The Clinical Laboratory Workforce:

Understanding the Challenges to Meeting Current and Future Needs

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KEY FINDINGS

The clinical laboratory workforce (also referred to as the medical laboratory workforce) in the U.S. supports a laboratory system that provides patients and medical providers with information essential for the prevention, diagnosis, treatment, and management of health and disease. Concerns about the supply of these critical personnel focus on the declining number of accredited education programs and of students entering them, increased demands on the workforce, and growing vacancy rates. Greater diversity is needed to increase the pool of qualified personnel. The COVID-19 pandemic also disrupted the workforce and may accelerate future shortages in the field of clinical laboratory medicine.

Examining these issues and identifying ways to address them were the overarching aims of the present study. We conducted a literature review and analysis of available secondary data to provide background for the study. We also conducted semi-structured interviews with key informants representing clinical laboratory education, employers, and professional organizations, and focus groups with individuals in clinical laboratory occupations representing the target professions for this study. While the clinical laboratory workforce is comprised of many roles, we focused on six: histotechnicians, medical laboratory assistants, medical laboratory technicians, phlebotomy technicians (also known as phlebotomists), histotechnologists, and medical laboratory scientists. Our goal was to assess the barriers and pathways leading to laboratory careers, the opportunities for professional development, and factors that support clinical laboratory workforce diversity and retention.

Results from interviews and focus groups conducted by this study strongly emphasized that meeting future workforce needs will require actions by, and collaboration among, education and training programs, employers, and professional organizations. While the COVID pandemic increased the visibility of clinical laboratory roles, it also impacted education, training, and practice. Our results suggest that there is an opportunity to leverage the pandemic's spotlight on the laboratory, as well as other findings from this study, to call attention to areas where there are opportunities to improve recognition of the clinical laboratory workforce and enhance careers in the field. If implemented, actions in these areas will likely contribute to increases in the availability of clinical laboratory workforce supply and strengthen the pathways into and among these careers long into the future.

IMPROVE THE VISIBILITY OF CLINICAL LABORATORY OCCUPATIONS

- Identify opportunities to encourage interest in clinical laboratory career education and training, especially among younger students, and provide tuition support, stipends or scholarships to potential students to attend formal educational programs.
- Offer incentives to laboratory employees who attend recruitment and awareness-building activities for the profession.
- Investigate program models that leverage funding partnerships to create education and training opportunities.
- Promote visibility of clinical laboratory occupations on campuses and in professional groups, network with educational, employer and professional clubs and societies, and support education programs and clinical training.
- Encourage employers to provide clinical training sites and employment resources for students in clinical laboratory programs.
- Promote consistent use of occupation titles and roles by reviewing and recommending changes to policies and regulations affecting the delineations of titles and roles of clinical laboratory occupations.

IMPROVE WORKFORCE RECRUITMENT AND RETENTION

- Encourage professional development and job satisfaction by providing financial incentives and considering factors such as schedule flexibility, benefits, regular pay increases, tuition incentives, and sign-on bonuses.
- Provide opportunities for career progression through tier levels, increases in pay and elevated titles.
- Support roles that encourage professionals to work at the highest skill level that is within their scope of practice.
- Examine opportunities for on-the-job training.

FOCUS ON DIVERSITY AND INCLUSION IN THE LABORATORY

- Promote diversity in academic recruitment by aligning recruitment efforts across the institution and partnering with STEM programs to recruit students from underrepresented groups, developing a clearinghouse of scholarships, improving data collection to better understand trends in diversity among students, and recruiting more men.
- Encourage employers to develop recruitment strategies and actionable items, expand mentorship and diversity training programs to retain laboratory staff from underrepresented groups, amplify promising efforts, and articulate and measure the benefits of having a diverse workforce.

Through our examination of six laboratory professions, this study revealed issues and targeted solutions to strengthen clinical laboratory workforce education, recruitment and retention. Building on the study's evidence is the need to coordinate efforts with a clearly articulated path forward that involves partnerships across stakeholders to address the needs of the field and ensure that patients get high quality care.

INTRODUCTION

Laboratory medicine is a critical component of the complex U.S. healthcare system, providing patients and medical providers with information essential for the prevention, diagnosis, treatment, and management of health and disease. The clinical laboratory workforce (also referred to as the medical laboratory workforce) supports a laboratory system that provides a variety of objective information used in clinical decision making. The laboratory workforce is diverse in terms of their roles, the types of tasks they perform, the types of qualifications needed, and the level of educational experience required to enter the field. However, many of them share common challenges facing the current and future state of the field, such as a declining number of accredited education programs and resulting decline in the number of students entering these programs, shortages of qualified personnel, increased demands on the workforce, and unmet employer demand. More information about factors contributing to these challenges is needed.

BREADTH OF THE CLINICAL LABORATORY WORKFORCE

According to the U.S. Bureau of Labor Statistics (BLS), there were approximately 337,800 clinical laboratory technologist and technician jobs in the U.S. in 2019, with 47% in hospital settings, 20% in medical and diagnostic laboratories, 9% in physician offices, 6% in schools and universities, and 3% in outpatient care centers.[1] In addition, there were approximately 132,600 phlebotomist jobs in the U.S. in 2019, with 38% in hospital settings, 32% in medical and diagnostic laboratories, 15% in other ambulatory settings, 7% in physicians' offices, and 2% in outpatient care centers.[2]

A survey conducted by the American Society for Clinical Pathology (ASCP) in 2019 of the current U.S. clinical laboratory workforce found that approximately 60% of the respondents had a bachelor's degree and 25% had less than a bachelor's degree but more than a high school diploma.[3] Other, related workforce data also suggest an unmet demand for laboratory occupations that require more than a high school diploma but less than a bachelor's degree, due in part to a declining number of accredited education programs and students entering these programs, coupled with increasing demand for these workers as a result of business and laboratory consolidation, increasing task automation, and limited opportunities for career and wage progression.[4]

Four roles that require less than a bachelor's degree were among the occupations examined for this study:

- Histotechnicians
- Medical laboratory assistants
- Medical laboratory technicians
- Phlebotomists

In addition, this study also examined two key clinical laboratory occupations requiring bachelor's degrees or higher to better understand how their skills are meeting employer needs as well as recruitment and retention challenges. These occupations were:

- Histotechnologists
- Medical laboratory scientists

WORKFORCE CHALLENGES FACED BY LABORATORY EMPLOYERS

The ASCP reports increasing amounts of testing being performed by the clinical laboratory workforce, with growing vacancy rates across professions.[5] In 2018, nearly half of hiring personnel and managers for the clinical lab workforce reported competition with other laboratories for pay/benefits and for well-trained personnel. Technological changes—including automation of tasks, emergence of point-of-care tests, and greater reliance on laboratory information systems and electronic health records—were reported to have been contributing to staffing changes and the increasing need for qualified workers.[3] This puts pressure on educational systems to produce well-trained professionals, yet there is limited published information about why the skills of the clinical lab

workforce are not meeting hiring expectations or how technological changes are affecting these skill needs.

There have been ongoing concerns for decades about the supply of clinical laboratory personnel, and a recent study by the ASCP showed growing vacancy rates for clinical laboratory workers, particularly in specific clinical laboratory fields, which underscores the urgency of these concerns.[5]

Vacancy Rates

Medical laboratory technicians, phlebotomists, and histotechnicians comprised approximately 30% of the respondents of the ASCP 2019 Wage Survey. These occupations also had some of the highest vacancy rates found by the ASCP 2018 Vacancy Survey, whose primary objective is to estimate the vacancy rates within medical laboratory departments in the U.S.[5] One implication of these rates is the challenge of finding new, qualified personnel to fill vacant positions, as well as retaining personnel in existing, critical roles, especially amid increasing volumes of laboratory testing.

Testing Volumes

As the number of personnel qualified to perform laboratory testing declines, the demand for laboratory testing steadily increases. An increase in use of more complex testing is a factor contributing to this demand for more specialized staff. In fact, 44% of the respondents to the 2018 Vacancy Survey indicated that molecular testing was the technology causing the greatest changes to their staffing needs.

Diversity

The need for greater diversity (including gender, race, and ethnicity) is another challenge to be addressed to strengthen the pipeline and increase the pool of qualified clinical laboratory personnel. Ensuring diversity within the health workforce, across the skills spectrum and career stages, has been a national priority.[6-7] From the ASCP 2019 Wage Survey of the clinical laboratory workforce, 81% of the respondents were female, and both the 2019 and the 2017 ASCP Wage Surveys suggested that Latinos and Blacks/African Americans were the most underrepresented among clinical laboratory personnel relative to the general population and the overall workforce.[8] Additional work to increase the diversity of the pool of qualified clinical lab personnel is needed.

Impacts of COVID-19

The COVID-19 pandemic has posed yet another challenge for the clinical laboratory workforce, much as it has for the nation's healthcare systems. Across the country, laboratory professionals are performing complex diagnostic tests for COVID-19 and developing innovative testing methods—yet in many labs, demand is down. Workforce data collected by ASCP in June and July 2020 from laboratory personnel in management-level positions or in human resources highlights how the pandemic has affected laboratories and what strategies they have used to maintain lab operations, particularly around changes in testing and staffing.[9] Among survey respondents, 61% indicated that they experienced a decrease in testing volumes in their laboratories, presumably due to clinic closures and temporary suspension of elective procedures. Staffing changes were one consequence of this decrease, with 24% of the respondents reporting that their department(s) had furloughed staff, with an average length of greater than one month. Laboratories also encountered hiring freezes and slowdowns, as indicated by more than two-thirds of the respondents (69%).

In order to retain current laboratory staffing levels, the majority of institutions offered shift adjustments/flexible scheduling/split teams/rotations, offered paid time off, and reassigned or cross-trained staff. Since this survey was deployed in summer of 2020, employment levels have returned to pre-pandemic levels and is on an upward trend. The BLS labor projections pre-COVID that suggested a growing demand for laboratory professionals are likely to be on track.[10] What remains uncertain is whether the pandemic may accelerate future shortages in the field of clinical laboratory medicine.

STUDY PURPOSE

The goal of this study was to assess the barriers and pathways leading to laboratory careers, the opportunities for professional development, and factors that support clinical laboratory workforce diversity and retention.

The aims of the study were to:

1. Identify how stakeholders are currently addressing recruitment and retention for the clinical laboratory workforce (including attracting students, filling vacancies, meeting an increased volume of tests, competing for workers within and outside the clinical laboratory field, and identifying qualified professionals).
2. Identify the barriers and facilitators, and factors contributing to successful models, for recruiting and retaining a qualified and diverse clinical laboratory workforce.
3. Recommend future approaches to address these barriers and facilitators (including education/training, credentials [e.g., certification and licensure]; employment environment policy/regulation; and marketplace issues).
4. Set the stage for developing a strategic blueprint of interventions based on the study findings, supported by philanthropy, to be implemented by ASCP (and any potential partners) to address these challenges and strengthen the clinical laboratory professional workforce.

This report summarizes the outcomes of the study, including the current landscape of approaches to recruit and retain workers and the barriers and facilitators faced by various stakeholders. It also lays the foundation for defining and prioritizing solutions and next steps to strengthen the clinical laboratory workforce.

METHODS

To meet the identified goal and aims, we reviewed and analyzed available literature and data describing the education pathways and supply of key clinical laboratory occupations. Data collection was multimodal and included literature reviews, analysis of secondary data, one-on-one interviews with key informants, and focus groups.

LITERATURE REVIEWS

We reviewed published and grey literature on the clinical lab workforce in the U.S. We identified literature from peer-reviewed journals and websites of academic programs and relevant professional associations on the workforce and policy conditions of these selected occupations. Topics of interest included: role and scope of practice, occupational and workforce diversity, educational requirements and career pathways, workforce supply and demand, and factors influencing recruitment and retention of these occupations.

SECONDARY DATA ANALYSIS

Individuals in clinical laboratory occupations can obtain required education and training in a variety of ways, including through post-secondary degree-granting institutions as well as through certification programs and on-the-job training. While not representing all new entrants to the field, we extracted and analyzed data on the number and racial/ethnic diversity of program completions from post-secondary degree-granting institutions using data from the publicly accessible Integrated Postsecondary Education Data System (IPEDS) for the 2016-2019 academic years (for more information on the data source and limitations, see Appendix A).[11] To extract data about programs of interest from IPEDS, we used the Classification of Instructional Programs (CIP) codes: "51.1009 Phlebotomy Technician/Phlebotomist" for Phlebotomy, "51.0802 Clinical/Medical Laboratory Assistant" for Medical Laboratory Assistants, "51.1008 Histologic Technician" for Histotechnicians, "51.1007 Histologic Technology/Histotechnologist" for Histotechnologists, "51.1004 Clinical/Medical Laboratory Technician" for Medical Laboratory Technicians, "51.1005 Clinical Laboratory Science/Medical Technology/Technologist" for Medical Laboratory Scientists. These programs range from certificate programs and associate-level degrees to bachelor's-levels degrees. Programs and institutions selected for analysis had at least one student completion in each program for each year.

KEY INFORMANT INTERVIEWS

To identify key informants from clinical laboratory education, we identified individuals in program leadership positions from a list of National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) accredited education programs, professional organizations, independent laboratory systems in hospitals and medical centers, and large reference and diagnostic laboratory systems with a large regional or national reach provided to us by our study partners at ASCP.

Due to the large number of academic programs in the disciplines of interest, we randomly selected programs for each occupation type, and substituted as needed to ensure representation from each Census region. We identified 25 academic programs across the clinical laboratory disciplines for recruitment.

We identified potential key informants from a variety of clinical laboratory organization types: individual laboratory systems within hospitals and medical centers, large reference laboratories with national or regional scope, and laboratory-related professional organizations. Using this list and following a similar protocol to above, we identified candidate organizations to invite for interviews spanning the occupations of interest and Census regions. The result was 12 academic and non-academic medical center laboratory systems; 19 professional associations for recruitment; and, five national or regional reference laboratories that were invited to participate.

We conducted 16 semi-structured interviews with key informants within these organizations who had experience in educating, employing, or advocating for the clinical laboratory workforce (Table 1). Interviews were conducted over Zoom between July 2020 and October 2020. A semi-structured interview guide was developed. Interviews explored recruitment methods for educators and employers, workforce diversity of those in the education pipeline and currently working in the field, current workforce recruitment and retention barriers and facilitators, opportunities for continuing education and professional development of incumbent laboratory professionals, and the current policy and regulatory environment and its effects on the workforce. As the interview guide was developed in early 2020, it was updated and adapted to include questions on how the COVID-19 pandemic has affected the laboratory workforce in terms of education and employment.

Researchers independently reviewed notes from interviews with key informants and identified themes, illustrative examples and quotations. We compared these findings to identify commonalities and resolve any differing interpretations of respondents' input. These findings are summarized in this report, along with select insights from the interviews. The study and interview data collection procedures were reviewed and determined exempt from human subjects research by the University of Washington Institutional Review Board.

Table 1. Categorization of Key Informants by Background and Census Region

	Number of Interviewees
Total Interviewees	16
Educational Program	
Phlebotomy	2
Histotechnology	1
Medical Laboratory Assistant	1
Medical Laboratory Technology	2
Professional Association*	
Phlebotomy	3
Histotechnology	4
Medical Laboratory Assistant	3
Medical Laboratory Technology	5
Medical Laboratory Science	4
Employer	
Academic Hospital	1
Non-Academic Hospital	2
Regional Reference/Independent Laboratory	1
Blood Bank	1
Census Region Location of Interviewee	
West	5
Midwest	6
South	2
Northeast	3

**Applies to multiple professions. Total may exceed 16 because interviewees may represent multiple occupations.*

FOCUS GROUPS

Focus groups were a primary method of data collection, with a range of participants representing the target professions for this study, those that require more than high school and/or less than bachelor's degree: histotechnicians, medical laboratory assistants, medical laboratory technicians, and phlebotomy technicians. Recruitment strategies included emails to ASCP members, posts on ASCP's social media channels (e.g., Facebook and Twitter), and posts on ASCP's website. In addition, emails asked ASCP's partner organizations and members of ASCP's workforce-related committees and councils to share the recruitment email with their members and colleagues. These partner organizations included the AABB (formerly American Association of Blood Banks), American Association for Clinical Chemistry, American Society for Clinical Laboratory Science, America's Blood Centers, Clinical Laboratory Management Association, Philippine Association of Medical Technologists, and National Society for Histotechnology. The overarching aim was to recruit a broad, diverse sample of participants that was representative of the workforce of clinical laboratory professionals targeted by the project.

Preliminary participant screening was done via an online information sheet/consent form and subsequently confirmed through the informed consent process. Prospective participants had to meet one of the following screening criteria:

- Currently educating, supervising, or managing laboratory personnel in the target roles (histotechnician, medical laboratory assistant, medical laboratory technician, and phlebotomy technician) in the U.S.
- Currently working in a laboratory performing medical testing or a laboratory-related educational setting (e.g., a hospital-based laboratory, clinical outpatient laboratory, public health lab, etc.) in the U.S.

Once recruited, eligible participants were assigned to one of ten focus groups based on their profession/role and their scheduling preferences. The focus groups were conducted in September 2020. Eight of the groups included supervisors, seven included non-supervisory staff, and six included educators. By profession/role, there were four groups for histotechnicians, and two groups each for medical laboratory assistants, medical laboratory technicians, and phlebotomists. Each group consisted of one to five participants.

Although the focus groups were intended to occur in-person, the sessions were conducted via Zoom due to the COVID-19 pandemic. Each group had one of three moderators who had previous experience as laboratory personnel and conducting focus groups and followed a semi-structured protocol with discussion questions based on current workforce-related literature. For the groups comprised solely of non-supervisory staff, the question protocol centered around topics such as employment recruitment and retention, career advancement and pathways, workforce shortages, COVID-19, and policy implications. The groups comprised of supervisory staff and educators followed a similar semi-structured protocol, also including topics such as academic recruitment, student retention, and clinical rotations. The focus group study procedures were reviewed and approved by the University of Utah Institutional Review Board (IRB # 00131113).

Quantitative analysis of the focus group data included descriptive statistics of demographic information of the focus group participants. Qualitative analyses of the transcripts from the focus group sessions included content analysis and thematic analysis aligned with the aims of the study to identify challenges and facilitators to the recruitment and retention of clinical laboratory personnel.

Clinical Laboratory Workforce:

Who Are They?

ROLES, EDUCATION/TRAINING AND CERTIFICATION

The six occupations investigated in this study cover a variety of roles and require a wide range of education and training. The various, typical post-secondary educational pathways for these occupations are detailed in Figure 1.

Phlebotomists

Phlebotomy technicians, also known as phlebotomists, are the laboratory professionals with the most frequent patient interactions and are responsible for collecting, transporting, and processing blood and other specimens to be analyzed in the laboratory. They can work in a blood donor center collecting blood products for transfusion, performing health history screenings, and preparing blood products for the blood bank. Phlebotomists can enter the occupation with less than a year of education that results in a post-secondary certificate, or in some cases, through on-the-job training. Phlebotomists may be certified through several organizations (i.e., ASCP Board of Certification (BOC), American Medical Technologists, National Healthcareer Association, National Center for Competency Testing). Phlebotomists may receive certification from ASCP BOC to become a phlebotomy technician or a donor phlebotomy technician, with the main distinction between roles being work location and purpose of blood collection.

