, cellular abnormalities, and other indications of disease or precursors to disease.[5] 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.

Due to advances in medical technology, clinical laboratory workers perform an ever-increasing range of diagnostic tests, from simple tests of blood type or cholesterol levels to genetic testing for markers of inheritable diseases.[6] They use computers and other sophisticated technologies to do their work. Clinical laboratory workers work in a variety of settings, most often hospitals, but also in physician offices, independent laboratories, universities/colleges, community colleges, and the biotech industry.[7] Figure 1 shows the percent of clinical laboratory workers who work in each type of setting.[8]

Figure 1. National employment of laboratory workers by industry setting.[9]



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History of the clinical laboratory science professions

The clinical laboratory science professions arose from the science of clinical pathology.[10] In the 1920s, clinical pathology was a largely undefined medical science practiced primarily by physicians to enhance their patient care, and hardly acknowledged by the American Medical Association. However, practitioners of clinical pathology foresaw that laboratory testing could potentially revolutionize the power and scope of medical diagnosis. 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."[11] A primary goal was to create a formal program to insure 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.

Growth of the profession

The field of clinical laboratory science has grown remarkably since its beginnings. In 2001, there were approximately 145,000 MTs and 147,000 MLTs employed in the United States.[12] There are currently several certification agencies in the field of clinical laboratory science, including the ASCP-BOR, the National Credentialing Agency (NCA),[13] American Medical Technologists (AMT),[14] and the American Association of Bioanalysts (AAB).[15] The ASCP certifies the bulk of professionals in the field, however; approximately 3,300 MTs and 2,100 MLTs annually.[16]

Education and Training

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/CLS 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.[17] To be employed as a MLT generally requires an associate degree or a certificate, plus up to a year of specialized training or work experience.[18] However, having a high school diploma with the necessary scientific coursework and two years of on-the-job training with an appropriately certified clinical or medical laboratory scientist can lead to employment in some states.[19]

Regulation and/or Certification

Certification is a designation of professional status used in many health professions. It verifies that a person has the necessary expertise to perform the functions of their profession, and is granted to individuals who have passed an exam in a particular specialization, after satisfying certain educational and training prerequisites for examination in that field. Licensure is a designation of legal status, which permits licensees to practice their profession in a given state. Some states require certification as a prerequisite for licensure. In other states neither certification nor licensure is required for employment at either the MT/CLS or MLT levels.

In California, laboratories and laboratory workers are regulated by Laboratory Field Services, through the Division of Laboratory Science at the Department of Health Services. *Certification* is not required for licensing of MTs/CLSs in the state. *Licensure* of these workers in California requires a baccalaureate degree, one year of laboratory training, and successful completion of a state licensure exam. However, it is expected that California will eventually accept professional certification in lieu of the state licensure exam.[20]

California allows uncertified, unlicensed laboratory workers at the assistant level, but they are not permitted to perform testing. The category of MLT-level workers, who can perform testing, does not currently exist in California. However, legislation

passed in 2002 formally creates MLT as a new category of clinical laboratory worker in the state, and licensure will be required of these workers.[21] Regulations to specify their licensing criteria are currently in development, and licensure is expected to be underway at the end of 2003.[22]

California is also in the process of implementing new regulations requiring professional certification (but not licensure) of PBTs.[23] Within the next three years, all PBTs in the state must pass a national certification examination or quit working in the field. There may be several agencies whose certification of PBTs will be accepted by the state.

Paths to certification

The specific prerequisites to national certification vary by agency and area of specialization. Clinical laboratory workers qualify to take certification exams through several routes, all of which involve some combination of education and clinical training or on-the-job experience. The standard route involves an associate or baccalaureate degree in medical technology or clinical laboratory science, and completion of an accredited training program. All certifying agencies will accept a candidate who qualifies through this route, but the criteria for on-the-job experience vary, generally in terms of the number of years of experience required and the window of time in which this experience must have occurred.

Wages

Nationally, salaries for clinical laboratory practitioners vary by specialization as well as by educational level and hierarchical position in the workplace.[24] Recent data show staff phlebotomists, at $21,944--the low end of the range of salaries for laboratory workers annually. Cytotechnology supervisors, at $60,320, define the high end of the range.

Salaries for clinical laboratory workers in California tend to be higher than the national average, but they do reflect the patterns of national salaries in the field, with staff phlebotomists averaging $27,040 and cytotechnology supervisors averaging $72,800 annually.[25]

Table 1. Average annual salaries of laboratory science workers in the United States and California, 2002 data.[26]

Position	National	California
MT/CLS – Staff	$40,186	$54,704
MT/CLS – Supervisor	$47,840	$66,685
MT/CLS -- Manager	$59,280	$59,280
CT – Staff	$49,920	$62,400
CT – Supervisor	$60,320	$72,800
Histotechnician	$34,549	$35,360
Histotechnologist	$41,122	$46,197
HT/HLT --Supervisor	$50,086	$57,845
MLT – Staff	$31,928	NA
MLT – Supervisor	$39,520	NA
PBT – Staff	$21,944	$27,040
PBT -- Supervisor	$33,488	$37,440

Demographics

The clinical laboratory professions are female-dominated, and in aggregate are fairly representative of the U.S. population with regard to ethnic or racial background.[27] 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 medical technologist group.[28] Data on the demographic characteristics of clinical laboratory workers in California is unavailable.