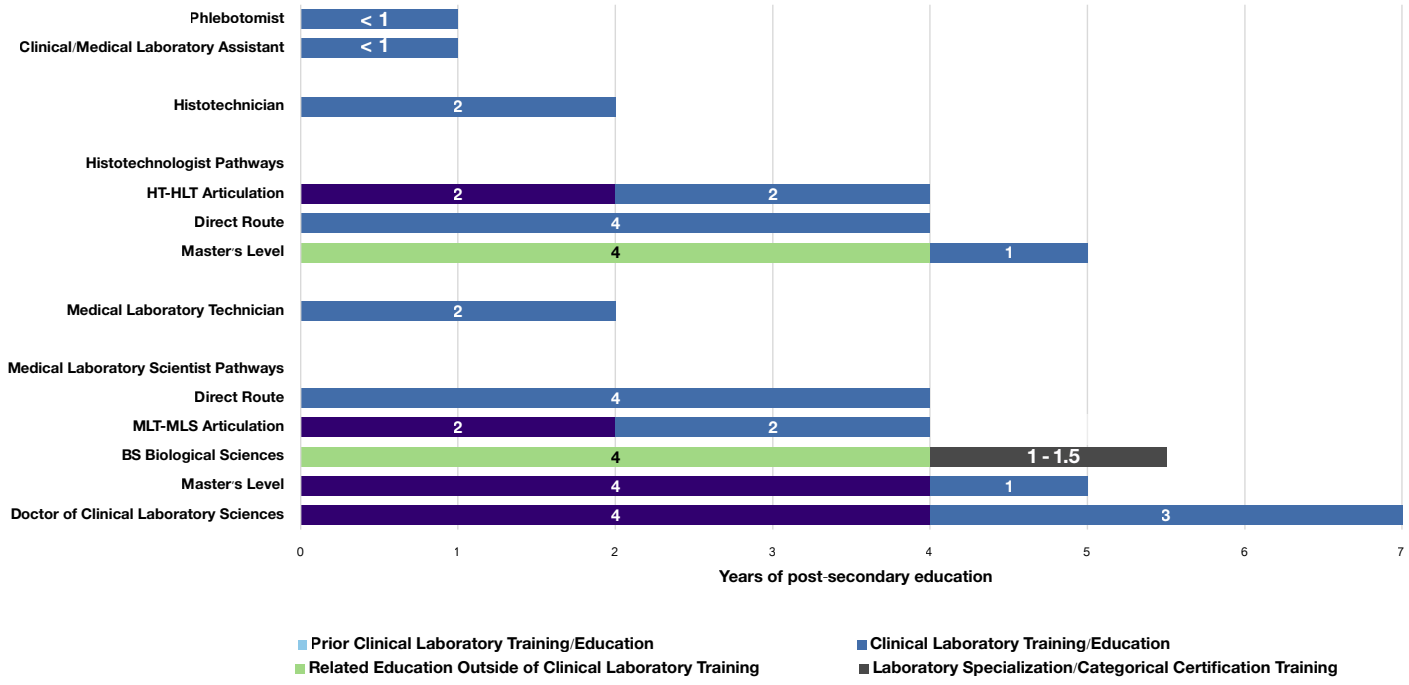
Medical Laboratory Assistants (MLA)

Medical lab assistants play diverse roles assisting other laboratory personnel and medical providers in phlebotomy, specimen processing, quality control, and laboratory orientation and regulation.[12] MLAs are responsible for preparing biological specimens, recording information, performing waived and point of care testing, and performing lab maintenance tasks such as cleaning equipment and stocking supplies.[13] To enter this occupation, medical lab assistants typically complete a one year post-secondary certificate program, but may fulfill the necessary requirements through on-the-job training without obtaining a certificate from an academic program or certification by ASCP BOC.

Histotechnicians

Histotechnicians or histology technicians prepare and process tissue samples for routine histologic techniques for examination under the microscope by pathologists.[14-15] Histotechnicians may be certified

Figure 1. Typical Years of Post-Secondary Education or Training Required for Select Clinical Laboratory Occupations



Data sources: National Society for Histotechnology. What is Histotechnology? About Histotechnology. Published n.d. Accessed March 11, 2021. https://www.nsh.org/about/about-histotechnology; Lab Tests Online. Medical Laboratory Professionals: Who's Who in the Lab. Published January 26, 2021. Accessed March 11, 2021. https://labtestsonline.org/articles/medical-laboratory-professionals Coordinating Council on the Clinical Laboratory Workforce. Explore These in Demand Laboratory Science Careers. Laboratory Science Careers. Published n.d. Accessed March 11, 2021. https://www.laboratorysciencecareers.com/careers-in-laboratory-science.html; Nadder TS. The Development of the Doctorate in Clinical Laboratory Science in the U.S. EJIFCC. 2013;24(1):37-42. Published 2013 Apr 12.

through ASCP BOC. To qualify for the certification exam, histotechnicians can either attend an accredited program or they can train on-the-job, following completion of a two-year associate degree that includes chemistry, biology, and mathematics credits.[16]

Histotechnologists

Like histotechnicians, histotechnologists are trained in the preparation and processing of tissue samples. They perform routine and complex histologic techniques (i.e., immunohistochemistry, in-situ hybridization, immunofluorescence) for microscopic review by a pathologist to diagnose disease. A histotechnologist may supervise a histotechnicians' work. Becoming a histotechnologist requires obtaining a bachelor's degree from an accredited program or through on-the-job training.[16] Transitioning from the two-year associate degree, a histotechnician may seek histotechnologist certification, which is an advanced certification that allows the holder to perform high-complexity testing. There are four-year programs that combine Bachelor of Science (BS) degree in clinical chemistry or biology with a histotechnology specialization, post-baccalaureate certificates in histology, and Master of Science (MS) degree programs in clinical chemistry or biology with a histotechnology specialization.[17] Advancement is also possible into areas such as education, test development, quality assurance, and management.[18] Histotechnologists may be certified through ASCP BOC.

Master's in histotechnology

Few programs in the U.S. offer a post-baccalaureate degree in histotechnology. These programs are often one-year master's degree programs available to individuals with a bachelor's degree in biological or allied health science.[19] These individuals are prepared to enter the workforce with the same skills and knowledge to perform high-complexity testing as histotechnologists with a four-year degree.

Medical Laboratory Technician (MLT)

Medical laboratory technicians work with phlebotomists, MLAs and MLSs to perform routine, large volume testing: the collection, processing, and analysis of biological specimens; the performance of lab procedures; the maintenance of instruments; and relating lab findings to common diseases/conditions.[20] Prospective medical laboratory technicians typically must complete at least a two-year associate degree program.[15] Most associate degree programs can be completed in two academic years, but fast-track certificate programs are available to those who already have training or professional background in a related healthcare field, such as nursing or phlebotomy.[20-21] Medical laboratory technicians may be certified through ASCP BOC, with some states requiring licensure.

Medical Laboratory Scientists (MLS)

Medical laboratory scientists (also referred to as medical laboratory technologists in SOC codes by the Bureau of Labor Statistics and CIP codes by IPEDS)[a] have extensive knowledge and skills in the laboratory field which includes the areas of blood banking, clinical chemistry, hematology, immunology, microbiology, and molecular biology. They not only perform sophisticated analyses and laboratory procedures, but also evaluate the results, integrate data, problem solve, consult, conduct research, and develop new test methods.[20] Medical laboratory scientists may also assume quality assurance or quality control roles and may supervise other laboratory personnel. These professionals often have a bachelor's degree in medical laboratory sciences and may be certified through the ASCP BOC. Professionals with a bachelor's degree in biological or chemical sciences with additional training and/or on-the-job experience may also become certified through the ASCP BOC as a medical laboratory scientist or a technologist in an area of the clinical laboratory (i.e., Blood Banking, Chemistry, Cytogentics, Hematology, Microbiology or Molecular Biology). Because not all states require medical laboratory scientist licensure, employers often do not require individuals to be credentialed or certified in their field. In ASCP's 2018 Vacancy Survey, most medical laboratory scientist respondents reported preferring a credential or certification for employment across these occupations.[5] Medical laboratory scientists may be certified through ASCP BOC.

MLT to MLS Articulation

Individuals who have completed a NAACLS-accredited medical laboratory technician program may be eligible to obtain a bachelor's degree in medical laboratory science, from some programs, without repeating courses common to both degrees.[20] Portions of the curriculum and clinical practicum may be waived in areas where proficiency has been demonstrated.

Advanced Degrees in Medical Laboratory Science

For those with a bachelor's degree in medical laboratory science, opportunities to earn a master's or doctoral degree in the clinical laboratory field are increasing. Master's programs emphasize core laboratory subjects such as clinical chemistry or microbiology, while also focusing on research, leadership development, and management skills.[22] The Doctorate of Clinical Laboratory Science is a 3-year post-baccalaureate program for those with a bachelor's of science in medical laboratory science that focuses on patient care management, education, applications of research, health care policy development, and health care services delivery and access.[23] The doctor of clinical laboratory science will be equipped to provide input to medical providers during rounds and provide quality assurance and control in point of care testing, serving a critical role as intermediary between medical providers and the clinical laboratory.

a There is a disconnect noted by professional organizations representing the clinical laboratory workforce between the federal standardized occupation codes and job titles and requirements and what is recognized by the field. The ASCP Board of Certification and the American Society for Clinical Laboratory Sciences propose making "medical laboratory scientist" the standardized job title for all who have graduated with a bachelor's degree and have successfully met the requirements of a national certification program. Source: www.ascp.org/boc/standardize-professional-title-of-MLS

Individuals in clinical laboratory occupations with MLS degrees, and related bachelor's or graduate degrees not in laboratory sciences (such as master's degree in public health, business administration, education, or public administration), may seek certification or specialization in laboratory sciences in categorical areas (i.e., blood banking, chemistry, hematology, microbiology, molecular biology, or cytogenetics).

Accreditation and Certification Organizations

NAACLS[a] is the main accrediting organization for academic programs in the clinical laboratory sciences. The Commission on Accreditation of Allied Health Education Programs accredits programs for specialists in blood banking and cytotechnology programs. In 1977, the National Certification Agency for Medical Laboratory Personnel (NCA) was formed as an independent certification body for individual laboratory personnel. In 2009, the NCA and the American Society for Clinical Pathology (ASCP) Board of Registry unified to become a single certification agency, now known as the ASCP Board of Certification (BOC).[24] Certification for recent entrants to these professions is recommended by academic programs and accreditors, employers, and professional associations, but may not be required in some states or by some employers for licensure purposes.

Individuals who received formal education in clinical laboratory sciences, on-the-job training in clinical laboratories (anyone from phlebotomists to medical laboratory scientists), or individuals with relevant backgrounds in biological sciences (including those with bachelors to doctoral degrees in biology, chemistry, epidemiology, or medical degrees) may be eligible to seek certification in a laboratory field. The ASCP BOC offers certifications in the clinical laboratory areas of blood banking, clinical chemistry, cytometry, hematology, microbiology or molecular biology, and the anatomic laboratory areas of histology and cytotechnology.

There are other laboratory personnel not specifically described by this study, often filling roles within specialty laboratories (i.e., cytology, cytogenetics, pathologists' assistant). These personnel are often at the medical laboratory scientist level and are often certified in the specializations listed above

a For more information about NAACLS, see: https://www.naacls.org/about.aspx.

Clinical Laboratory Workforce:

Supply and Demand

According to the U.S. Bureau of Labor Statistics (BLS), employer demand for phlebotomists is projected to increase by 17% between 2019 and 2029, and clinical laboratory technician and technologist occupations[a] are projected to increase by 7% between 2019 and 2029, faster than the average projected growth rate among all other healthcare occupations.[1] Application of the BLS demand projections is difficult, however, because the BLS combines clinical laboratory technicians and technologists into one occupation category for its projections, combining relatively diverse laboratory occupations ranging in specialty and education requirements from general technicians and technologists (medical laboratory technicians and medical laboratory scientists), to specialists with roles in immunohematology, clinical chemistry, hematology, immunology, microbiology, and molecular biology (cytotechnologists, histotechnologists and histotechnicians).[1] While demand projections for specific occupations (medical laboratory technicians vs. scientists, or histotechnicians vs. histotechnologists) are not available from federal data sources, demand appears to be growing across the field, and there have long been ongoing concerns about the sufficiency of the supply to meet demand. A recent study by the ASCP shows growing vacancy rates for some clinical lab professional occupations, underscoring the urgency of these concerns.[5]

According to BLS, there were approximately 132,600 phlebotomist jobs in the U.S. in 2019, with 38% working in hospital settings, 32% in medical and diagnostic laboratories, 15% in other ambulatory settings, 7% in physicians' offices, and 2% in outpatient care centers.[2] Median wages for phlebotomists, according to BLS, was $35,510 in May 2019 and varied depending on employment setting with those working in outpatient care centers earning the most at $41,620 and those working in hospital settings earning the least at $33,720.

BLS reported 337,800 clinical laboratory technologist and technician jobs in the U.S. in 2019, with 47% working in hospital settings, 20% in medical and diagnostic laboratories, 9% in physician offices, 6% in schools and universities, and 3% in outpatient care centers.[1] Median wages for this broad group of laboratory occupations was $53,120 in May 2019, but ranged from $30,920 to $81,530. The clinical laboratory technologist and technician category encompasses occupations that may require anywhere from a two-year degree or equivalent on-the-job training to those with a bachelor's or master's degree in clinical laboratory fields or those with equivalent training outside of the laboratory who might have a specialized or categorical certification. Median wages for occupations covered in this study are detailed in Table 2.

In a 2017 wage survey from ASCP across their current membership (including the professions of interest in this study), 80.5% of respondents were female and had an average age of 42.9 years.[8] Approximately 60% had a bachelor's degree and 25% had less than a bachelor's degree but more than a high school diploma. Medical and diagnostic laboratories tend to run 24 hours a day, seven days a week and depending on their work setting, the work hours of these professionals may vary between the three shifts (day, evening, and night).

Table 2. Salary and Work Environments of Selected Clinical Laboratory Occupations

Profession	Average Salary (2017)	Work Enviroxnments
Phlebotomist	$32,985	Phlebotomists can work in a variety of settings: hospitals, clinics, doctors' offices, nursing homes, private home care, medical labs, blood donation centers, research institutes, and insurance companies.
Medical Laboratory Assistant (MLA)	$37,772	MLAs typically work in hospital laboratories, although some may work in public health, research, and reference laboratory settings.
Histotechnician	$54,237	Histotechnicians typically work in clinical pathology or private laboratories. Some may work in research, veterinary, pharmaceutical, and forensic laboratories.
Histotechnologist	$56,369	HTLs typically work in clinical pathology or private laboratories. Some HTLs may work in research, veterinary, pharmaceutical, and forensic laboratories.
Medical Laboratory Technician (MLT)	$45,715	MLTs typically work in hospital or clinical laboratories in doctor's offices. MLTs may work in public health, research, or reference laboratories.
Medical Laboratory Scientist (MLS)	$61,112	Medical Laboratory Scientists typically work in hospitals, clinics, or reference laboratories forensic or public health laboratories. They may also work in specialized laboratories (infection control, public health, forensic, or research laboratories).

Sources: Garcia E, Kundu I, Fong K. The American Society for Clinical Pathology's 2017 Wage Survey of Medical Laboratories in the United States. Am J Clin Pathol. 2019;151(1):29-52. doi:10.1093/ajcp/aqy139; Mayo Clinic College of Medicine and Science. Explore Health Care Careers - Phlebotomy Technician. Mayo Clinic College of Medicine and Science. Published n.d. Accessed March 11, 2021. https://college.mayo.edu/academics/explore-health-care-careers/careers-a-z/phlebotomy-technician/; Coordinating Council on the Clinical Laboratory Workforce. Explore These In Demand Laboratory Science Careers. Laboratory Science Careers. Published n.d. Accessed March 11, 2021. https://www.laboratorysciencecareers.com/careers-in-laboratory-science.html; Mayo Clinic College of Medicine and Science. Explore Health Care Careers - Histology Technician. Mayo Clinic College of Medicine and Science. Published n.d. Accessed March 11, 2021. https://college.mayo.edu/academics/explore-health-care-careers/careers-a-z/histology-technician/; Mayo Clinic College of Medicine and Science. Explore Health Careers - Medical Laboratory Scientist. Mayo Clinic College of Medicine and Science. Published n.d. Accessed March 11, 2021. https://college.mayo.edu/academics/explore-health-care-careers/careers-a-z/medical-laboratory-scientist/.

RECRUITMENT AND RETENTION

A common recruitment challenge reported across laboratory occupations is finding qualified applicants with the necessary educational background, certification, and skills to perform the work.[25] Challenges to retention of qualified laboratory professionals included increasing retirements, competition driven by laboratories' compensation packages, competition with employers outside of laboratory settings, comparatively lower salaries compared with other healthcare fields (e.g., MLS vs RN positions), limited potential for career advancement or

a According to some professional organizations, BLS uses outdated terms to describe the clinical laboratory workforce. Clinical laboratory technicians and technologists can be categorized as medical laboratory scientists (MLS) and medical laboratory technicians (MLT) (source: https://www.ascls.org/position-papers/321-laboratory-workforce/440-addressing-the-clinical-laboratory-workforce-shortage). Phlebotomists have their own SOC code under BLS (source: https://www.bls.gov/ooh/healthcare/phlebotomists.htm).

additional compensation, and workload concerns or burnout. The top perks offered to "all laboratory personnel remain similar to those obtained in the 2016 survey and include health/retirement benefits; premium pay for overtime, holidays, or weekends; and tuition reimbursements."[25] Specifically, for MLS, some employers have adapted to recruitment and retention challenges by beginning to hire non-certified personnel to perform testing.[25] These uncertified individuals often have Bachelor of Science degrees in biological sciences, such as biology or chemistry, and can perform pre-analytic processes or low complexity analytical testing while working towards the necessary experience and education to apply for categorical certification through ASCP.

EDUCATION

During the 2015-16 academic year, there were 8,378 student completions across 326 phlebotomy programs in IPEDS (Table 3). These numbers decreased slightly from 2015-16 to 2018-19 when there were 8,031 student completions across 314 programs. For MLAs, there were 552 student completions across 34 programs in 2015-16 with a slight increase in 2018-19 of 803 student completions across 31 programs. MLT programs experienced a slight decline over this period, from 4,365 student completions across 282 programs to 4,137 completions across 268 programs. Histotechnician and histotechnologist programs remained relatively constant (Table 3). MLS programs experienced a drop in the number of programs with at least one student completion while the number of student completions remained relatively constant. In 2015-16, there were 3,666 student completions across 249 programs. In 2018-19, there were 3,663 student completions across 237 programs.

DIVERSITY

Tracking racial and ethnic diversity in the clinical laboratory workforce is hampered by the limited data available for most relevant occupations. A study examining changes in race and ethnicity among allied health occupations in the U.S. from 2005 to 2014 reported findings for the 2000 U.S. Standard Occupation Code (SOC) category "Clinical laboratory technologists and technicians", which includes multiple clinical laboratory occupations.[11] Using data from the American Community Survey of the U.S. Census, this study found that the clinical lab workforce was slightly more racially and ethnically diverse compared to the overall health workforce, and reported increasing diversity over time.[26] Specifically, the study found 68.5% of this category was White in 2014, 4.2 percentage points less than in 2005, and 9.7% Hispanic, an increase of 2.1 percentage points since 2015. Black/African American clinical laboratory technologists and technicians in 2015 were estimated to comprise 15.3% of this field, which is higher than the 12.7% Black/African American of the overall U.S. population.[6]

The clinical laboratory workforce has historically been a majority-White field. In examining program completions from 2016-19 using data from IPEDS (Figures 2 and 3, Table A2), new entrants to the field (at least from post-secondary degree-granting academic institutions) continue to be mostly White. There is variability across disciplines, with MLA student completions being among the most diverse (Table A2). It is worth noting that only 35 MLA programs had at least one completion from 2016-19. These programs had the lowest number of completions among the selected lab occupations tracked in IPEDS (including histotechnicians and histotechnologists). Histotechnicians, histotechnologists, MLTs, and MLSs tended to be the least diverse (Figure 3, Table A1).

Historically, the clinical laboratory workforce has been predominately female.[25] As shown in Figures 4 and 5, this trend continues when looking at new entrants. The largest gap between genders across programs was in phlebotomy (Table A3). The gap between genders was narrowest in MLS programs (Table A3).

More information about the diversity of the clinical laboratory workforce is needed, including from federal data sources such as Census surveys. To achieve this goal, data are needed to provide estimates for the individual occupations grouped in the SOC code for clinical/medical laboratory technologists and technicians as well as for other clinical laboratory occupations.

Table 3. Number of Education Program Completions and Education Institutions by Program Type, 2016-19

Program	Year	Number of Completions	Number of Institutions
Phlebotomy	2016	8378	326
	2017	8472	329
	2018	8136	315
	2019	8031	314
Medical Laboratory Assistant	2016	552	34
	2017	704	35
	2018	826	34
	2019	803	31
Medical Laboratory Technician	2016	4365	282
	2017	4078	280
	2018	4033	268
	2019	4137	268
Histotechnologist	2016	110	15
	2017	139	15
	2018	120	16
	2019	112	16
Histotechnician	2016	267	16
	2017	221	17
	2018	260	18
	2019	252	16
Medical Laboratory Science	2016	3666	249
	2017	3661	242
	2018	3665	244
	2019	3663	237

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways.

Figure 2. Composition of phlebotomy and MLA academic program completions by race and ethnicity, 2016-19

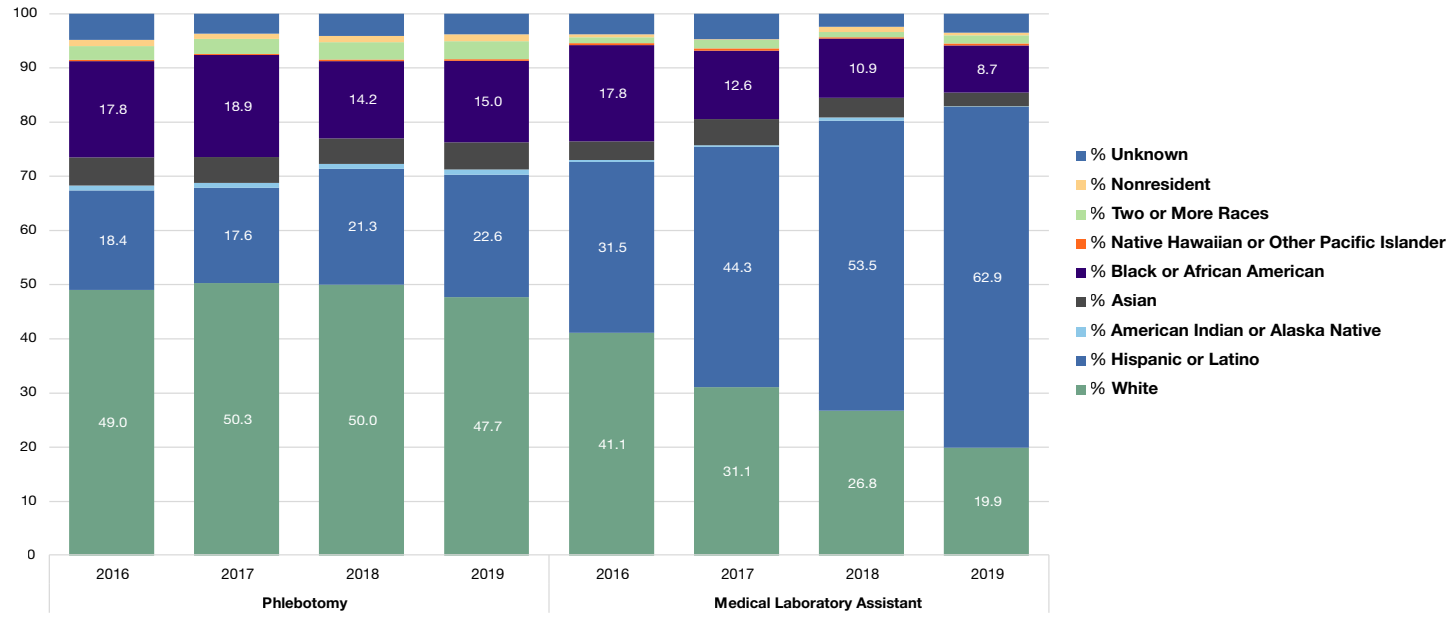
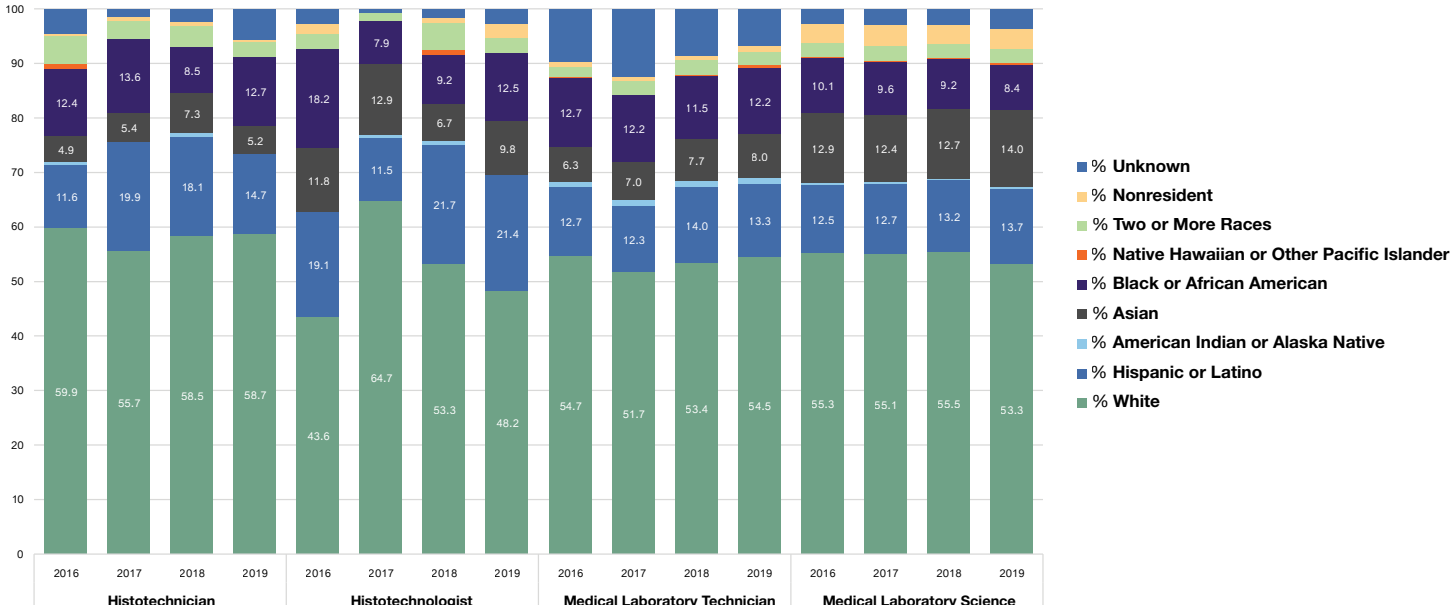


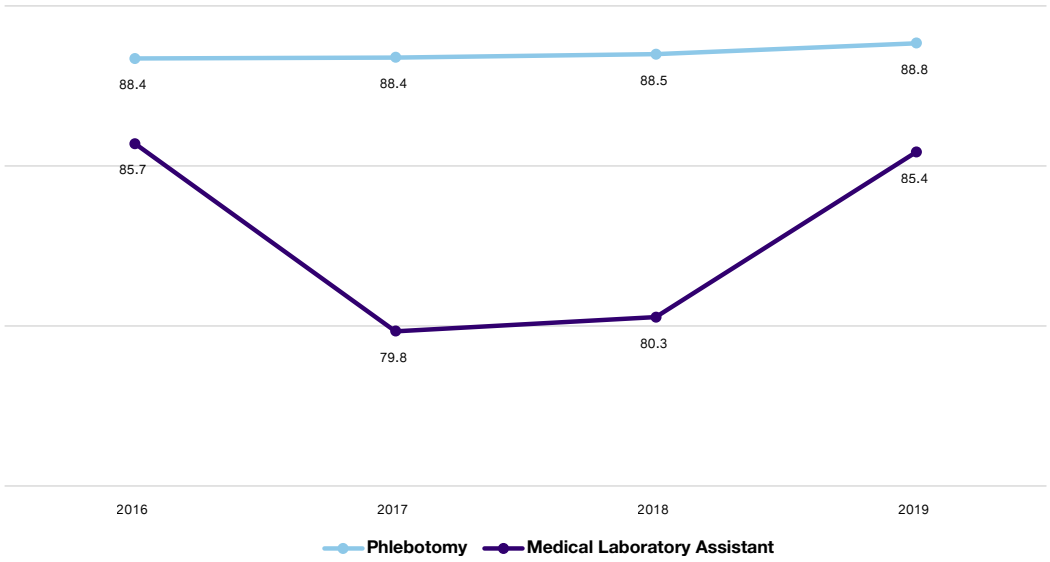
Figure 3. Composition of histotechnician, histotechnologist, MLT, and MLS academic program completions by race and ethnicity and program discipline, 2016-19



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.

Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways. In IPEDS, the "Hispanic or Latino" category is mutually exclusive of other racial/ethnic categories. All known and unknown race/ethnicity categories include US citizens, resident aliens, and other eligible non-citizens. Nonresident aliens are reported separately as "Non-US Resident." Columns add up to 100%.

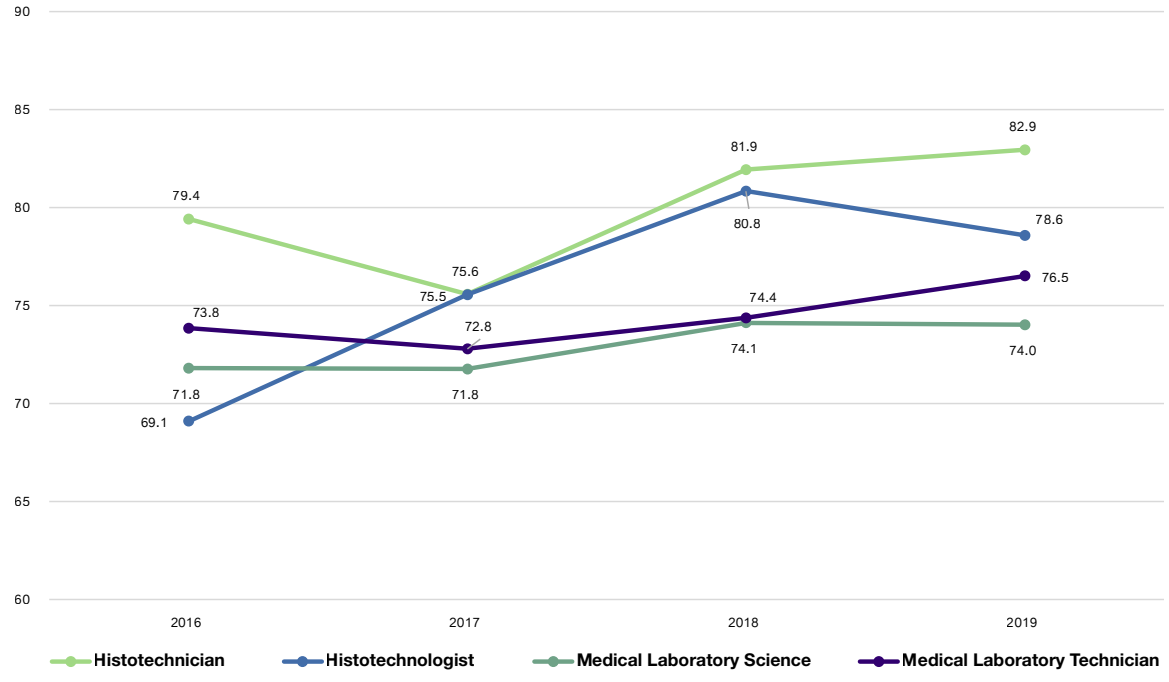
Figure 4. Percent female among phlebotomy and MLA academic program completions, 2016-19



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.

Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways. Columns add up to 100%.

Figure 5. Percent female among histotechnician, histotechnologist, MLT, and MLS academic program completions, 2016-19



Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.

Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways. Columns add up to 100%.

Findings from Key Informant Interviews

EDUCATION AND TRAINING

Program Size and Resources

Key informants reported that program cohort sizes across all types of clinical laboratory programs tended to be relatively small, with 8-20 students in a typical cohort. Phlebotomy, MLA, and histotechnician certificate programs tended to have multiple cohorts each year, which allows more students to move through their 9- to 12-month programs. Histotechnologist, MLT, and MLS degree programs, which are longer, tended to only have one cohort each academic year. These programs often have longer clinical rotations and more hours in the on-campus simulation laboratory. Interviewees noted increasing challenges in securing clinical rotation sites for their students: many sites can only accommodate one or two students and only for some programs. This has limited program enrollment, especially in rural areas. Interviewees pointed out that clinical laboratory programs also tend to be more expensive to operate than many other academic programs because of the additional costs of maintaining simulation laboratories for students to practice running tests and other laboratory procedures. Higher costs and smaller class sizes leave these programs vulnerable to being reduced or eliminated in environments where higher education funding is being cut.[27-29] Interviews confirmed the ongoing threats of funding cuts, program closures, and decreasing enrollments.

Student Characteristics

The background and characteristics of students in clinical laboratory education programs varies across disciplines. The certificate and two-year associate degree programs tended to have younger students, especially those without post-secondary education, although interviewees cited instances of older students looking to change careers. The bachelor's degree-level programs tended to enroll college-age students, students with previous laboratory experience looking to advance their careers, or older students looking for a career change, according to key informants.

Overall, across disciplines and geographies, interviewees from laboratory education/training programs indicated that most programs recruit from the area closest to the academic institution. MLS programs, which are mostly bachelor's degree programs, often recruit students at the state or regional level.

Insights (paraphrased and quoted) from key informants, by program discipline:

Phlebotomy:

- Students are largely female, tend to be younger (not exclusively), typically just out of high school (without post-secondary degree) or looking for a career change (occasionally)
- Phlebotomy students tend to be racial/ethnically diverse (likely related to the local community demographics)
- Phlebotomy may not be a long-term career choice, but a job choice to further education while securing an income

MLA:

- From a rural program director: many students on financial assistance; they have low tuition compared to other institutions in the state
- "We have a recruiting plan to diversify our pool [from other parts of the state] and other neighboring states (…) We're not as diverse as we would like for a university and the same thing would apply to our clinical lab programs."

Histotechnician/Histotechnologist:

- Some students come in after high school, others in their second/third careers.
- One institution offers 1+1 programs where students can get their prerequisites elsewhere, then attend their program for clinical training
- The bachelor's level degrees tend to be less diverse than associate level degrees

MLT:

- MLT degrees are mainly offered through community colleges with two-year degree programs. "MLT is meeting the needs of those who want to stay in their community and increase their standard of living. They're not interested in moving on... That's an important function of community colleges as a whole. MLT is one of those programs that helps the community."
- Program diversity, among community college programs interviewed, largely reflected the diversity of the school's community.
- "We have a large white population; we are not very diverse. This is partly at fault for diversity at the college, but largely within the profession."

Recruitment into Education and Training

Program directors reported using various recruitment strategies, both active and passive, to recruit potential students. Across disciplines, these strategies ranged from social media or television advertisements to engaging in middle and high school career fairs or visiting science classes, often enticing potential students with their program's "high graduation, employment, and exam pass rates."

Respondents from MLT, histotechnician, and MLS programs reported a more difficult time recruiting potential students than phlebotomy programs.

> *"Our program struggles with recruiting talented individuals. When people think of health care, they don't think of these specialized allied health professionals. The general population doesn't know about us. It's been challenging to recruit a full class."* —Histotechnician program director

Many programs have found that a lack of awareness of clinical laboratory careers by the general public has been a significant barrier in recruiting more students, leading faculty to be more directly and actively involved in demonstrations at career fairs or in science classes. Histology and medical laboratory technician programs tended to use these more active recruitment strategies. MLS programs are often housed within universities with biological sciences programs from which they can

recruit students who do not wish to pursue graduate education in biological or medical science fields.

We interviewed several academic programs housed within large healthcare organizations. These programs can often recruit students/trainees directly from the organization's incumbent workforce, as well as through active recruitment outside the organization.

> *"Our faculty actively interact with high school programs in the area… a couple times a year for all faculty within the school of clinical sciences."*

These programs reported having the institutional infrastructure to provide clinical training along with didactic instruction, either through affiliate programs or internal instruction.

When asked specifically about recruitment efforts to increase racial and ethnic diversity, most informants did not mention specific programmatic or institutional strategies. Instead, they indicated that the diversity of their programs, especially for the certificate and associate degree programs, tended to reflect the diversity of the surrounding communities. While they acknowledged the lack of racial/ethnic and gender diversity among students, most informants did not identify existing or planned efforts to actively recruit from underrepresented populations.

Some informants described the value of programs like the federal HRSA Health Careers Pipeline and Diversity Grants that offer direct financial support to students from underrepresented racial/ethnic backgrounds or medically underserved communities pursuing careers in health professions.[30] They stressed the need for more nationwide efforts encourage students to enter clinical laboratory professional programs, including programs to increase diversity.

How are Students Recruited?

Insights (paraphrased and quoted) from key informants, by program discipline:

Phlebotomy:

- For-profit institution: a robust admissions team and strong presence through traditional and social media.
- Public institution: mostly through word of mouth and community engagement (outreach through high schools, involvement in community events).

MLA:

- Engaging with local high schools, active recruitment program through other means (global campus office, state events, etc.).
- Institution-level efforts to increase diversity are not specific to the MLA program.

Histotechnician/Histotechnologist:

- Traditional and social media plus intentional efforts to recruit in high schools to increase visibility and awareness of the field.
- Institution offers numerous programs offering students a chance to upskill.
- "Our program struggles with recruiting talented individuals… Our solution has been more of an aggressive in-person recruitment strategy through career fairs and physical recruitment… We've been doing more engagement in the classroom."
- A large healthcare organization with academic programs recruit students through its website. The recruitment office within their larger organization also promotes the program.

MLT:

- High school career counselors, visits, career fairs and worker re-training centers. One program markets itself to employers as an opportunity to upskill current employees.
- Attempts to recruit with diversity in mind, specifically among Native American communities, has not been as successful.

Institutional and Programmatic Support for Students

Financial aid continues to be a prominent source of institutional support for students. Federal financial aid is unavailable to some students in phlebotomy, MLA, and the one-year histotechnician programs because programs of less than an academic year do not qualify. As a result, these programs are fee based. The associate and bachelor's level degree programs can offer federal financial aid. Across disciplines, programs offer additional support including childcare services, tutoring and student support, or paying for their students to sit for the certification exam.

Insights (paraphrased and quoted) from key informants, by program discipline:

Phlebotomy:

- Institutional supports (childcare, tutoring, housing assistance), personalized faculty-to-student assistance, and helping students figure out within the first two weeks if the program is a good fit.

MLA:

- One program offers laddered programs that progress from MLA to MLT to MLS if students choose to go that far. Student groups are mentored by a faculty member, engage in community outreach events. Program actively creates a social structure in which students are encouraged to engage. Dedicated tutor and extra resources available.

Histotechnician/Histotechnologist:

- One program offers program-specific academic success and coursework tutoring, library support services to help with onboarding and financial aid. The key informant emphasized that the field is so specific, they offer program-specific tutoring services. Mental health and academic support services available.

MLT:

- The lack of clinical training sites impacts the incoming pipeline of students: "One of the reasons we've dropped in our capacity to take students is because we lose clinical sites. I'm looking for new hubs to open (…) We do not have the capacity to take 21 students. In my first year, we had two applicants for every position. Now we have one."

- Lack of visibility for the profession: "There's this unknown of what laboratory people do. People won't enter a field they're not familiar with. It's a struggle to get people into labs."
- "Students are coming in from not being in school or a career, this is a different mindset. They are not prepared to do the level of work that needs to be done… We have 100% success rate because we don't let them fail. This is what sets us apart from other college courses. We lay out a success plan. If students score less than 70%, they have to meet with the instructor and me as a program director…. at least six students...fall into this category."

Curricula

Individual academic programs across disciplines indicated similar methods for making changes to curricula. Academic programs often track national board exam pass rates, including overall pass rates and pass rates from individuals who have completed their program, to get a sense of how their graduates compare to other institutions. Many informants cited distributing and reviewing surveys sent out to recent graduates and local employers. Advisory committees or groups consisting of local employers, industry professionals, and clinical rotation sites provide feedback. As one informant explained:

> *"We send out an employer survey twice a year, we also have an advisory committee with local employers and clinical sites. We have our academic department review done on a 5-year basis. This is with the IL community college board. We review it for strengths and weaknesses in different areas. With our advisory committee, I make regular visits to the clinical sites and speak directly to the labs. When changes are coming about, we have a heads up and we use that to discuss, within our advisory committee, if any changes need to be."*

Only one of the academic programs interviewed mentioned using information and materials from conferences in updating their curriculum and program.

Insights from key informants, by program discipline:

Phlebotomy:

- Curriculum is updated by obtaining input from advisory boards with local employers and clinical sites, in addition to accreditation reviews.

MLA:

- Annual advisory board meetings with employers from the region, from sites where most graduates end up working. "We look pretty closely at the ASCP sub-discipline scores to monitor trends to see if there's something that we're missing."

Histotechnician/Histotechnologist:

- "We have close ties with community lab partners and do yearly reviews".

MLT:

- Programs are reviewed and evaluated in order to maintain accreditation by tracking national board exam scores, surveying graduates and employers, and convening an advisory committee that includes local employers and clinical training sites.

Clinical Training

Informants said that securing adequate numbers of clinical training sites is difficult. One informant attributed this challenge to consolidation in laboratories and health systems: "There's different specialties [in the laboratory] that are highly specialized and some are being consolidated. Usually we move students around [between clinical sites], and through that changing process we make sure that they get training in all areas of the lab. Consolidation limits the number of clinical sites available for training."

These limitations are reducing the number of students who can be accepted into clinical laboratory programs, the funding for those programs, and as a result, the number of new entrants into laboratory occupations. As our informants noted, academic programs and local employers can work together to increase these numbers. One informant argued for increasing wages for laboratory occupations:

> *"It would attract more people to the profession. It would signal the importance and visibility of the profession and that they're equal to other professions… Once you do that, you'll need to find a way to train these people. [One way is through] direct funding of educational programs. That's the only way they're going to get scaled up enough to train enough people. There's a related issue: programs struggle to find clinical sites. Clinical sites don't have enough people to train them. Creates a death spiral."*

Employment Rates for Recent Graduates

Across the programs and disciplines interviewed, graduation and program completion rates were high, often upwards of 90%. Degree-granting programs often accept students based on prior academic performance, among other criteria, which can help to explain the high completion rates. From the perspective of the program directors, when students do not complete the programs or pass their certification exam, it is likely due to specific external or intervening factors related to the student's ability rather than the performance of the program.