Table 2. Race/ethnicity of laboratory science workers and the U. S. population in 2001.[29]

	Laboratory Workers	Population
Race/Ethnicity		
White, Non-Hispanic	71%	74%
Hispanic/Latino	6%	10%
Black, Non-Hispanic	15%	10%
Asian/Pacific Islander	7%	4%
Other	1%	2%
Sex		
Male	21%	48%
Female	79%	52%

Critical Issues and Policy Concerns

Workforce shortage

Currently, the shortage of laboratory science workers is one of the most pressing issues pertaining to this workforce. Recent ASCP wage and vacancy data from 2002 show variations by laboratory science specialty and geographic region.[30] The lowest vacancy rate, that for MT/CLSs, was 7% nationally, ranging from 6% in the Far West region to 10.2% in the Southwest region. The highest vacancy rate was for HLTs, at 10.7% nationally, ranging from 6.1% in the Northeast region to 12.9% in the Midwest region.

Rural laboratories may have a harder time than urban and suburban laboratories in attracting and retaining clinical laboratory workers, though this also varies by type of worker.[31] There is also greater reported difficulty filling weekend and night shifts.[32]

In California, the shortage has been severe. In 1999, there were nearly 36,000 active clinical laboratory science workers in California.[33] In 2001, there were about 26,000. Yet the California Employment Development Department predicts continued growth in demand for clinical laboratory science workers in the state through 2005.[34] Nationally, 122,000 openings are projected for MTs/CLS and MLTs between 2000 and 2010.[35] Compared to most other states, California has far fewer clinical laboratory science workers per population. In 2001, California had 76 clinical laboratory workers per 100,000 population compared to 102 nationally, and it ranked 43rd among the 50 states on this measure.[36]

Table 5. Laboratory workers per 100,000 population in 2001.[37]

	National	California
MTs/CLSs	50	37
Technicians	51	39
Total	102	76

A major factor related to the drop in clinical laboratory science workers in California is the closing of educational programs in this field. While program closure has been a national trend, California has been left with comparatively fewer programs in clinical laboratory science. In the 2000-2001 academic year, despite the fact that California is the most highly populated state in the nation, there were only 9 of these programs, which ranged in capacity from two to thirty students per cohort.[38] Texas, the second most populated state at 62% the size of California, had over twice as many programs and graduated nearly five times as many students as California in the 2000-2001 academic year. Michigan, with a population 29% the size of California's, had 12 programs and graduated nearly three times as many students in the same year.

Table 6. MT/CLS programs and graduates in the eight most populated states, 2000-2001 academic year.[39]

State	Population (millions)	Programs	Grads
CA	35.1	9	33
TX	21.8	20	180
NY	19.2	11	100
FL	16.7	10	78
IL	12.6	12	90
PA	12.3	14	54
OH	11.4	8	59
MI	10.1	12	93

Currently, there are 8 programs remaining in California. This is not enough to meet the current demand for MTs/CLSs in the state, nor will it meet anticipated demand due to retirement among an aging clinical laboratory science workforce. Access to programs in the state is particularly limited in less populated areas, and in the central and northern regions of the state.[40] Five of the state's programs are located in and around the Los Angeles area, while only three are located in Northern California, each near a major metropolitan center.

Table 7. CLS Programs in CA, 2003-2004.[41]

Program	Class Cap
UC Davis Medical Center	4
San Francisco State University	20
San Jose State University	16
Santa Barbara Cottage Hospital	4
CSU/Dominguez Hills	9
UC Irvine Medical Center	2
Loma Linda University	30
Eisenhower Memorial Hospital	4

In addressing the question of why programs closed, experts in the field point to the high cost of operating clinical laboratory science programs, which require space and high-tech equipment for training.[42] However, others note that even with the closure of programs, most remaining programs do not meet their maximum capacity per cohort, and suggest that this indicates a decline of interest in the field. Lack of recognition for the laboratory science professions and high-paying alternatives for students talented in the sciences are the primary reasons cited for the difficulties clinical laboratory science programs have had recruiting students.[43]

Impact of the shortage

It is difficult to document how or to what extent the shortage in laboratory science workers affects the quality of work performed in medical and clinical laboratories, or quality of care for patients. In interviews with laboratory directors, some reported that patients had no negative outcomes from the shortage of laboratory personnel, while others reported problems ranging from delays in testing to inaccuracies including the mislabeling of specimens and conducting the wrong tests.[44] In either case, it is clear that a shortage creates changes in the testing process, and some of these changes may have negative consequences.