Across disciplines and professions, with the exception of phlebotomy, informants reported that there are not enough qualified applicants to fill vacancies. Job placement rates among new graduates tend to be upwards of 90% or 95% within six months of graduation, with the majority of students hired by their clinical rotation site.

> *"There's more jobs available than there are students to fill them…. Every student in the past eight years was employed at the time of graduation."*

When employment rates were not as high, student focus was often the reason, said one informant:

> *"[The graduate may] pass their exam, but are committed to a different aspect of their lives. Maybe a different opportunity presents itself or they get promoted in their current position/ role. It's a choice made by the students based on what's currently happening in their lives. Another barrier is lack of participation with the career services department. We build career services into our program. If a student chooses not to utilize those resources, they are often not getting hired."*

From the perspective of many of the respondents, responsibility for completing the program and securing a job rests with the student, and the programs are satisfied with their current graduation and job placement rates and generally feel that they offer adequate program support to students to ensure their success.

Insights (paraphrased and quoted) from key informants, by program discipline:

Phlebotomy:

- Phlebotomists are in demand: "Typically, we have students hired before or shortly after they finish the program."
- Successful employment depends on the students' level of engagement with wanting a job in phlebotomy and participating with career services.
- Phlebotomy is a "revolving door", an entry-level position that provides graduates with skills and connections to be employable and offers opportunities to advance in other allied health professions:
- "More phlebotomists go on to become more than a phlebotomist. A lot of the students coming through the program use this as an entry into the workforce and a continuation of a career into the healthcare workforce."

MLT:

- Clinical sites aren't necessarily used for direct job placement, but often provide additional training at the end of the program to help with CVs and interviews.

Student and Employer Expectations

All the program informants interviewed called regular employer surveys a key component to reviewing and evaluating the program. These employer surveys allow for the programs to gauge how well their program and students' knowledge and skills align with employer needs. As one interviewee stated:

> *"We get positive feedback, mostly because the affiliates hire the graduates they train or graduates are going to a similar facility."*

Many programs also send surveys to new graduates asking similar questions about job satisfaction and how the education program could be improved. Key informants reported that much of this feedback is positive, and when not, program directors and faculty can make adjustments to meet the needs of students and employers. Some interviewees acknowledged that they can prepare the students to the best of their ability within a controlled, academic environment, but once graduates enter the field they will always encounter unknowns or "aha moments" that require them to adapt to the pace of their lab, the personalities working in the lab, and other real world factors.

Other informants noted a gap or disconnect between employer expectations and academic programs' capabilities. Educators and academic programs see themselves teaching and equipping students with the skills necessary for career entry, but not the skills needed for specific laboratories or laboratory environments. In addition, interviewees mentioned some challenges associated with expectations for what MLT versus MLS graduates can or should do once hired.

Insights (paraphrased and quoted) from key informants, by program discipline:

Phlebotomy:

- Soft skills and basic career preparation work is provided by the program, depending on who is coming to the class .

MLA:

- Based on employer feedback, expectations are well-aligned. "We get positive feedback, mostly because the affiliates hire the graduates they train or graduates are going to a similar facility. I don't know if that person went to Houston if they'd have the right skill set."
- Students are generally pleased with their new careers and the programs, but some are disappointed, which one interviewee attributed to a personality difference between the student and their mentor.

MLT:

- Students can be surprised at how complex the laboratory is: "When you finish the program and graduate, it's not the end of the process, but the beginning. Graduates are expected to continue to learn more and become more proficient and skilled."
- "It's been an expectation of rural employers that they can hire an MLT and do the work of an MLS. It's not reasonable or fair to the employee… Over the years, MLTs have complained than they do the same work as an MLS [who] get paid more."

EMPLOYMENT

Hiring

Key informants offered varying perspectives on the ability of laboratories to find qualified applicants to fill vacancies. They noted that metropolitan areas experience competition between laboratories, although vacancy rates are lower because employers are able to pay relatively well. In rural regions with fewer qualified applicants, recruitment and retention problems tend to be more acute.

Some respondents described potential applicants discouraged by comparatively lower wages (compared with other occupations), and concerns over stress, workload, and potential burnout. Limited public visibility and awareness of clinical laboratory occupations was cited by some as impairing the ability to recruit enough qualified applicants to fill vacancies.

Insights (paraphrased and quoted) from key informants, by occupation:

Phlebotomy:

- "The pay isn't high enough and with COVID they're putting themselves at risk. That's something to think about. These are people without a degree that can be trained on the job. I feel like we need to do better by them. Their role is very important; they're interfacing with the patient."
- Difficult to retain phlebotomists: "They go on to do other things."

Histotechnician/Histotechnologist:

- "They are one of the lower paid professionals. They have been treated as cogs in the wheels and not as skilled individuals… There's not enough bodies trained to come in. The HTL has a bachelor's degree, the histotechnician has an associate. The histotechnologist is seeking other career paths due to low pay. The other issue in terms of compensation is that priority is given to credentialed techs, but employers aren't supporting professional development and maintenance of their credential. Employers are their own worst enemies. The reality is that the employers are not taking care of these techs."
- "We might be more top heavy [with older employees] than other professions as folks are not getting great money to get started… Younger trainees are not staying in the field."

MLT:

- For MLT (as well as MLS): There are not enough people to fill open positions, particularly in rural areas. There has been a reduction in the number of schools offering these programs, making enrollment competitive. Where there is competition between employers, those offering the highest salaries can attract more applicants.

MLS:

- There are not enough qualified applicants to fill vacancies. The workforce is also aging, with the average age of MLSs in the laboratories in the late 50's. There will be a lot of people retiring and difficulty replacing them.

Workforce Diversity

As shown in the IPEDS data above and in Appendix A, while most clinical laboratory workers are women, the race and ethnicity of new entrants to these occupations tend to be fairly diverse: about half or more (inclusive of Hispanic or Latino ethnicity) were reported to be a race/ethnicity other than White. According to informants, the workforce has historically been comprised largely of white women, but this is changing as these individuals exit the workforce. As one informant stated: "I would say that the graduating workforce is increasing in diversity and looking less white and less female."

However, other informants pointed to the lack of accurate data across the workforce to examine diversity.

> *"Diversity is a major issue for us right now, and our biggest problem is that we can't accurately pinpoint our diversity."*

Alignment of Education and Training with Employer Needs

Across occupations, informants reported that training programs appear to align well with employers' needs because the widespread practice of using advisory groups and routine NAACLS review and accreditation fosters good communication. Working with local academic programs either through membership on advisory committees or as clinical practice sites, employers can help update curricula and set expectations for graduate skills. Offering clinical practice sites also lets employers train future employees in the hard and soft skills that equip them to succeed.

Employer informants also highlighted the conflict between the need to update curricula to respond to employer needs and current workforce demands and the slower pace of change at accreditation and credentialing organizations. Many academic programs design their curricula to support student success in credentialing exams, but the exams and curricula may be out of sync with the needs of local or regional employers. One informant stated, "This is a paradigm that must change—there's a five-year lag. It might be time to look at competency-based education."

Insights (paraphrased and quoted) from key informants, by occupation:

MLT:

- Insufficient clinical training: "Training programs need more relationships with clinical training sites. [It is] harder to get the bench training that MLTs used to have."
- State licensure would help align standards in education and employment. An update to current CLIA regulation would further align education and training with employer needs. Informants noted that current CLIA standards are centered on the laboratories themselves, and not the personnel. CLIA could be updated to include qualifications and requirements for occupations to run certain tests, creating an updated set of educational and/or training requirements and a clear scope of practice for educators and employers to reference.

MLS:

- "We have to be thinking about the curriculum—it should change in the future. I see an increasing need for MLS to understand quality metrics better than they do. (…) From lab to lab you see different levels of knowledge around quality. Our training programs could be beefed up around quality management and performance improvement programs, students get exposure to this, but I think there will be higher demand in the future for familiarity with quality management systems."

On-the-Job Training and Apprenticeships

On-the-job training opportunities are available across occupations, but are mainly implemented among phlebotomists and MLAs, or for people in lab occupations who pursue specialty certifications. In some situations, individuals pursuing entry into clinical laboratory occupations may not be required to complete formal post-secondary education programs, or may be able to build on a prior related degree. For example, individuals pursuing the MLS occupation may receive on-the-job training in order to receive their specialization certification if they have a bachelor's degree in biological sciences, in order to accrue required laboratory training hours.

Our informants did not mention experience with any specific or formal apprenticeship models. One informant noted that NAACLS-accredited programs are prevented from seeking or allowing their students to pursue apprenticeships because apprentices are paid, and NAACLS prohibits programs from paying students. The majority of academic programs are primarily connected with on-the-job training through clinical training agreements with local employers.

Insights (paraphrased and quoted) from key informants, by occupation:

Histotechnician/Histotechnologist:

- "I hear that it's possible to train histotechnicians on the bench. There are people working as histotechnicians who can get the certification while they're working. There is progression from the entry-level positions to certification positions. The feasibility of this is up to the employer. Those currently working within the lab have an advantage as they work up through positions."

MLS:

- "BS in biological science grads can go into lab positions, they may be required to have a certification through ASCP, they are often working in a lab and going through a clinical training program. Many hospitals have a formal training program like this. Even those outside the lab, but still within the institution, and they meet the requirements, they may also go through that same training program."

Retention and Professional Development

Professional Development and Continuing Education

Employer informants interviewed for this study mentioned various opportunities for professional development and continuing education that let individuals in the field expand scientific skills, skills on quality assurance and improvement, and soft skills such as inter-professional communication. Because many occupations are required or strongly encouraged by their employers or state licensure requirements to be certified through ASCP or a similar professional organization, continuing education is an important component of maintaining that credential. Continuing education may be provided by professional organizations, equipment manufacturers, or large employers themselves.

While there may be opportunities for professional development and continuing education available to the incumbent laboratory workforce, informants reported that participation often depends on the extent to which employers allow employees the time to engage in these activities. Individual workers also vary in the extent to which they are interested in strengthening their skills. Some employers may not have adequate resources to pay employees' salaries while they pursue professional development or cover related expenses such as tuition assistance. As one informant stated:

"It comes down to if you have enough people in your workforce to be able to attend these events, and provide compensation for that. Sometimes it's difficult for employers and employees to do this. With the workforce shortages it's difficult to maintain [continuing education] involvement. [Continuing education] is adequate, but it's the workforce shortage that makes it difficult."

Career Advancement

Across occupations, informants noted that there are opportunities for career advancement within the clinical laboratory workforce, but career progression is not always linear or as straightforward as is the case for some other careers in healthcare.

"I think the answer is yes, if a lab professional wants to pursue [career advancement]. Lab science attracts a certain kind of person. These are folks who are smart enough and have the capacity to have chosen any kind of profession, but they chose this one… The big opportunities are moving into management, inter-professional roles. This is where you can see income growth because what they bring to the table is invaluable to the system."

Some informants mentioned that progressing in laboratory occupations sometimes requires innovation and thinking outside the box. Most informants stated that the clinical laboratory field, across occupations, does not have well-defined career pathways or ladders.

Occupations such as phlebotomists or MLAs, can be a stepping-stone to laboratory occupations that require additional education or to opportunities within healthcare outside of the laboratory. Informants provided examples of phlebotomists working toward their nursing or medical laboratory technician/scientist degree. For histotechnicians, histotechnologists, MLTs, and MLSs, career advancement opportunities are limited to supervisory, management, quality control, quality improvement, point-of-care oversight, or laboratory information system positions. Limited career progression opportunities, noted some informants, have some negative impact on retention.

Because MLTs and MLSs master a large range of skills in order to perform a variety of tests, informants described how their skills can be applied outside of medical and clinical laboratories. There may be options for these occupations to apply their skills in research, forensic, or pharmaceutical laboratories. Specialty certificates are also available. The new Doctor of Clinical Laboratory Science degree is opening additional opportunities for advancement, but as informants pointed out, the roles that individuals with this credential will eventually fill within the laboratory and medical care teams are evolving.

Turnover and Workforce Retention

Across occupations, informants noted that turnover is mainly dependent upon location and position. There tends to be more turnover among occupations requiring fewer years of formal or on-the-job training. For higher-wage occupations, turnover and retention problems tend to occur in areas with more competition between laboratory employers. For lower-wage occupations, the competing jobs are outside the clinical laboratory or healthcare fields. Burnout and workplace cohesion can affect retention across occupations, as can employees' feelings that they lack clear career pathways and opportunities for advancement.

Across occupations, but mostly among higher-wage occupations, the clinical laboratory workforce is aging and increasing numbers of individuals are retiring or leaving the workforce. Informants said that many joined the clinical laboratory workforce when it was expanding during the 1970s and 80s. Many have retired in recent years, mainly among the occupations requiring two or more years of post-secondary education.

Geographic location can also be an issue, as educational programs and employers are not evenly distributed across the country or across urban and rural areas. Some regions may be saturated with some clinical laboratory workers, increasing competition for jobs, while other regions struggle to fill open positions.

Potential Solutions and Novel Approaches

Solutions and approaches to retention and professional development issues that can be accomplished without state and federal legislation and regulation are limited. For recruitment, informants illustrated the importance of sign-on bonuses to attract qualified applicants. They also stressed the importance of keeping wages competitive with other area laboratories and positions outside laboratories that require a similar amount of experience (for example, setting phlebotomist wages to be consistent or higher than what someone would receive at a grocery or big box store).

Informants also described various ways in which employers could solve issues around retention and turnover. Academic programs and employers can set realistic expectations of workload and FTE. Employers also can create variety in shift schedules and increase support for continuing education and professional development opportunities. Some employers can also create opportunities to share staff between laboratories within the same organization to increase variety in tasks performed, help workers gain skills and vary their work environments, and reduce the potential for burnout. One informant noted that their organization had created career ladders within job titles as a way to improve retention, offering opportunities for advancement within those positions and clear guidelines on how to progress in careers within the laboratory environment.

PRACTICE AND POLICY ENVIRONMENT

Impacts of Practice Changes

Task Automation

For education programs, keeping up with workplace technological advances in their clinical training and simulation labs can be expensive. For example, informants noted that preparing students for careers that rely on increasing use of task automation is difficult and expensive because task automation equipment is so quickly outdated. Nevertheless, such training is important because performing some tests by hand may no longer be required in future positions. We heard from some informants that it may be more important to emphasize the theory of tests and lab processes to give students a basis to apply throughout their careers, given that technology will continue to evolve. This approach shifts more clinical training toward laboratory sites and reduces the emphasis at education institutions.

For employers, technological advances help labs meet increasing demands and testing volumes without expanding their workforce.

> *"Automation has played a significant role in efficiency, workflow and processing of testing on [samples]. It's increased capabilities."*

Some Informants indicated that automation has allowed the workforce to use more efficient processes, reducing the chance of error. They cited examples of how using robotics and other software to automate manual, repetitive processes and communicate test results to the laboratory information system can improve job satisfaction. There are opportunities for automation and technology to reduce the manual work, including paperwork, in laboratories.

> *"We can automate that task by creating a bot that would take information from a paper requisition and create a field and run the test."*

Insights (paraphrased and quoted) from key informants, by occupation:

Histotechnician/Histotechnologist:

- "When a slide is prepared, a pathologist has to physically review the slide to make a diagnosis. There's a push to create a digital pathology world where the slide is scanned and a diagnosis can be made from the scan. Histotechnicians will still prepare the slide to be scanned, [so] the automation there will be limited. In terms of quality control, from a teaching perspective it would be a different opportunity during teaching—we wouldn't need to be tied to the microscope while teaching."

MLS:

- Technologies such as task automation can allow MLSs to work at the top of their certification by eliminating more mundane parts of the job.

Point-of-Care Testing

Point-of-care testing refers to the "analysis of patient specimens outside the clinical laboratory, near or at the site of patient care, usually performed by clinical staff without laboratory training, although it also encompasses patient self-monitoring. It is able to provide a rapid result near the patient and which can be acted upon immediately."[31] Several informants representing academic programs reported that students are being trained—either through their programs or in clinical training settings—to use a variety of point-of-care testing equipment.

Employer informants described varying impacts of point of care testing. Histotechnicians and histotechnologists may not be directly affected by this technology. For other, more patient-facing occupations like phlebotomists or MLAs, there may be opportunities for increased efficiency in specimen collection and testing. Informants mentioned that point of care testing can generate concerns about the qualifications of the occupations conducting the tests. Informants noted that point of care testing may be used in a variety of settings to run a multitude of tests, and while these tests may be performed by other occupations, it is important to keep qualified clinical lab occupations involved to oversee quality assurance and quality control and make sure the point-of-care testing platforms are working properly. There are increased opportunities for the clinical laboratory workforce to work as point of care testing coordinators or in these quality assurance and control roles, working with non-laboratory professionals with their systems for test validation.

Use of Electronic Health Records (EHR) and Laboratory Information Systems (LIS)

Our informants noted that the use of EHR and LIS systems can help increase efficiency, accuracy, and transparency of testing processes and results. These systems can help further integrate or expose the laboratory to the full patient file and see how testing fits within the whole medical picture. Similar to point-of-care testing, there are opportunities for MLTs and MLS to be involved in and help build out LIS systems.

Insights (paraphrased and quoted) from key informants, by occupation:

Phlebotomists:

- Within blood and donor centers, the use of EHR systems is important and used in many settings. Where these systems are used, there is often a lack of communication between platforms. Integrating these systems can "create efficiencies in reducing clerical errors, while providing additional safety and quality measures."

Histotechnician/Histotechnologist:

- There are opportunities to integrate more digital pathology platforms (e.g., EHRs and LIS) and expand their use in current laboratory practices

Health System and Business Consolidation

Our informants noted that health system and business consolidation can take different forms and the impact to the clinical laboratory workforce depends on what is being consolidated and how. Informants representing academic programs noted that different areas of the lab that require specialization are being consolidated or merged. Some academic programs have adapted by encouraging students to move around within the lab during their clinical training to make sure that they are trained in all areas. Consolidation has also limited the number of available clinical sites for student training.

> *"We're concerned about the automation and consolidation of microbiology. Smaller facilities are closing their microbiology capabilities and outsourcing that. We're going to have to make up the difference in our coursework. We can do something that's close to a real clinical lab experience, but it's not the same thing."*

Some employer informants expressed concerns that consolidation could further blur the role between MLT and MLS as well as histotechnicians and histotechnologists. Consolidation can also create more jobs. For example, for phlebotomists and MLAs, larger medical offices or health systems with more locations can have more patient-facing specimen collection sites, even if their specialty or core laboratories have been consolidated.

Insurance Reimbursement

Informants noted the importance of the Promoting Access to Medicare Act of 2014 (PAMA) in setting reimbursement rates and laboratory menus (for the Medicare Part B clinical laboratory fee schedule) and its effects on the clinical laboratory workforce. In 2018, the fee schedule was based on data on fees collected from laboratories on private payer rates for clinical laboratory tests and test volumes.[32-33] Professional organizations have called this method of data collection and determining reimbursement rates for laboratory tests and its implementation flawed. Many educators, employers, and professional associations agree that Medicare reimbursement rates should be closely tied to private market rates, but such a small fraction of laboratories and tests were reported that the finalized numbers are not representative of actual test volumes or reimbursement rates.[34]

Due to PAMA's impact on reimbursement rates, many employers have considered or implemented centralization and consolidation in order to lower costs. As a result, PAMA was reported to have contributed to reduced testing services and reduced testing volume, which led to decreased staffing levels, increased layoffs, and increased turnaround times for tests, among others effects. Educators did not mention PAMA as having a tangible impact.

Concerns around insurance reimbursement rates also coincide with concerns about the effects of cost-cutting on the skills of the available clinical laboratory workforce. As one informant stated: "What I become concerned about is the quality of the work and the quality of outcomes for patients as we continue toward those who can process the specimen but don't understand the science or can't do that process manually."

FUTURE POLICIES, REGULATIONS, AND POTENTIAL SOLUTIONS TO STRENGTHEN THE CLINICAL LABORATORY WORKFORCE

Across occupations, informants advocated for greater visibility of the clinical laboratory workforce and the occupations comprising it. A policy solution put forth by informants from various backgrounds was to implement public awareness campaigns.

> *"There's a public perception that lab tests are performed by doctors and nurses, and not by those trained to perform those tests, regulatory components, and interpretation of those results. A better public perception of the field would help to bring in more students. We see biology or chemistry students with bachelor degree who come back to complete a program with us because their bachelor degree doesn't cover it."*

There was also acknowledgement from informants that the field has not made a concerted, more formal effort to recruit individuals from underrepresented and diverse communities for academic program enrollment and employment. Both of these efforts could be bolstered by the inclusion of clinical laboratory sciences and specialties into both federal and non-federal efforts related to Science, Technology, Engineering, and Math (STEM), which does not significantly fund health care careers at either the secondary or postsecondary levels. Additional investments are also needed to address the underlying equity issues (e.g., access to high-quality education, institutional racism) that serve as systemic barriers to achieving diversity. These efforts could increase visibility, awareness, and funding from a variety of sources to struggling academic programs and bring new interest and involvement in the field.

> *"In my opinion, a big reason behind that is a lack of federal funding for those programs as compared to other health professions—they're expensive programs to run with small class sizes, they're on the chopping block at universities under financial pressure because there's not the same level of support for those programs as there is for others. We're not going to have MLS if the programs don't stay open. They could use some funding."*

Education

Informants noted that educators and program directors increasingly need to be focused both on the outcomes of their students and the

viability of their programs. Clinical laboratory education programs can be expensive to run, given the cost of up-to-date equipment in labs that often can accommodate just a few students at a time. College administrators often point to the high per-student costs of clinical laboratory programs when deciding where to make funding cuts.

Some informants advocated for more public funding for community colleges as a whole, which in turn would support clinical laboratory programs.

> *"There's no reimbursement for those clinical sites to take on those students. There's no reimbursement for taking on those students, when you're stressed and understaffed it's hard to take on those students."*

Informants argued that increased and sustained funding for their education programs would allow them to take on more students. Increased program and institutional funding would also allow for program directors and faculty to invest more time and resources in recruitment by promoting their programs in their communities through activities, such as high school career fairs and promoting laboratory sciences in high school science classrooms. Some informants mentioned they would invest their time in recruitment efforts into middle schools as well.

Informants said changes in work environments and policies as well as regulations governing clinical laboratories, are increasing the need for workers with four-year degrees, such as histotechnologists or MLSs. This creates opportunities for academic institutions to create bridge programs between histotechnicians and technologists and MLTs and MLSs to upskill incumbent workers.

Informants also noted that increased collaboration in the clinical laboratory field, including stakeholders from education, employment, policy, and professional organizations, would benefit the workforce. One informant proposed regional boards or consortia to bring this diverse group of stakeholders together to work on diversifying and building a robust pipeline and workforce of laboratorians:

> *"I would try to do something on a regional level. There's regional differences. It'd be nice for consortium or collaboratives within a region that could work together to understand the workforce pipeline in education and employment, pull financial resources together to incentivize, fill vacancies. We're all trying to do this individually within our organizations, a regional approach would be more efficient and could propel the movement further."*

Employment and Practice

Higher visibility for the profession, informants noted, could improve collaboration between the laboratory and medical teams.

"The lab needs to be viewed as part of the larger hospital system. Programs need to be instituted to raise education and awareness of the value of the lab to the outcomes and impacts on patient welfare. There needs to be an appreciation for the contribution of the lab."

Other informants noted the potential of the new role of Doctor of Clinical Laboratory Science. This occupation could serve as a liaison between medical teams and laboratories, potentially integrating them into patient's medical decision-making processes.

Increased awareness and visibility would also contribute to efforts to raise or keep pay competitive for clinical laboratory workers. There are ongoing efforts by professional organizations and the workforce to make wages more competitive with other healthcare occupations requiring similar educational and experiential requirements. Informants also noted that unlike healthcare professions such as nursing, the majority of laboratory workers are not unionized. This can have an adverse impact on wages, working conditions, and benefits because there is not a collective effort by the workforce at large or regionally to address these issues.

Some federal legislation focused broadly on allied health occupations with clinical and medical laboratory components. The Allied Health Personnel Shortage Act focuses on student loan repayment programs for recent graduates from allied health programs.[34] Informants noted that loan repayment programs can help address the urban-rural distribution and recruitment problems facing laboratory employers.

There was some agreement among informants that updates to CLIA – the federal legislation that regulates laboratory testing, clinical laboratories, and personnel – regarding technological improvements, increased task automation, and point of care testing, need to be strengthened and refined within the regulation.

> *"I'll be blunt: the CLIA regulations don't align with what the best practice is in most facilities. Most facilities want ASCP certification, whereas CLIA doesn't have that requirement. The minimum requirements to perform testing are not sufficient. There needs to be major changes."*

Some respondents stated that CLIA regulations do not necessarily specify a level of education or expertise for laboratories running moderate- and high-complexity testing. Occupations such as histotechnicians and histotechnologists and MLTs and MLSs that are often grouped together with overlapping roles and duties, both under federal SOC codes and employers, are not distinct. Informants recommended updating CLIA to create clearer delineations between occupations and their roles and responsibilities. Improved visibility of these occupations among regulators and policy makers could trickle down into visibility for hospitals and other employers into the laboratory, potentially allowing for higher reimbursement rates for laboratory tests and translate into higher wages for laboratory personnel.

Focus Group Results

PARTICIPATION

A total of ten focus groups were conducted for this study (Tables and Figures are found in **Appendix B**). Four focus group types were developed based on their profession/role, **Table B1.** A summary of participants by focus group is shown in **Table B1.**

Demographic data indicated that approximately 40% (n=12) of participants were staff without supervisory responsibilities, 47% (n=14) were supervisors/managers, and 30% (n=9) were educators. Participants were located across the United States, **Figure B1.** By geographic area, 50% of participants work in urban areas, 29% in rural areas and 21% in urban clusters.[35]

Data on facilities that described the participant's current institution were also collected, **Figure B2.** When asked if they consider their work to be in an academic setting, 43% (n=13) indicated yes, while 43% (n=13) indicated no and 13% (n=4) were not sure. Further, almost 97% (n=29) of participants were ASCP certified laboratory professionals.

FOCUS GROUP OUTCOMES

Individuals who currently work as a laboratory professional or laboratory educator shared their knowledge and perceptions on the challenges their institutions experience with regards to employment and academic recruitment and retention, diversity and inclusion, the and COVID-19 pandemic. Segmented by professional/role group, the following sections also highlight strategies to address these challenges.

HISTOTECHNICIAN EMPLOYMENT RECRUITMENT AND RETENTION

As shown in **Table B1**, there were ten participants in the focus group for histotechnicians. Four were laboratory staff members, five were supervisors, and one was an educator.

Employment Recruitment

Challenges

The challenges for recruiting histotechnicians are shown in **Table B2.** Lack of qualified histotechnician applicants appears to be the most common issue managers face in the laboratory. There is a consensus among participants that certification, critical technical skills and years of experience are what they seek in an ideal histotechnician candidate. Often, supervisors encounter applicants who have *"…graduated and are certified and licensed, but they haven't had any experience in the past three or four years."*

The absence or presence of histotechnician training programs in the areas where participants currently work also affect the supply for histotechnicians. Those who reported that they have histotechnician training programs on-site have access to new graduates, while those who do not experience a rapid drain in their pipeline. Salary, an issue for all clinical laboratory professionals, has a unique dynamic for histotechnicians. Participants said most salaries are "all-inclusive", and do not compensate for specialized skills that these personnel utilize in their work. The relationship between geographical area and salaries was also discussed. One example given was that, rural area labs are not attractive to potential histotechnician applicants, while urban area lab salaries are not high enough to compensate for the high cost of living.

COMMON SENTIMENTS ON THE LACK OF AWARENESS OF THE HISTOTECHNICIAN PROFESSION:

"I feel like..people don't know what Histology is. It's kind of one of those fields where you really don't know about it until you fall into it or if you've been trained on the job..." (histotechnician supervisor)

"For recruitment, I think it's just that people don't know about us. It seems like a lot of the histotechs that I've worked with have fallen into the field and love it." (non-supervisory histotechnician)

Strategies

Table B3 shows the recruitment strategies that participants' institutions use to hire histotechnicians. The most common recruitment outreach and partnerships activities discussed were online job postings and partnering with laboratory training programs in the area. Some participants also indicated that they were recruited through networking with histology societies in their state. Comment analysis reveals that while partnering with training programs can provide access to recent graduates, even large institutions experience competition from other laboratories when hiring histotechnicians.

Participants say that sign-on bonuses are the primary financial incentive their institution offers candidates. Laboratories with unions offer higher salaries and better benefits, which can render them more them attractive to potential employees.

Employment Retention

Challenges

The most prevalent challenge in retaining histotechnicians was competition with other laboratories or institutions, (n=4, 40%), **Table B4**. Turnover can be high when employees leave their positions for other labs offering more flexibility in work scheduling or better pay, especially in high cost-of-living areas. One participant said, *"One thing that I've seen is you stay at your job for forever you're going to get like that 2 to 3% raise each year. And if you actually do the job hopping back and forth, you're going to make much more because you know you jump to someplace else and they're going to actually give you far more than 2 to 3% to move over…so it actually is beneficial for the employee to be bouncing back and forth."* Another factor was the lack of understanding from management, which underscored the disconnect and lack of synchronization between the laboratory department and human resources when budgeting for personnel. Geographic location and staff retirements were also factors. According to participants working in rural areas, histotechnicians trained in those areas oftentimes leave the region unless they have family ties there. Retirement also affected the field as many histotechnicians left the workforce in 2020 due to the pandemic. The resulting staff shortages from unfilled positions exacerbated the challenges of turnover as the remaining histotechnicians were overworked, experienced burnout, and sought employment elsewhere.

The second most common challenge in retaining histotechnicians was a lack of career pathway opportunities in laboratories, whether in the form of a promotion or extra training that would lead to advancement. Thus, the lack of career pathways in their institutions was a barrier to career advancement (n=4, 40%). Overlapping job descriptions posed a related challenge (n=3, 30%). Staff get the same pay regardless of the tasks they are performing or what degree they have. For example, those with higher-level skills/degrees, (e.g., bachelor's degrees) are not paid more than those with lower-level degrees (e.g., associate degrees), and less experience. Similarly, there was no pay distinction between histotechnicians who had entered the job via on-the-job training (OJT) versus those who had entered with a degree.

Lack of staff engagement was another problem that plagued the histotechnicians. According to the supervisors, incoming histotechnicians have expectations about their scope of work and role coming into the job, and when those expectations are not met, they lose enthusiasm about their job. As one supervisor said about this type of intellectual boredom: *"They get a little bit pigeon holed almost with us, where they might not get as much variety as they maybe*

thought that they were going to see when they first started" or *"… most of the students said they didn't have the diversity to use all of their skills. If they were in one department. It seemed like they were left in that department."* Encouraging the staff to pursue opportunities for professional development and rewarding new skills or techniques could help address this type of challenge.

Strategies

Strategies for employee retention identified by participants ranged from promoting positive workplace culture to offering solutions to address the lack of engagement histotechnicians experience in the laboratory, **Table B5.** Specific types of conditions or efforts that the participants described included having or being a manager that is fair and consistent and inviting individuals from the C-suite (high level executive positions within the hospital or non-hospital labs) to visit their laboratory to build awareness of the important role the laboratory plays in the health care system. Financial incentives also played a role in retention strategies for histotechnicians, 40% (n=4). In some cases, sign-on bonuses, one of the main incentives used to make positions more attractive, had stipulations that required staying in the position for certain number of years after being hired. Other examples included offering two raises per year and shift wage differentials. Participants whose institutions offer work schedule flexibility noted an increase in offering PRN (pro re nata or as needed) positions to accommodate employee schedule and laboratory vacancies. Some laboratories also provide flexible schedule to histotechnicians who are pursuing advanced degrees.

Related to the work environment, fostering employee engagement was another type of retention strategy that the participants described. Some of the histotechnician supervisors encouraged their staff to expand their career paths and become more engaged by helping them attend national conferences, create scientific posters, and travel to receive training on how to operate new laboratory instrumentations. One supervisor stated, *"I think that there are a group of employees who really like the setting where you do a lot of different things and you have some challenging cases. And it's just more interesting workload."*

The participants' discussion also focused on the overlap between increasing histotechnician engagement and having career pathways within the laboratory. For example, having defined career pathways/ ladders helped staff see what types of opportunities were available for advancing their career and what types of professional development could help them progress. At one participant's institution a clear career ladder was progressing from entry-level laboratory assistant → non-certified technician → certified technician → lead technician → supervisor → manager. According to the participants who were supervisors, both leadership and staff desire this opportunity. For the staff, defined career pathways helped illuminate the progression and advancement of skills and expertise. For the supervisors, pathways provide a structured, formal means for recognizing the staff's talents and helping them grow, thereby keeping them engaged with the job.

REASONS WHY CAREER PATHWAYS ARE ATTRACTIVE FOR HISTOTECHNICIANS:

"So the most success I've had is I've been able to hold on to my younger generation longest when they've had opportunities for growth, whether it's more responsibilities, a change in title like stepping stones has been the way I've been able to retain them the longest." (histotechnician supervisor)

"… something that I've heard a lot from the younger employees I worked with is [that by having a] specialized title…feels very important to them like… being the IHC tech." (histotechnician supervisor)

"And I have been fighting for…at least lead tech or, you know, senior tech, something like that because the positions here are just HTL and HT supervisor and, you know, for the people that have been here and they're excellent workers, I would love to be able to offer advancement opportunities." (histotechnician supervisor)

While the topic of career pathways was extensively discussed in the focus group, only one participant described having an explicit ladder such as the one from an entry-level assistant to a histotechnician manager. However, almost all participants indicated that their institutions had strategies for career advancement, as shown in **Table B6**. The participants whose institutions offered on-the-job training indicated that their training is done in-house and that there is no difference in pay scale or promotion opportunities between personnel who progressed via on-the-job training and personnel who came in to the position with a degree.

Participants whose institutions do not offer on-the-job training state the following reasons: licensure, institutional polices against on-the-job training, and facilities in partnership with laboratory training programs that prefer hiring their student graduates to providing on-the-job training to existing lower-level staff who might want to become histotechnicians. Some of the participants whose institutions did not offer on-the-job training and lacked access to local laboratory training programs suggest that they might have to implement on-the-job training in the future to overcome this challenge.

Support for histotechnicians pursuing or completing an academic degree or continuing education was provided in the form of tuition reimbursements or financial support, according to participants.

One institution focuses on employee retention and career pathways through - formal leadership program. Candidates are encouraged to apply to the program to gain leadership experience. Led by an education specialist, the program offers a range of activities for professional development including resume writing assistance, meeting with a panel of specialists and supervisors in Anatomic Pathology, and pairing participants with a leadership mentor (e.g., supervisors or operations manager).

MEDICAL LABORATORY ASSISTANT EMPLOYMENT RECRUITMENT AND RETENTION

As shown in **Table B1,** there were three focus group participants representing MLAs. One participant was laboratory staff, one was a supervisor/manager, and one was an educator.

Employment Recruitment

Challenges

According to participants, the most common challenge faced by MLAs is lack of clear hiring specifications (e.g. hiring MLAs from different educational backgrounds that may or may not be laboratory-related). One participant indicated that the Human Resources have a matrix for recruiting other types of laboratory professionals, but they do not have one for MLAs **Table B7.** Further, one lab supervisor expressed frustration in recruiting process because there is a substantial delay between the time the new MLAs are hired and when Human Resources says they can start working in the laboratory. Licensure, which is not required in all states, was also mentioned as a challenge. If a new hire comes from a non-licensure state, the hiring process is lengthened while the applicant completes the hiring process, **Table B7.** Lastly, participants indicated that pay for medical laboratory assistants pay is low and some, such as those working in high- cost urban areas, may need to commute from areas with lower costs of living, **Table B7**, which could make some job positions less attractive.

Strategies

Recruitment outreach/partnerships and financial incentives were the two most common recruitment strategies discussed by participants, **Table B8**. Examples of partnership activities included partnering with local laboratory training programs and recruiting at universities and high schools (to inform potential recruits of career opportunities). Types of career pathways shared by participants included providing support to those pursuing or completing an academic degree or CE and helping students map career ladders (4+1 = bachelor's degree + 1 year of science = MLS) that would position them to become medical laboratory assistants and provide institutions with a pipeline of prospective recruits.

Participants had also promoted successful recruitment by creating positive work environments/relationships and offering career pathways. One participant said that addressing specific issues relating to recruiting and hiring new personnel had helped foster a positive environment at his or her institution, **Table B9**. For example, the supervisor had cultivated a good working relationship with the human resources department and with outside recruitment agencies, which facilitated the process of hiring new staff. These positive relationships also helped with recruiting prospective job candidates as it promoted the institution's reputation as a good place to work. The institution also offered continuing education as a perk for prospective job candidates.

Employment Retention

Challenges

Top retention challenges by MLAs are listed in **Table B10.** Lack of benefits was the common concern from all participants in this group. Participants identified the lack of flexible schedules as the most pressing concern, as well as lack of retention bonuses and tuition reimbursement. MLAs who work night shifts but want to move to day shifts, or those who are pursuing academic degrees or continuing education are not usually offered a flexible schedule or given tuition reimbursement. Competition with other labs was another challenge. Medical laboratory assistants move to labs that offer better benefits. In one case, a rural lab offered acres of land as an incentive, **Table B10.** Labs have also lost medical laboratory assistants through retirement and the pandemic, **Table B10.** Said one participant, *"You know, for a really long time we kind of had this gap or we had a lot of people that were seasoned lab techs 30-40 years and a lot of them, for different reasons COVID, the computer systems… many of them have retired."*

Burnout also affects retention of MLAs. One participant informed the group that MLAs in her lab only stay for six to 12 months and then move on to a different job due to burnout, **Table B10.** Further, some felt that their labs do not appreciate the work that they do, from picking up shifts when needed to training new MLAs, **Table B10.**

Financial barriers discourage career advancement and the retention of MLAs. For staff who are pursuing advanced degrees, there were few scholarships or a lack of awareness of the few available scholarships. A rural location also created a barrier for career advancement as well as more work for trainers because incoming MLAs lacked experience. Another barrier to advancement was a lack of on-the-job training, especially in states that required licensure or institutions that opted to not offer on-the-job training.

Strategies

Top retention strategies for MLAs are listed in **Table B11.** According to participants, offering financial initiatives was the method most used by their institutions to retain MLAs, usually in the form of retention bonuses, annual pay raises and tuition incentives for full-time MLAs, **Table B11.**

Promoting positive workplace culture was also used as a retention strategy MLAs, **Table B11**, because participants stated that not only did a great workplace/work environment build their laboratory's reputation as an ideal place to work, but it also encouraged staff to stay in the department**.** Examples of specific initiatives were:

- a weekly "huddle" where supervisors meet with staff to talk and exchange feedback about work that week,
- staff bonuses for reaching "landmark" years of employment (working in the laboratory for a specific number of years), and
- sending company-wide congratulatory emails to staff reaching the landmark milestones.

Tuition reimbursements, opportunities to attend professional meetings and conferences, and adjusting shifts to accommodate those who attend school were some of the institutional tools used to support career pathways, **Table B11.**

A current initiative replicated from one laboratory institution to another gives staff opportunities to work with a team on project-based activities. Staff and supervisors are encouraged to participate and based on their level of engagement in their assigned teams, these opportunities can result in promotions for staff-level personnel.

According to participants, 67% (n=2), OJT is utilized by most of their employers as a recruitment tool. Many rural laboratories use OJT to recruit due to shortage of personnel and potential candidates. Some participants shared that institutions that do not offer advancement opportunities are looking into offering tiered MLA levels (e.g. non-technical laboratory assistants or technical laboratory assistants) in the future, 67% (n=2). One participant also discussed various supports for MLAs who want to advance through pursuing or completing an academic degree or continuing education. Benefits covered by the institution include offering pathways from phlebotomist to medical laboratory assistant, tuition reimbursements, scholarships (though few), and flexible work hours. For one licensure state, MLA classes are offered in high schools, so students graduate with MLA certification.

MEDICAL LABORATORY TECHNICIAN EMPLOYMENT RECRUITMENT AND RETENTION

There were nine participants in the focus group for MLTs, **Table B1**, over half of whom who supervisors/managers and/or educators.

Employment Recruitment

Challenges

While partnering with local technical colleges and offering internships, as described by one participant, was helpful for recruiting MLTs, recruiting in rural areas was a common challenge for over half of the participants (56%; n=5), **Table B12**. One reason is because the profession competes with higher-paying occupations outside the field, and staff who live in urban or suburban areas do not want to drive to rural areas to work for less pay.

Regarding MLT salary, participants talked about competition with hospitals offering better compensation packages. It was shared that while Human Resources believe their offer is comparable, participants do not think that the salary offer is competitive. As a consequence, demand is high for MLTs. Some participants reported that even with a nearby training program that provided a steady supply of graduates, they were still left with vacancies. Not being able to fill vacant positions was especially an issue in rural areas. It was not easy to replace retiring MLTs in rural areas, and hospital systems struggled to fill MLTpositions in small community clinics or hospitals. As these older workers near retirement, not being able to find people to replace them adds to the challenge.

Strategies

The most common strategy discussed to recruit MLTs is providing financial incentive in the form of sign-on bonuses, **Table B13.** Some sign-on bonuses were coupled with flexible schedule offering. There were also institutions that offer to pay for licensure fees, discounts on car/homeowners insurance and cellphones. In rural areas, participants worked with human resources to recruit in smaller towns but with increased pay. One benefit that was discussed was the federal student loan forgiveness programs. Participants suggested highlighting this existing program, as not many medical laboratory technicians know about it. Recruitment outreach and partnerships was the second most-discussed topic, **Table B13**, with participants sharing their strategies to recruit MLTs**.** Examples given were:

- laboratories working with their hospital institution on recruitment strategies,
- partnering with local hospitals and training programs to track MLAs and recruit them to be MLTs, and
- partnering with local technical colleges and offering internships that included short-term stints in lab departments in different hospitals (rural areas a challenge).