One major impact is that hospitals now rely heavily on sending specimens to outside "reference" laboratories for testing. Some specimens are routinely sent out of the hospital, and occasionally even out of the country, for testing. Though this practice potentially reduces the risk of testing errors on the part of overworked staff, it also results in increased costs. Hospitals may lose money on tests that are sent out, particularly in an environment of prospective reimbursement. Where these costs are paid out of the in-house laboratories' budgets, hospital administrators are likely to see their laboratories as financial liabilities. There is concern that, over time, these factors could lead to permanent loss of budgeted positions as administrators cut persistently vacant positions to reduce laboratory overhead.

Job satisfaction

Satisfaction with salary is a major component of job satisfaction in general, and the salaries of laboratory science workers have not kept pace with those of other types of allied health professionals.[45] This has lead to what some observers have described as a "brain drain" of professionals trained in clinical laboratory technology to other, more highly compensated fields.[46] High productivity demands have been associated with overwork and "burn-out," leading to decreased job satisfaction. Staff reductions have been found to increase both workloads and salaries for workers who remain employed, but these salary increases do not offset the decreases in job satisfaction resulting from staff reductions.[47]

Solutions

Promote professional commitment

A distinction has been made in the professional literature between job satisfaction, which is transitory and dependent on situational aspects of one's job, and professional commitment, which is more stable, and is negatively associated with intent to leave the profession.[48] Promoting employees' professional commitment through activities associated with membership in professional associations, such as reading professional literature and attending meetings and conferences, can positively impact levels of professional commitment, and may help retain workers in the field over the long term.[49]

Promotion of careers in clinical laboratory science

Interviews with experts in the field suggest that careers in clinical and medical laboratory science are not adequately promoted to pre-college age students.[50] Professional organizations and educational programs could do more to produce promotional materials, increase their participation in school career fairs, volunteer to speak in classrooms, and develop partnerships with school-to-career programs. Special attention should be paid to producing age-appropriate materials for students of different age groups.

More support for education and training

Educators report that a large proportion of students need to work during their educational programs to support themselves and perhaps a family as well.[51] More financial support should be made available to

attract students into careers in clinical laboratory science. Increases in stipends and scholarships could be effective in attracting people to the field, and research suggests that loan payback programs are an effective means of attracting practicing laboratory science personnel into rural or other underserved regions.[52]

"Grow our own" approach

In interviews with laboratory directors, several described an approach they called "grow our own."[53] These directors developed partnerships with MT/CLS educational programs, providing laboratory training to students from the local area with the intention of hiring them full-time upon completion of their training. This strategy is intended to reduce the need for recruiting from out-of-area, and improve employee retention by hiring individuals who are more likely to stay in a given location. This could be an especially important strategy for addressing workforce shortages in rural areas. An additional advantage of this strategy is that it eliminates much of the learning curve that workers trained in other laboratories would experience upon beginning work at a new laboratory, so it is more efficient for both individual workers and laboratories.

Distance learning

Current communications technologies make it more feasible than ever to create distance education programs, which can dramatically decrease the overall cost of educational programs by centralizing their classroom components.[54] This type of program has the additional significant advantage of making education more accessible to would-be students in rural areas. The approach is particularly suited to be used in conjunction with the "grow our own" approach described above. A model MLT program that incorporates web-based distance learning has been developed at Hartnell College in Salinas. This program has two academic affiliates with which it shares courses – De Anza College in Cupertino, and College of the Sequoias in Visalia.

Career Ladder

The career ladder approach to professional development is an approach in which each stage of development is clearly defined and can be reached from the prior stage through a series of articulated steps.[55] This approach helps make education accessible for lower income students and non-traditional students because it permits flexibility with regard to combining education with work. Students can attend school, attain professional status at one level, and then work at that level with the option of pursuing career advancement through continuing education. The career ladder approach can be incorporated into the educational structure through articulation agreements – that is, formal agreements between community colleges and four-year institutions to develop programs at one level that provide the academic foundation for the next level. Articulation agreements provide assurance of the orderly transfer of academic credits from one program and/or institution to the next.

California has taken an important step towards incorporating the career ladder approach into the regulatory structure around clinical laboratories and their workers by passage of SB 1809. [56] This urgency legislation is intended to address the workforce shortage by creating a new category of licensed laboratory worker (MLT) to the state. Having MLTs as part of California's clinical laboratory workforce is expected to alleviate the shortage of clinical laboratory science workers because MLTs can perform the bulk of more routine tests, thereby freeing MTs/CLSs to do the high complexity testing and problem solving they have been trained to do.

Introduction of MLTs to California's laboratory science workforce has the additional benefit of providing the second stage of a clinical laboratory science career ladder, which progresses from PBT, to MLT, to MT/CLS. The MLT program at Hartnell College again provides a model for the state, with its articulation agreement with the CLS program at San Jose State University.

Summary

There is a severe shortage of clinical laboratory science workers in California, and the state does not have enough educational programs to meet the demand for these workers in the near future or beyond. There are some promising efforts to address the shortage, such as the introduction of MLTs to the state, and the development of distance education and career laddering opportunities

through the MLT program at Hartnell College. We must continue to develop both educational opportunities and recruitment efforts in clinical laboratory science in California. Increasing both salaries for clinical laboratory practitioners and public awareness and respect for the clinical laboratory professions are necessary to attract workers and retain them in the field.

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