The group also discussed raising awareness of the MLT profession, **Table B13**, through the following activities:

- inviting high school students to shadow lab professionals, and
- participating in an established program for high school seniors from different minority groups to showcase the lab and introduce the students to the profession.

Some MLT participants shared established existing initiatives for recruitment at their institution. Examples ranged from financial incentives to outreach and partnerships:

- grow your own: hiring local students that want to come back to the area and work as a MLT (initiative found to have encouraging results),
- completion of education: MLTs already employed at their institution can participate in a program that pays for them to pursue an academic degree or continuing education, including time away from their job to finish their schooling. They must work at the institution when they graduate, and
- scholarship program (rural area): partner with local universities and tech schools to provide scholarships to students who would sign-on to work as a MLT for X years after they graduate.

Employment Retention

Challenges

Competition with other labs was one of two main topics of discussion for the MLT group, **Table B14.** According to participants, they lose MLTs to other institutions in the area that offer better benefits such as retirement matches or shift differentials. Salary was also a widely discussed issue. Concerns ranged from not being able to compete with non-academic

institution salaries to MLTs leaving the field to go to nursing school. One participant also said, *"And why did I ever get into this. I'm not making enough money. I think that's what the young people are saying. I think we might have a problem with younger people not staying in this profession."*

Another retention challenge is that the MLT population is getting older and close to retirement, **Table B14.** Participants' institutions cannot find people to replace them.

Strategies

Top retention strategies are listed in **Table B15.** The MLTs group participants shared a robust list of financial incentives their institutions offer to retain MLTs, including:

- retention bonuses after being in the laboratory for a one-year minimum,
- sign-on bonuses after staying in the laboratory for a year, with a suggestion to increase the retention bonus every year to address the issue where some personnel leave after receiving bonus,
- shift differentials after two years increased by $4/hour,
- employee referral bonus—between $2,000 and $5,000,
- education reimbursement based on length of time employed,
- employee fund for miscellaneous needs, and
- time-and-a-half incentive for those who sign up on night shifts for at least six months.

Flexible schedules were also a popular retention strategy, **Table B15**, especially among staff who were attending school. PRN and part-time is also gaining favor from MLTs because it helps with flexibility.

Career pathways was also an important topic for this group, **Table B16**. Some participants' institutions have partnered with community colleges to start an MLT program or offer higher education/leadership/specialty opportunities. One participant's institution developed an apprenticeship program. In this program, MLTs who apply are paired with a mentor to do a leadership project to, *"give them that perspective of what's going on behind the scenes in leadership and help them gain interest or even see if they want to go that route, as well as help us with succession planning."*

Top career pathways discussed by MLTs are listed in **Table B16.** Advancement opportunities were provided via a leadership academy or program where a medical laboratory technician can partner with a supervisor, manager or someone from a different area of the lab. According to the participant, this yearlong training/mentoring program worked out well. One established institutional initiative requires MLTs to develop and submit a project to the program committee. If accepted, they receive a higher designation and future promotion.

An important point discussed by participants was the need to promote a positive work culture. One participant talked about collecting MLT workforce feedback to strengthen recruitment strategies, **Table B16.** They reach out to universities and ask upcoming graduates what they are looking for in a laboratory employer so they can stay competitive. One supervisor said *"… there's lots of studies out there that suggest that if a new employee feels… immediately right off the bat that they have a friend and they really grow those relationships within that work field, that they tend to stay longer. So yes, we want them to be here long enough where they can build that relationship and really feel like they are part of that culture and that family and have those relationships built."*

While several strategies for career advancement were discussed, the primary barrier mentioned was the lack of career pathways. Lack of understanding from the administrative coordinator who is not a lab professional prevented the lab from having promotions for medical laboratory technicians.

PHLEBOTOMY EMPLOYMENT RECRUITMENT, RETENTION AND CAREER PATHWAYS

There were eight phlebotomists in this group who are currently working as either laboratory staff, supervisor/manager or educator.

Employment Recruitment

Challenges

Salary was the most discussed recruitment challenge in phlebotomy, **Table B17.** According to participants, offering a competitive salary can be a struggle for this field. Employers outside the field offer more money even for those without similar training and skills. Supervisors are also always looking for qualified phlebotomists, one participant said: *"Number one, a lot of people applying are simply medical assistants, who have done some phlebotomy. It's hard to find just a straight-up phlebotomist by trade. Some of them are jack of all trades but master of none."*

Rural areas encounter severe recruitment challenges. A participant from a rural location who worked in a hospital-based laboratory with fewer than 100 beds indicated that they are always short staffed that new phlebotomy training graduates use this degree as a stepping-stone to other healthcare careers. The lack of sign-on bonuses or retention bonuses discourages potential employees to pursue a career in phlebotomy.

Strategies

Table B18 shows the recruitment strategies used by the participants' institutions to hire phlebotomists. Offering competitive benefit packages, financial incentives like sign-on bonuses, and schedule flexibility have been effective tools in recruiting phlebotomists. One participant said that due to a high turnover rate in their lab, phlebotomy positions are kept open all year as part of their initiative to recruit.

Employment Retention

Challenges

Similar to recruitment challenges, salary is the most talked-about concern pertaining to retaining phlebotomists **Table B19.** According to participants, low salary is the major contributor to high turnover rates.

COMMON PARTICIPANT SENTIMENTS ON LOW SALARY FOR PHLEBOTOMISTS:

"it's a lot that you're doing and you're asked to do and a lot of people feel they're not being compensated enough for what they're doing." (non-supervisory phlebotomist)

"So, a lot of them will stay in phlebotomy for a year or two and then they'll go into nursing or they go into, you know, another area of the hospital. So there is a big turnover and I think salary has a lot to do with it." (phlebotomy supervisor and educator)

"...Overall for the actual profession, it's way low for you know, what they do. And I think a lot of us tend to move on into something." (non-supervisory phlebotomist)

Lack of recognition also affects phlebotomists' retention rates, **Table B19**. Those who spoke about this topic agree that phlebotomists experience frustration due to the lack of respect from nurses or the laboratory they work in, even though their role in patient care as "first responders" is vital. Another common discussion topic was the lack of understanding from management when it comes to filling phlebotomy vacancies, **Table B19**. Phlebotomy supervisors continue to struggle with their institution hiring certified nursing assistants or nursing students to perform a phlebotomist's tasks. Participants felt that this practice would more likely provide poor quality specimens, which can result in incorrect test results and negatively impact patient care. Yet there was a disconnect with the institution's perspective. According to one participant, *"So they acknowledge that there is a skill needed, they acknowledge that there is a shortage, but they're not willing to look at paying more at least at this point. And yet, unfortunately they scratch their heads wondering why there's such a shortage."*

The lack of bonuses and schedule flexibility also affects retention of phlebotomists, according to (38%; n=3) of participants. Increased workload and extra tasks (such as administrative work) caused burnout and has driven phlebotomists to leave their positions as well, **Table B19.** Competition with other laboratories and institutions as well as a lack of defined career pathways are also, **Table B19.**

The lack of any career pathway is a significant barrier to career advancement, 38% (n=3), specifically due to the absence of phlebotomist tiers that allow for increased income. Supervisors stated:

- "…we feel like this is an area where we're pretty limited…We don't have a distinction for phlebotomy…".
- "We really don't. Unfortunately, I think a lot of it is they see this as people are going to leave anyway, so they just kind of embrace the revolving door."

One participant mentioned that financial barriers caused phlebotomists to move between facilities ("flip-flop") to earn more. Location in a rural area is also a barrier, 13% (n=1).

Strategies

For the majority of participants, flexible schedules are a strategy to retain phlebotomists, **Table B20.** Examples include allowing phlebotomists to choose their types and days of schedule or accommodating schedules for those pursuing an academic degree or continuing education. Financial incentives discussed included offering bonuses for those willing to pick up four extra hours after their shift and retention bonuses. Promoting positive workplace culture is also an important consideration for potential workers considering employment options. The majority of participants who weighed in on this topic discussed the benefits of morale-boosting activities, getting along with colleagues, and having a supportive manager.

ASPECTS OF POSITIVE WORKPLACE CULTURE IN THE LABORATORY HIGHLIGHTED BY THE PARTICIPANTS:

One participant opted to do a 30-minute longer drive to work because, "…the culture in the one hospital just was really difficult to deal with versus what I had heard was a really good culture and a really good manager, a really good lab director and it made all the difference in the world. It makes such a difference to have a lab where people work together. They're a team, they support each other." (non-supervisory medical laboratory technician)

"I can speak for my department. I think we have a really great dynamic. Everyone seems to get along and respect one another." (non-supervisory medical laboratory technician)

Career pathways towards higher income that participants said contribute to phlebotomist retention included the presence of phlebotomy tier levels, certification, and accommodations for those pursuing higher academic degree or continuing education. Advancement opportunities was the topic most discussed by this group on the subject of career pathways, **Table B21.** Those whose institutions offer advancement opportunities offered examples: phlebotomy position tiers (PBT 1-3), each with different qualifications; advancing from being medical laboratory assistant to phlebotomist in some institutions; and traveling as a phlebotomist to patient's homes, especially elderly patients in rural areas.

Support for phlebotomists in pursuit of an academic degree included tuition reimbursement, according to participants. As for offering on-the-job training, only a small number of participants (25%; n=2) mentioned having this in their institution. Those that did not have on-the-job trainings said that they prefer to hire certified phlebotomists.

Some participants shared existing institutional initiatives to boost career advancement, 38% (n=3). Examples included:

- leadership Institute offering internal support and resources for phlebotomists, and
- institutional pairings with community colleges for academic degrees or certifications that is discounted for phlebotomists.

ACADEMIC RECRUITMENT IN LABORATORY TRAINING PROGRAMS – CHALLENGES AND STRATEGIES

Challenges

The challenges facing academic recruitment are lack of training programs, minimal visibility, lack of students to recruit, lack of resources/awareness of resources, lack of rotation spots, and issues related to geographic location (e.g. rural).

Histotechnician. Participants both from urban and rural locations echo the same sentiment: that the lack of training programs affects their histotechnician pipeline, 60% (n=6). They also emphasized the need for more training programs at universities and community colleges. In addition, participants indicate that they encounter issues with visibility—"people are just not aware" of the profession, 20% and there is not a large enough pool of students to recruit in their area, 10%.

Medical Laboratory Assistant (MLA). Geographic location affects the recruitment of MLAs, especially in rural areas, 67% (n=2). Concern was raised that some rural areas lack laboratory training programs, 33% (n=1), or that existing rural training programs lack enough training slots to meet demand. Together the two training challenges adversely affect the ability of local labs to secure enough lab personnel.

- Approximately 67% (n=2) of participants shared that visibility was also a challenge in recruiting MLA students. University admissions counselors do not know much about the profession and MLAs often heard about the profession through acquaintances or family. One participant said, "*I didn't know that it was a reliable field to go into… or necessarily even know that existed. And I think that's one of the main barriers around here and maybe potentially everywhere else that a lot of people don't even know that our profession exists.*"
- Lack of scholarship resources for students was also discussed as an issue, 67% (n=2). For the most part, sources of some scholarships for MLAs (and other lab professionals) are located in the NAACLS website.[36] Competition for the few scholarships that are offered is high.

Medical Laboratory Technician (MLT). Lack of resources, especially in rural areas and lack of awareness of resources was the challenge most discussed by the MLT group, 22% (n=2). Two resources they lack but strongly need are staff-time to help recruit and building awareness of the scholarships and tuition aid, especially to non-traditional students. Program closures and reduced enrollment affect current and future shortage, 11% (n=1) and there are not enough students to recruit, 11% (n=1), according to participants.

Phlebotomist. The only academic recruitment challenge discussed was the lack of training programs or some programs offering only one course per year, which affects the supply of phlebotomists in some areas of the country, 13% (n=1).

Strategies

The majority of session participants indicated that they have strategies that reach out to elementary school, middle school, high school and post-secondary students/adults across the country, examples are listed in **Table B22.**

They also shared how they raised awareness of their program through outreach activities, promoting visibility and in a few cases, offering financial support for students.

Histotechnician. 40% (n=4) suggested and discussed raising awareness through recruitment activities listed in **Table B22**. There was also a suggestion of "growing your own" to avoid high turnover in labs once students finish the training program.

Medical Laboratory Assistant (MLA). 67% (n=2) suggested and discussed raising awareness through recruitment activities listed in **Table B22**.

Medical Laboratory Technician (MLT). 56% (n=5) discussed raising awareness through making connections outside the field (for example, establishing connections with teachers to allow them to introduce the field to their students), colleges creating virtual immersion programs about what the lab does, medical laboratory technicians attending and presenting at community seminars to talk about lab science, and medical laboratory technicians featured in a local news story about the lab, especially targeting minority groups or underrepresented groups.

- Some MLT programs offered students, especially from underrepresented groups, free housing and a $2000 loan (forgiven if they stay and work in the area for two years) so they can continue in the MLT program, health care scholarships to local students, food stipend and rides, 56% (n=5).

Phlebotomist. 13% (n=1) participants suggested and discussed raising awareness through recruitment activities listed in **Table B22**. One educator also indicated that "ringing accolades" for their phlebotomists is another way they raise awareness.

DIVERSITY AND INCLUSION IN THE FIELD OF LABORATORY MEDICINE

Employment in the Laboratory

Histotechnician. Approximately 40% (n=4) of histotechnician focus group participants indicated that they lack awareness of efforts by their institutions to recruit from underrepresented groups/populations to fill vacancies in their labs. Further, 40% (n=4) reported that their institutions lack targeted strategies in recruiting underrepresented groups for histotechnician positions. Those whose institutions had diversity and inclusion initiatives for recruitment indicated that their institution as a whole provides support from leadership on how to be strategic about recruiting a diverse workforce. One participant's institution offers H1B visas.

- Participants who talked about retention and diversity of employees in their institutions said they are now encouraged to put more focus on diversity and inclusion through open conversations, employee resource groups, diversity training and creation of task forces, 20% (n=2). Example of existing diversity and inclusion initiatives for retention include mentorship programs that pair high-level leaders with employees from underrepresented populations. For this group, geographic location plays a role in the diversification of their laboratories. Those from urban settings mentioned that they are "diverse by default," having an area that is non-homogenous.

Medical Laboratory Assistant (MLA). The majority of MLA participants who discussed diversity and inclusion in their employment recruitment, 67% (n=2), revealed that because their locations and the populations are diverse to begin with, the laboratory in turn is diverse. They are exposed to a variety of communities and populations from which to recruit. One participant said that her institution already had a workforce diversity team and is looking to have more within their team to discuss how to recruit a more diverse workforce.

Medical Laboratory Technician (MLT). The majority of MLT participants who discussed diversity and inclusion in their employment recruitment, 33% (n=3) and retention, 22% (n=2), shared that grants to attend school and financial assistance for obtaining licensure/certification are offered to recruit MLTs from underrepresented groups.

Phlebotomist. Only 13% (n=1) of phlebotomy participants weighed in on diversity in employment recruitment and they stated that they lack awareness of any strategies their institutions utilize to recruit from underrepresented groups/populations.

Academic Laboratory Training Programs

Histotechnician. The majority of histotechnician participants who discussed efforts to recruit a diverse histotechnician student body reported that they lack awareness of existing initiatives in their institution, 20% (n=2). Those from urban settings also mentioned that they are "diverse by default," having an area that is non-homogenous, 20% (n=2).

Medical Laboratory Assistant (MLA). Outreach to underrepresented community populations was discussed by 67% (n=2). An established program for academic recruitment/community outreach was shared in which underrepresented or underprivileged high school students tour the lab and engage in hands-on activities. The program was popular but whether it encouraged students to enter the pipeline haven't been measured. Partnering with STEM programs to recruit students from underrepresented groups was also discussed.

- Scholarships and grants were also discussed, 33% (n=1). According to participants, scholarships are hard to find for MLAs in general and and students from underrepresented minority groups in particular. One suggested the field develop a national clearinghouse of scholarships for lab professionals. Other suggestions included coaching diversity and inclusion students on applying for scholarships and completing applications, as well as looking into various communities who already offer scholarships for underrepresented students (example given: Hispanic organizations).

Medical Laboratory Technician (MLT). Only 11% (n=1) of participants discussed strategies to promote diversity and inclusion. Other participants focused on the lack of strategies: institutions that do not use social media or other media platforms to recruit individuals from underrepresented groups or market in a variety of languages in diverse areas. Lack of resources such as housing and childcare are also barriers to diversifying programs.

- Strategies, 56% (n=5), utilized by institutions to recruit include providing free housing, and using a preferred language in reaching out to the community about the laboratory profession, e.g., Spanish when recruiting from the Hispanic community.

Phlebotomist. Approximately 25% (n=2) of participants discussed strategies for a diverse academic recruitment, identifying outreach activities to underrepresented groups and granting scholarships as the most common activities. One example given was an institution serving Native American tribes and recruits in this community's high schools, although outcomes have not been measured.

PREPARING A RESILIENT CLINICAL LABORATORY WORKFORCE FOR THE FUTURE

When asked about suggestions on how to create a resilient clinical laboratory professional workforce, one common theme prevailed: creating a supportive environment for laboratory professionals, **Table B23.** Because the future of the profession relies on the next generation entering the field, increased focus on the generational differences in laboratories might provide insight on how to effectively recruit and retain younger laboratory staff to replace the legions who are about to retire, **Table B23.** Lastly, participants call for the educational institutions/programs and laboratories to come together to align with the needs of the lab professional, **Table B23.**

When asked about the driving forces for any changes over time (including past/present or present/emerging) within the profession, participants shared the potential need for OJT, especially due to lack of training programs and higher vacancies, licensure requirements for work, and encouraging staff engagement. So what skills, credentials and roles did participants think will be in highest demand within the clinical lab professions in the future? Two topics dominated the discussion: the need for soft-skills and technical skills/credentials, **Table B24.** Better communication skills, resilience and leadership are soft skills many of the participants thought would highly contribute to a successful laboratory career. Educational requirements to become a qualified laboratory professional is key. Lastly, critical thinking skills, especially in using automated machines and troubleshooting, are valuable technical skills for the laboratory personnel of the future, **Table B24.**

Response to COVID-19

The COVID-19 pandemic forced many in the clinical laboratory workforce into the spotlight. The workforce has been on the frontlines through its involvement in developing and implementing new tests and procedures and performing greatly increased test volumes with rapid turnaround demands. As a result, the increased workload and pressure likely contributes to burnout among the workforce. At the same time, some laboratories experienced furloughs when elective medical procedures were stopped or reduced. Work environments have changed for many. Instead of working close together on the bench, occupations have had to adjust their procedures to accommodate social distancing. Academic programs also experienced closures at the beginning of the pandemic and have had to be flexible in creating opportunities for their students to continue their education.

KEY INFORMANT INTERVIEWS

Response by Educators

In the spring and early summer of 2020, many academic programs stopped in-person classes and training due to concerns around COVID-19 and challenges in maintaining adherence to safety and hygiene protocols. Many programs previously offered in-person adapted by changing to online or hybrid classes. Programs already operating on a hybrid model found making the necessary changes easier. Academic programs also had to contend with clinical site closures at the beginning of the pandemic. Students had to be shifted between clinical sites that were open.

Academic programs for clinical laboratory education made many modifications to in-person education in response to the pandemic. In addition to reducing class sizes, increasing hygiene practices, and using hybrid or all-distance education, on-campus programs also had to incorporate the turnaround time for student COVID testing. Phlebotomy programs, whose students must have direct patient contact to complete their training, had a harder time adjusting. Informants described how some phlebotomy programs staged student cohorts to use on-campus facilities on separate days to allow for thorough cleaning, and some added in as much non-human alternatives as possible (e.g., practicing needle insertions with fruit) and use of family members for practice, to compensate for reduced access to on-site clinical training. Looking to the future, informants expressed interest in continuing hybrid models of education.

Response by Employers and Professional Organizations

When hospitals reduced or eliminated elective procedures in the spring of 2020, clinical laboratories responded differently across the country. According to informants, laboratories that provide a large proportion of their testing for elective procedures experienced a sharp decrease in testing volumes, and many furloughed or reduced the hours of their workforce. Laboratories that became involved in COVID testing increased personnel or redeployed personnel from other areas of the lab to improve turnaround times. The workforce in these labs may have also experienced burnout and stress due to increasing test volumes and the workload of developing and implementing processes for new types of test (e.g., molecular and serology COVID tests). At the beginning of the pandemic, COVID tests required new processes and equipment that incumbent workers had to learn very quickly, although informants were confident that the workforce has since adjusted to demand and new test procedures. Informants were also concerned about returning to pre-pandemic workloads while also keeping up with testing demands due to the pandemic. In some cases, labs were not able to redeploy personnel from other areas of the lab to run COVID testing. COVID-19 polymerase chain reaction (PCR) and serology tests are typically run by MLSs. Because the pandemic has amplified the need for an increased supply of MLS graduates to fill these roles, employers have increasingly turned to those with a bachelor of biological sciences to fill these positions.

The COVID-19 pandemic has contributed to concerns around turnover and retention. While the clinical laboratory workforce does not frequently interact with the general patient population (with the exception of phlebotomists), clinical laboratories are often set up in ways that make social distancing among workers difficult. Anecdotes from our informants indicate workplace safety concerns among clinical lab workers have affected that workforce just as they have for other health care occupations. Employers of phlebotomists who interface with the public have heard concerns about safety, and some phlebotomists left the for positions in other industries with similar wages and lower health risks. Safety protocols and worker concerns led some laboratories to decrease the number of individuals working each shift to allow for adequate social distancing. This was cited as a complication to existing concerns about workload and burnout as potentially fewer people may be working in the lab just as the test volume has greatly increased

Employers and laboratories experienced personal protective equipment shortages in the beginning of the pandemic, but now have developed stable supplies and protocols to ensure that all personnel have adequate personal protective equipment.

Informants highlighted the importance of cross-training and expanding the use of digital resources to better prepare the workforce for crisis situations in the future. Cross-training could be incorporated into organizational disaster preparedness and pandemic plans. Cross-training would also allow personnel from different specialties to work together and collaborate, counteracting the tendency for laboratories to be siloed by specialty. The pandemic has also offered opportunities for more digital pathology and at-home specimen collection and testing, potentially easing burnout and stress on the workforce by increasing efficiency and decreasing volumes.

FOCUS GROUPS

COVID-19 in the laboratory was discussed by the focus group participants. (Tables can be found in **Appendix C**)

COVID-19 Related Challenges and Strategies and Perceptions about the Laboratory During the COVID-19 Pandemic – Histotechnicians

In many ways the COVID-19 pandemic has exacerbated several of the recruitment- and retention-related challenges facing histotechnicians, especially staffing and workload. It has also sparked strategies for addressing both short- and longer-term challenges.

Challenges

As shown in **Table C1**, staffing was the most common challenge that the participants identified, although a couple of the participants (n=2, 20%) reported not having any staffing issues. The majority of the participants who discussed furloughs and hiring freezes during the pandemic said that they were voluntary furloughs and that the hiring freezes were already being lifted at the time of the focus group (September 2020), **Table C1**. High turnovers affected histotechnician contractors while others left due to underlying health concerns. Some were also redeployed in COVID-19 labs, **Table C1.** The 20% (n=2) who indicated increased workload stated that they are now back to pre-COVID-19 numbers as far as frozen sections but with fewer staff.

Strategies

Two of the participants (n=2, 20%) discussed actions taken by their institutions to assist the histotechnicians working during this unprecedented time. Examples included providing child care, offering flexibility in terms of hiring, scheduling, and/or role, and being transparent in all communications related to the pandemic.

Perceptions about the lab and laboratory professionals

One area of discussion around the implications of the COVID-19 pandemic was public awareness of the role of laboratory personnel. For histotechnicians this issue was particularly salient as a lack of visibility of the profession was one of the top three challenges in recruiting histotechnicians (**Table B2**). When asked whether the pandemic brought increased visibility to the profession, participants had mixed views. The majority of the participants (n=6, 60%) expressed frustration with the public's view that the laboratory is a *"homogenous group of people and doing the same thing."* The three educators who said that the laboratory had indeed increased in visibility, (n=3, 30%) explained that they were starting to receive more applications for training programs, with the other participants hopeful that this trend would increase interest in the profession.

When asked about the long-term implications of COVID-19 in the lab, one participant indicated that they are aware that there will be implications in how they interview, socially distance, develop new safety precautions and think about lab operations. Currently, their administration hasn't begun to develop new protocols.

COVID-19 Related Challenges and Strategies and Perceptions about the Laboratory During the COVID-19 Pandemic – MLA

As with the other laboratory roles, the pandemic affected staffing, workload, and work-life balance of many MLAs.

Challenges

Furloughs, lack of resources, redeployment, and salary were discussed by all participants as the challenges they faced during the pandemic, **Table C2.** For example, due to a lack of staff resources, MLAs were pulled off the bench to process COVID-19 samples and take extra shifts without receiving a shift differential. One participant also noted that some staff left the field due to a fear of catching the disease.

The work-life balance of MLAs was also, as they experienced burnout and caregiving challenges. All participants experienced increased workload from covering colleagues, taking up extra shifts and students taking up useful functions such as stocking tubes and making controls and reagents. The increased number of tests placed a heavy burden on the MLAs in laboratories running with less staff. Some managers come in early to catch up for the day, while others work 60-70 hours per week. For parents and caregivers, closed schools added to the overall stress. One supervisor said:

> *"Our lab teams are very dedicated they're going to do what needs to be done. And that's the only thing it is keeping a lot of this going…, but you can only do that for so long before you face burnout."*

Strategies

Participants discussed a number of ways to address these types of challenges, with schedule and role flexibility being the main strategy to assist the MLAs, 67% (n=2). Two institutions gave staff a voluntary furlough option, while other institutions offered the choice between a 10% pay cut or extra shifts in the main laboratory to avoid being furloughed. In one short-staffed laboratory, one MLA student said that after being taught how to set up control reagents, she was asked to do that task and perform daily maintenance in the laboratory while everyone tried to catch up on COVID-19 related work. One participant also reported that hospitals had partnered with daycare facilities to provide care for their employees' children.

Transparency and communication also assisted the MLAs in at least one of the institutions. Supervisors were transparent about furloughs and gave the staff information in advance. Some supervisors made sure that their colleagues were feeling supported through weekly newsletters and open conversations.

Perceptions about the lab and laboratory professionals

When asked whether the pandemic brought increased visibility to the profession, 100% of participants agreed. The spotlight on the lab gave MLAs the opportunity to ask for their laboratory needs and administration granted them without much resistance. Some indicated that they are gaining more recognition from people outside the field who are asking more about the profession or interested in joining. MLAs are excited about being recognized for performing the COVID-19 tests. One participant suggested the field take advantage of the spotlight to*:*

> *"…beef up our efforts to take this interest and turn it into lab techs and I think it will…it may be the way to fill the gap of some of the baby boomer lab techs that are going to retire…".*

COVID-19 Related Challenges and Strategies and Perceptions about the Laboratory During the COVID-19 Pandemic – MLTs

The COVID-19 pandemic has exacerbated the challenges that the workforce was already facing, particularly around staffing of MLTs.

Challenges

Almost all of the participants reported that staff departure was the biggest challenge during the pandemic, **Table C3.** Regular positions and temp positions, such as travel techs, were reduced in response to the reduction in lab referrals attributable to the pandemic. Supervisors were concerned that they might not be able to recruit these MLTs back. Some retired early and others left temporarily during the height of the pandemic. The lack of resources discussed by this group centered on vacancies and lab supplies, **Table C3.** Participants were already having MLT shortages pre-COVID and with more MLTs retiring during the pandemic, the vacancies are not being filled. Some also mentioned that department funding is not sufficient for supplies needed.

Strategies

To address staffing and workload-related issues, one participant indicated that their laboratory built another molecular laboratory site near their facility at the time of the pandemic and hired 10 to 15 laboratory professionals. This addition helped with the testing volume and workload.

Perceptions about the lab and laboratory professionals

When asked whether the pandemic brought increased visibility to the profession, two-thirds of participants agree that it has. Some examples of the positive outcomes of increased visibility provided by participants were:

- Shared video on the lab profession released by a national television channel
- Spotlight on the lab to improve communications between laboratory professionals and physicians
- C-suite and Executive Board wanting to visit the labs
- Institutions giving lab professionals recognition awards while working during the pandemic for their important contributions.

Some suggested laboratory professionals use this visibility to attract talented people to come into the field. One participant said while the pandemic made the laboratory profession more visible, she doesn't know if it is always in a positive light.

When asked about the long-term implications of COVID-19 in the lab, a third of the participants indicated that the staffing shortage that existed pre-COVID will persist post-COVID. One participant said,

> *"I can only see it being the same or more because the original problem has not been solved. There's still not enough lab personnel out there to fill the positions that need field."*

Virtual meetings (Webex, Zoom, Skype) were an opportunity for MLTs who cannot usually attend in-person meetings or education and they hope that this platform continues.

COVID-19 Related Challenges and Strategies and Perceptions about the Laboratory During the COVID-19 Pandemic – Phlebotomists

The pandemic affected staffing, workload and work-life balance of many phlebotomists. As first responders during the pandemic, this group faced many challenges.

Challenges

For phlebotomists, the most common staffing challenge faced during the pandemic was staff departure, **Table C4.** Reasons for departure include: health concerns, salary cuts (according to one participant, their colleagues went to work for Amazon for higher pay with benefits), and early retirement. Those who spoke about furloughs indicated that they were voluntary. The majority of individuals who discussed hiring freezes in their institution said that recruitment was largely scaled back and start dates for new hires were postponed, with some eventually losing their position before they could even start.

Workload significantly increased for phlebotomists as well. Participants noted that labs went back to full capacity in the summer and they were left with *"half the workforce but all of the workload"* because not all staff had returned to work at that time.

Strategies

Most common strategies utilized by the participants' institutions to assist phlebotomists are hiring flexibility and schedule/role flexibility. One mentioned that their institution had COVID-19 incentive for phlebotomists by offering a $25 bonus for any phlebotomists that was willing to pick up a four-hour time slot in addition to the regular hours.

Examples of schedule/role flexibility offered:

- Paid time off (PTO)
- Opportunities to leave early
- One week on – one week off type of work schedule

Perceptions about the lab and laboratory professionals

When asked whether the pandemic brought increased visibility to the profession, participants had mixed views. Almost two-thirds of phlebotomists felt that while it put a spotlight on the laboratory, it did not significantly raise the value of what they do in the public's perception. One participant summed up the group's thoughts by saying,

> *"I think it put the spotlight on lab, but I don't know that was fairly in a positive light. Nor do I know that was necessarily related to appreciation or what we represent."*

Others just indicated that they do not think the pandemic changed the visibility of the field.

COVID-19 -Related Academic Challenges and Strategies and Perceptions about the Laboratory During the COVID-19 Pandemic

Challenges

Lack of clinical rotations and recruitment challenged lab training directors from all four session types during the pandemic, **Table C5.**

- **Histotechnician:** Histotechnician session participants reported that many of their students missed out on their clinical rotations or had difficulties finding an institution to do an externship with. Some also indicated that they had a hard time signing up new students.
- **MLA:** Two-thirds of MLA participants indicated the pandemic affected the availability of rotation sites. Many externship sites didn't want students due to COVID-19, some turned down students, weeks before they started rotations and students did not receive enough hands-on experience at this time. A third of participants indicated that recruitment was also halted.
- **MLT:** Lack of clinical rotations was the only challenge discussed by the majority of participants. For example, students encountered limitations in getting into different areas of the lab while other clinical sites stopped taking students during the pandemic. For those opening up sites for students, the number of spots and hours continue to be limited.
- **Phlebotomist:** Lack of clinical rotations and recruitment challenges delayed the start of programs.

Strategies

Strategies to assist students during the COVID-19 pandemic are listed in **Table C6.**

Long-term Implications of COVID-19

- **Histotechnician:** Training moved entirely virtual for students. Program director plans to have virtual option even after the pandemic.
- **MLA:** Restructure program format in the future to qualify for graduation, as highlighted by the pandemic.
- **MLT:** Hopes to have virtual trainings post-COVID.
- **Phlebotomist:** None was discussed from the phlebotomist group.

Discussions and Next Steps

There is evidence that laboratory workforce shortages will likely increase in the near future due to increased demand for laboratory services, diminished education and training opportunities, and barriers to recruiting and retaining clinical laboratory workers. Results from interviews and focus groups conducted by this study strongly emphasized that meeting future workforce needs will require actions by, and collaboration among, education and training programs, employers, and professional organizations. Through review of background information and direct contact with informants in the field, this study provides insights about areas of opportunity to enhance both the clinical laboratory academic and employment environments, and their influence on the workforce.

This study identified areas where there are opportunities to improve recognition of the clinical laboratory workforce and enhance careers in the field. If implemented, actions in these areas will likely contribute to increases in the availability of clinical laboratory workforce supply and strengthen the pathways into and among these careers long into the future.

IMPROVE THE VISIBILITY OF CLINICAL LABORATORY OCCUPATIONS

A lack of awareness about clinical laboratory careers—a workforce that is almost invisible to anyone who is not already working in healthcare—constrains the pipeline of potential new entrants to careers in clinical laboratory occupations. Key informants and focus group participants for this study suggested ways to increase the visibility of these occupations, especially among younger age groups. Prioritizing education and training programs, which are often underfunded or at risk of being eliminated, would also help achieve this goal, informants said. And the study found that lack of consistency in the use of occupation titles and associated roles contributes to the difficulty of promoting these jobs and encouraging careers in the clinical laboratory field.

Identify Opportunities to Encourage Interest in Clinical Laboratory Career Education and Training

Poor visibility of clinical laboratory occupations is a barrier that was identified as impacting the recruitment of students. Limited training options coupled with lack of visibility of this field was described as contributing to the lack of students, including histotechnicians and medical laboratory assistants (**Table B22**). Informants to this study suggested areas where taking specific actions could address these barriers.

- Expose students younger than high school to clinical laboratory professions. While there is a robust list of activities for high school and post-secondary/adult students, only a few are provided for elementary and middle school students. Specific activities and program content geared toward elementary and middle school students are needed, which could be accomplished through partnerships between academic training programs and laboratories.
- Provide free tuition, stipends or scholarships to potential students to attend formal educational programs. These recruitment tools may also help laboratories "grow their own" professionals who may be more likely to stay in their community after entering a clinical laboratory occupation. While programs to expose young people to laboratory careers through campus visits, career fairs and partnerships with hospitals are common, providing additional incentives for participation was suggested to be effective.
- Offer incentives to lab employees who volunteer or perform community outreach, such as attending recruitment and awareness-building activities for the profession. This suggestion from study participants was seen as a way to increase access to these activities.
- Investigate program models such as the Avera Academy and Build Dakota Scholarship that leverage funding partnerships to create education and training opportunities in fields including clinical laboratory sciences.

> *"Go to career fairs, go to the high schools and middle schools, meet with classes, share with them what medical laboratory science is. The hospital is really working with some of our local schools to do sort of a health care fair, where a member of all of our different specialties came to the high school and they can walk around in booth and learn what each of our departments does."*

Promote Visibility of the Clinical Laboratory Occupations on Campuses and in Professional Groups

Enhancing the visibility of clinical laboratory occupations within professional networks and on college campuses can support recruitment to the field, study participants said. Some study participants described the benefits of conducting outreach and nurturing partnerships among relevant education, employer, and professional organizations. Informants suggested:

- Promote awareness by networking with educational, employer and professional clubs and societies.

Support Education Programs and Clinical Training

The limited, and in some cases declining, number of laboratory education programs is also a significant barrier to supporting the pipeline of new laboratory workers. Regardless of geographic area (urban or rural), many laboratory training programs across the U.S. struggle for adequate funding, especially those in community and technical colleges where budget cuts frequently threaten programs that have comparatively expensive clinical training components. To safeguard and potentially increase program funding, study informants recommended that the importance of careers in the clinical laboratory field be more broadly communicated and emphasized to the education community. Employer partners are instrumental in making the case for clinical laboratory education, as well as to provide clinical training opportunities at laboratory sites in conjunction with education programs. Informants suggested:

- Encourage employer engagement with community and technical colleges (and other relevant education/training programs) to provide clinical training sites and employment resources for students in clinical laboratory programs. Employer engagement enhances the visibility, of and advocacy for, these programs.

Promote Consistent Use of Occupation Titles and Roles

As described in detail in this report, the clinical laboratory workforce is composed of multiple occupations, requiring a wide range of different education and training pathways, and there are many opportunities to achieve specialized roles within some of these occupations. To the uninitiated, navigating the titles used for these occupations and roles is confusing, and the confusion is exacerbated by uses of different titles in federal data sources, by different regulatory agencies, by state licensing and credentialing regulations, and within the field's accreditation and credentialing bodies. Greater consistency and clarity of titles and roles could help achieve the goal of increasing visibility of these occupations and help in communicating opportunities for professional growth and career pathways in the field. Informants suggested:

- Review and recommend changes to policies and regulations affecting the delineations of titles and roles of clinical laboratory occupations in order to promote clear and consistent use of terminology. A position paper by the ASCLS and the ASCP BOC recommends identifying and adopting a standardized credential and title (medical laboratory scientist) for those with baccalaureate level education and training in the medical laboratory sciences.[24] Identifying ways to promote these recommendations, and identifying other areas where standardization of clinical laboratory titles and adoption of a standardized educational program titles is needed, would likely benefit the field.

ASCLS and ASCP BOC Position Paper "Standardizing the Professional Title of Medical Laboratory Professionals"

"…[O]ur professional credentials, how we refer to ourselves, how others refer to us, and the job/position titles for similarly educated individuals are not consistent. We refer to ourselves as Medical Technologists or Clinical Laboratory Scientists or Medical Laboratory Scientists, depending on degree program, certification, or job title. Job titles often do not reflect current professional credential designations. Some facilities use Medical Technologist while others have adopted the current professional credential designation of Medical Laboratory Scientist. Individuals use casual, non-professional terms such as 'med tech', 'lab tech', or 'tech' in referring to laboratory professionals. Unlike physicians, nurses, physical therapists, or other health care professionals, we have not adopted a single identity/title that in turn denotes us as a recognizable profession. These factors contribute to a crisis in our professional identity not only within, but also external to the medical laboratory profession. Our name is important. Adopting a unified term is one step toward controlling our professional destiny. If we don't refer to ourselves in a consistent, recognizable, professional manner, how can we expect the public and other health care professionals to regard us as a single profession, to acknowledge our professional identity, and to recognize the fundamental part we play in the health care team?"

IMPROVE WORKFORCE RECRUITMENT AND RETENTION

While each occupational role investigated by this study shares similar challenges in employment recruitment and retention, they differ in the type of challenge that affects them the most. For example, when recruiting histotechnicians, focus group participants described the lack of qualified applicants as a major barrier; for medical laboratory assistants, lack of clear hiring specifications was most frequently mentioned; for medical laboratory technicians, geographic location (specifically rural areas) posed the greatest barrier, and for phlebotomists, not having a competitive salary hindered recruitment and retention. Salary was cited as a recruitment challenge across occupations, although phlebotomists, who typically receive the lowest salaries in the field, are most affected by this issue. The link between academic recruitment and employment recruitment was highlighted by study informants as an important factor in connecting students to jobs. Shortages of clinical training opportunities, however, limits that recruitment route. When available, an on-site or in-state laboratory training program can provide a steady pathway into jobs, but increased demand for some laboratory personnel (e.g., medical laboratory technicians) can exceed the available clinical training positions. In addition, increased clarity and visibility of these occupations and their roles will help recruitment into the field. Many approaches to improve clinical laboratory recruitment and retention surfaced through input from informants for this study.

Encourage Professional Development and Job Satisfaction

Ensuring salaries and benefits are competitive with other employers and commensurate with the skills and roles required of a position were frequently cited as a critical incentive for initial and ongoing employment. Informants suggested:

- Provide financial incentives to encourage employment recruitment and retention. This was the most common recruitment strategy identified by focus group participants. To ensure that positions are competitive with other laboratories and institutions, as well as jobs outside laboratory employment, employers should consider factors such as schedule flexibility, benefits, regular pay increases, tuition incentives, and sign-on bonuses.
- Provide opportunities for career progression (upward mobility), such as implementing tier levels for phlebotomist employment. Increases in pay and elevated titles can be an effective tool in recruiting and retaining a satisfied workforce.
- Support roles that encourage professionals to work at the top of their highest skill level that is within their scope of practice, such as through increased use of automation and robotics to minimize repetitive, manual processes.

Examine Opportunities for On-the-Job Training

Where reduced numbers of training programs are impacting the pipeline for clinical laboratory professionals, increased on-the-job training may be a way to address demand. Some employers may prefer to offer on-the-job training because employees recruited in this way require less on-boarding upon full employment because of their familiarity with the role and the organization's systems. On-the-job training may also be preferred by individuals seeking ways to minimize education costs or earn income while in training. Among factors to consider that could affect workplace cohesion and employee satisfaction are the extent of differences in pay and promotion opportunities between employees trained on the job and laboratory employees with degrees. Informants suggested:

- Examine where investment in on-the-job training can counteract the decline in training programs and/or can help to recruit employees seeking ways to reduce education costs or earn income while in training.

FOCUS ON DIVERSITY AND INCLUSION IN THE LABORATORY

Ensuring diversity and inclusion across the health workforce is an important contributing factor to achieving health equity in the US. Findings from informants highlighted a need to promote diversity and inclusion as well as to raise awareness of the benefits at all points along the career pathway for laboratory professionals.

Promote Diversity in Academic Recruitment

Diversity among students in the laboratory professions was not identified by key informants or focus groups as a critical concern though there was a general awareness of the importance of having diversity in the field. Secondary data on new entrants into the laboratory professions support the general feeling among key informants and focus group participants that the field is already relatively diverse. Often the diversity of the student body was noted as being reflective of a program's surrounding community. Focus group participants often described their program as being in the early stages of thinking around strategic recruitment to ensure diversity of the study body. Among the activities identified by this study as area for improving promotion of diversity across academic programs:

- Align program-level recruitment efforts with institution-level efforts around diversity and inclusion as well as partner with STEM programs to recruit students from underrepresented groups.
- Develop a clearinghouse—one place to access scholarships for lab professionals across the country.
- Use social media or other media platforms to their full potential when recruiting individuals from underrepresented groups.
- Improve data collection to better understand underlying factors related to equity that contribute to the current state of diversity among students in the laboratory professions. For example, according to IPEDS data, Hispanics have experienced growth in representation across the professions, particularly among clinical laboratory assistants where Hispanics are nearly two-thirds of the new entrants, while Blacks/African Americans have experienced a decline, or remained relatively stable, across professions over time. Understanding the reasons behind the rapid growth of Hispanics in some occupations but not others and to prevent further decline in the representation of Blacks/African Americans among laboratory professions warrants further investigation.
- Recruit more men, given that women represent approximately 75% or more of the new entrants across the laboratory professions.

Encourage Employer Efforts to Increase Workforce Diversity

Laboratory professionals are more diverse with higher representation of Blacks/African Americans and Hispanics than the general population based on secondary data. Diversity in the field does not seem to be related to proactive actions by employers given the scant evidence on diversity-related programs or initiatives identified by this study. Two of the four focus group session types, histotechnician and phlebotomist, indicated that they either lack awareness of efforts by their institutions to recruit laboratory employees from underrepresented groups/populations or their institutions lack targeted strategies to do so. Clinical laboratories that are diverse described themselves as "diverse by default"—common in urban areas or rural areas with a diverse community (e.g., Spanish and Native American communities). Current recruitment activities are only in the discussion phase—in the form of diversity workgroups or leadership meetings, where laboratories are starting to recognize the need to develop strategic plans to reach out to underrepresented communities. Potential activities that may help expand recruitment efforts and strengthen retention programs to promote diversity in the laboratory include:

- Identify structural barriers and solutions that may affect equitable access to employment in the laboratory professions and hamper any efforts by employers to achieving diversity.
- Develop employment recruitment strategies and actionable items (and move beyond discussion).
- Expand mentorship and diversity training programs to retain laboratory staff from underrepresented groups.
- Amplify promising efforts to ensure a diverse workforce into the future.
- Articulate and measure the benefits of having a diverse workforce on outcomes such as productivity, innovation, and patient outcomes.

LESSONS LEARNED FROM THE COVID-19 PANDEMIC

Laboratory training programs were impacted by the pandemic primarily through difficulties finding clinical rotations for students, which affected the fulfilment of degree requirements for those close to graduation. The main strategy utilized by program directors was having virtual classes/trainings for their students. When asked about long-term implications of COVID-19 on laboratory training programs, participants reported that they will either continue or expand their virtual learning capacity after the pandemic. Many are reassessing their programs to either change the number of rotations required for graduation, or to make more lectures virtual, which could encourage potential students from areas without a training program to enroll.

The pandemic had a significant effect on staffing, workload, and work-life balance of many laboratory professionals. Although much of the early concerns around having sufficient PPE and safety protocols has been resolved, social distancing remains a problem. Staffing affected histotechnicians and medical laboratory assistants mainly through furloughs, while medical laboratory technicians and phlebotomists experience staff departures mainly due to health concerns and early retirement. All four groups reported experiencing workload increase because of short-staffing, taking on extra shifts, and increased number of COVID-19 related tests in addition to pre-COVID testing volumes returning. The pandemic heightened awareness and urgency about the need to address staffing challenges that laboratories have long experienced, as well as identifying strategies to address work-life balance challenges and burnout among laboratory professionals.

Among the strategies identified to support staffing during the pandemic and in the future were to increase cross-training opportunities across laboratory professions and expand the use of digital resources. Focus group results show that to alleviate the burden caused by the pandemic on laboratory professionals, institutions from the four groups studied mainly offered hiring flexibility and schedule/role flexibility. Voluntary furloughs, hiring more lab professionals to work at testing sites and making sure that staff has opportunities to take time off were also among the potential solutions.

When asked whether the pandemic brought increased visibility to the profession, the histotechnician and phlebotomist groups had mixed views. While they are happy that the lab is gaining more prominence, they feel that the role that each worker plays in the lab remains unclear to the public. For the medical laboratory assistant and medical laboratory technician groups, the pandemic has brought favorable views of the profession, including more recognition from administration, more recognition outside the field, and increased interest in laboratory careers. These results suggest that there is an opportunity to leverage the spotlight on the lab to cultivate the future of the laboratory profession as a whole as well as the individual specialties.

Conclusion

This study provides a comprehensive examination of six laboratory professions including areas of commonality and differences in the challenges that they face in education, recruitment, and retention. A common challenge is the lack of understanding about the roles of specific occupations, which in turn affects the visibility of the specific occupations. A concerted effort by the field to outline the multiple career pathways in the laboratory professions would prevent students from missing these career opportunities. In addition, purposeful recruitment by both educational institutions and employers is necessary to ensure diversity and inclusion in the field. Educational institutions and employers also need to work together to ensure that students are meeting the evolving needs of employers. Throughout this study, results reflect one participant's statement, "one-size-fits-all approach might not be the solution" to the challenges faced by laboratory professions. This study revealed that some issues are unique to each occupational role studied and will require targeted solutions. The COVID pandemic has increased the urgency of ensuring a robust and flexible laboratory workforce to meet growing patient demand. Building on this evidence is the need to coordinate efforts with a clearly articulated path forward that involves partnerships across stakeholders to address the needs of the field and ensure that patients get high quality care.

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AMERICAN SOCIETY FOR CLINICAL PATHOLOGY

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CENTER FOR HEALTH WORKFORCE STUDIES AT THE UNIVERSITY OF WASHINGTON

The **University of Washington Center for Health Workforce Studies** (UW CHWS) conducts research to elevate the importance of workers in the delivery of health care in policy discussion. UW CHWS was established in 1998 with funding from the federal Health Resources and Services Administration (HRSA). It is based in the Research Section of the Department of Family Medicine, part of the University of Washington School of Medicine. For more information: **familymedicine.uw.edu/chws**

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APPENDIX A:
Findings from Secondary Analysis of Education Diversity Data

We analyzed data on student completions from academic programs using Integrated Postsecondary Education System (IPEDS) to estimate the number of students completing certificate and degree-granting institutions across laboratory occupations as well as data on their sex, race, and ethnicity over the four most recent academic years. Participation in IPEDS is required for postsecondary institutions that apply to or receive federal funding for student financial aid programs authorized under Title IV of the Higher Education Act of 1965 (For more, see: https://nces.ed.gov/ipeds/use-the-data). IPEDS may not represent the full picture of new entrants into the workforce as several occupations can gain the necessary skills through on-the-job training or the programs are too short to qualify for federal financial aid and thus not reported in IPEDS. These limitations mainly apply to phlebotomists and clinical/medical laboratory assistants. Data on student age was not available at the program-level on IPEDS.

Completions at the program-level were compared across race/ethnicity categories, with race and ethnicity being mutually exclusive and including IPEDS' categorization of residence status (i.e., "Hispanic or Latino" or "American Indian or Alaskan Native," "Asian," "Black or African American," "Native Hawaiian or Other Pacific Islander," "White," "Non-U.S. Residents (International)," "Race/Ethnicity Unknown," and/or "Two or more races"). All known and unknown race/ethnicity categories include U.S. citizens, resident aliens, and other eligible non-citizens. Nonresident aliens are reported separately as "Non-U.S. Resident", a category mutually exclusive of other racial/ethnic categories.

Table A2. Composition of education cohort completions by race and ethnicity and program type, 2016-19

		2016		2017		2018		2019	
Program	**Race/Ethnicity**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**
Phlebotomy	American Indian or Alaska Native	0.9%	79	0.9%	77	1.0%	78	0.9%	76
	Asian	5.2%	433	4.8%	407	4.7%	383	5.0%	401
	Black or African American	17.8%	1,488	18.9%	1,597	14.2%	1,156	15.0%	1,207
	Native Hawaiian or Other Pacific Islander	0.3%	22	0.2%	16	0.3%	28	0.3%	26
	Two or More Races	2.5%	213	2.8%	234	3.2%	260	3.3%	269
	White	49.0%	4,106	50.3%	4,260	50.0%	4,070	47.7%	3,830
	Hispanic or Latino	18.4%	1,538	17.6%	1,488	21.3%	1,735	22.6%	1,817
	Unknown	4.8%	404	3.6%	309	4.1%	333	3.8%	305
	Nonresident	1.1%	95	1.0%	84	1.1%	93	1.2%	100
Clinical Laboratory Assistant	American Indian or Alaska Native	0.4%	2	0.3%	2	0.6%	5	0.1%	1
	Asian	3.4%	19	4.8%	34	3.6%	30	2.5%	20
	Black or African American	17.8%	98	12.6%	89	10.9%	90	8.7%	70
	Native Hawaiian or Other Pacific Islander	0.4%	2	0.4%	3	0.2%	2	0.4%	3
	Two or More Races	1.1%	6	1.6%	11	1.0%	8	1.5%	12
	White	41.1%	227	31.1%	219	26.8%	221	19.9%	160
	Hispanic or Latino	31.5%	174	44.3%	312	53.5%	442	62.9%	505
	Unknown	3.8%	21	4.7%	33	2.4%	20	3.5%	28
	Nonresident	0.5%	3	0.1%	1	1.0%	8	0.5%	4
Histotechnician	American Indian or Alaska Native	0.4%	1	0.0%	0	0.8%	2	0.0%	0
	Asian	4.9%	13	5.4%	12	7.3%	19	5.2%	13
	Black or African American	12.4%	33	13.6%	30	8.5%	22	12.7%	32
	Native Hawaiian or Other Pacific Islander	0.7%	2	0.0%	0	0.0%	0	0.0%	0
	Two or More Races	5.2%	14	3.2%	7	3.8%	10	2.8%	7
	White	59.9%	160	55.7%	123	58.5%	152	58.7%	148
	Hispanic or Latino	11.6%	31	19.9%	44	18.1%	47	14.7%	37
	Unknown	4.5%	12	1.4%	3	2.3%	6	5.6%	14
	Nonresident	0.4%	1	0.9%	2	0.8%	2	0.4%	1
Histotechnologist	American Indian or Alaska Native	0.0%	0	0.7%	1	0.8%	1	0.0%	0
	Asian	11.8%	13	12.9%	18	6.7%	8	9.8%	11
	Black or African American	18.2%	20	7.9%	11	9.2%	11	12.5%	14
	Native Hawaiian or Other Pacific Islander	0.0%	0	0.0%	0	0.8%	1	0.0%	0
	Two or More Races	2.7%	3	1.4%	2	5.0%	6	2.7%	3
	White	43.6%	48	64.7%	90	53.3%	64	48.2%	54
	Hispanic or Latino	19.1%	21	11.5%	16	21.7%	26	21.4%	24
	Unknown	2.7%	3	0.7%	1	1.7%	2	2.7%	3
	Nonresident	1.8%	2	0.0%	0	0.8%	1	2.7%	3
Medical Laboratory Technician	American Indian or Alaska Native	1.0%	45	1.0%	40	1.1%	45	1.2%	50
	Asian	6.3%	274	7.0%	285	7.7%	310	8.0%	329
	Black or African American	12.7%	554	12.2%	499	11.5%	465	12.2%	505
	Native Hawaiian or Other Pacific Islander	0.3%	12	0.1%	3	0.3%	12	0.4%	18
	Two or More Races	1.7%	75	2.5%	100	2.6%	104	2.5%	105
	White	54.7%	2,387	51.7%	2,108	53.4%	2,154	54.5%	2,256
	Hispanic or Latino	12.7%	554	12.3%	501	14.0%	564	13.3%	551
	Unknown	9.7%	422	12.3%	503	8.5%	344	6.6%	275
	Nonresident	1.0%	42	1.0%	39	0.9%	35	1.2%	48
Medical Laboratory Science	American Indian or Alaska Native	0.3%	11	0.4%	13	0.2%	9	0.5%	18
	Asian	12.9%	472	12.4%	454	12.7%	465	14.0%	511
	Black or African American	10.1%	371	9.6%	353	9.2%	339	8.4%	308
	Native Hawaiian or Other Pacific Islander	0.2%	7	0.3%	10	0.2%	8	0.2%	6
	Two or More Races	2.5%	90	2.7%	98	2.5%	93	2.7%	100
	White	55.3%	2,026	55.1%	2,019	55.5%	2,034	53.3%	1,952
	Hispanic or Latino	12.5%	459	12.7%	465	13.2%	483	13.7%	503
	Unknown	2.7%	98	2.9%	106	2.9%	105	3.5%	129
	Nonresident	3.6%	132	3.9%	143	3.5%	129	3.7%	136

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.

Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways. In IPEDS, the "Hispanic or Latino" category is mutually exclusive of other racial/ethnic categories. All known and unknown race/ethnicity categories include US citizens, resident aliens, and other eligible non-citizens. Nonresident aliens are reported separately as "Non-US Resident."

Table A3. Composition of education program cohort completions by gender and program type, 2016-19

		2016		2017		2018		2019	
		%	n	%	n	%	n	%	n
Phlebotomy	Men	11.7%	976	11.6%	984	11.5%	937	11.2%	897
	Women	88.4%	7,402	88.4%	7,488	88.48	7,199	88.8%	7,134
Clinical Laboratory Assistant	Men	14.3%	79	20.2%	142	19.7%	163	14.6%	117
	Women	85.7%	473	79.8%	562	80.3%	663	85.4%	686
Histotechnician	Men	20.6%	55	24.4%	54	18.1%	47	17.1%	43
	Women	79.4%	212	75.6%	167	81.9%	213	82.9%	209
Histotechnologist	Men	30.9%	34	24.5%	34	19.2%	23	21.4%	24
	Women	69.1%	76	75.5%	105	80.8%	97	78.6%	88
Medical Laboratory Technician	Men	26.2%	1,142	27.2%	1,110	25.6%	1,034	23.5%	972
	Women	73.8%	3,223	72.8%	2,968	74.4%	2,999	76.5%	3,165
Medical Laboratory Science	Men	28.2%	1,034	28.2%	1,034	25.9%	949	26.0%	952
	Women	71.8%	2,632	71.8%	2,627	74.1%	2,716	74.0%	2,711

Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), 2015-16 to 2018-19, Institutional Comparison. Retrieved December 11, 2020 from https://nces.ed.gov/ipeds/use-the-data.

Note: IPEDS may not capture all program offerings and completions. Some academic programs may not qualify for federal financial aid, nor does it capture individuals who enter these professions through alternative pathways.

APPENDIX B:

Results from the Focus Group Sessions among Histotechnicians, Medical Laboratory Assistants, Medical Laboratory Technicians, and Phlebotomists

DEMOGRAPHICS

Figure B1. Regions and states in which participants currently work

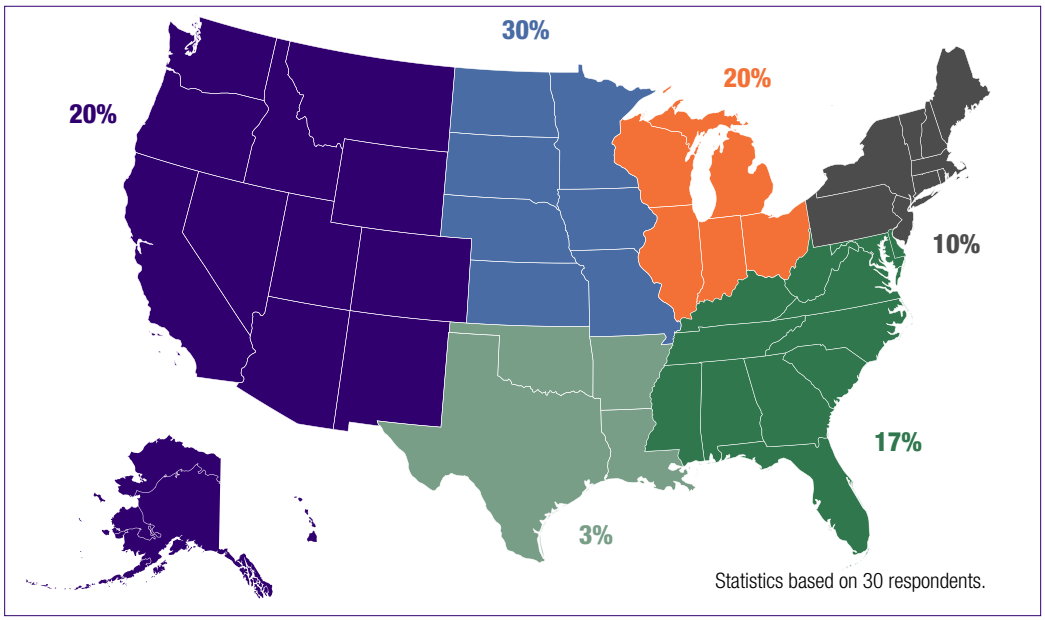
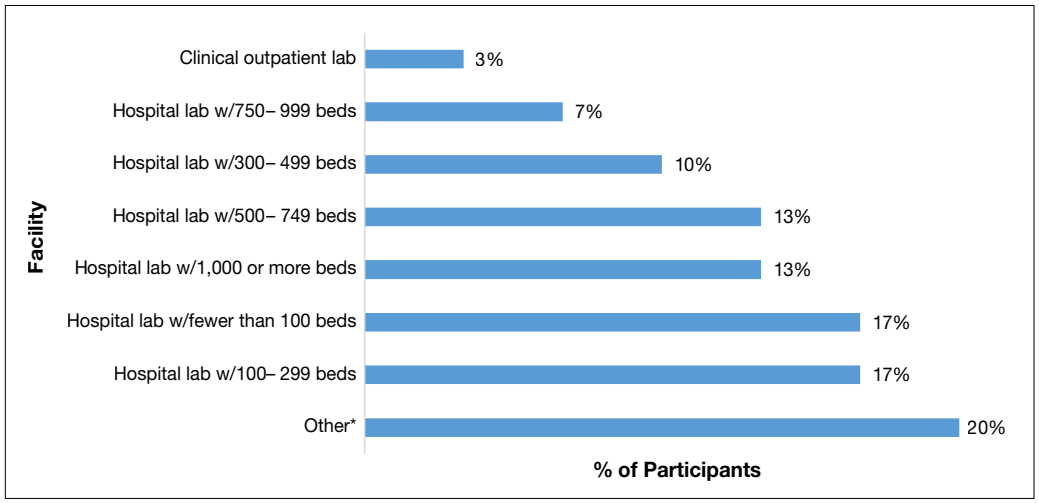


Figure B2. Focus group participants by the type of facility where they currently work



* Other included Quality Assurance and Educational Consultant to multiple facilities, community college, University, reference laboratory, and multiple locations

Table B1. Number of participants by occupational level and educator role

Focus Group Type	Staff (N,%)	Supervisor (N,%)	Educator (N,%)	Total No.
Histotechnician (HT)	4 (40%)	5 (50%)	1 (10%)	10
Medical Laboratory Technician (MLT)	3 (33%)	5 (56%)	5 (56%)	9
Phlebotomist (PBT)	4 (50%)	3 (38%)	2 (25%)	8
Medical Laboratory Assistant (MLA)	1 (33%)	1 (33%)	1 (33%)	3

Note: Occupational Level and Educator Role overlapped for some participants.

HISTOTECHNICIANS

Table B2. Challenges in recruiting histotechnicians (HT)

Challenges	No. and % of 10 HT Participants
Lack of qualified laboratory professionals	6 (60%)
Competitive recruitment due to demand (between institutions and across states)	4 (40%)
Salary	3 (30%)
Visibility of the field	3 (30%)
Benefits	2 (20%)
Geographic location	2 (20%)
Rural area	1 (10%)
High cost of living	1 (10%)

Note: Participants responded to more than one category

Table B3. Strategies used to recruit histotechnicians (HT)

Strategies	No. and % of 10 HT Participants
Recruitment outreach and partnerships	4 (40%)
Online job postings	2 (20%)
Partnering with training programs	1 (10%)
Financial incentives	3 (30%)
Competitive benefits packages	2 (20%)

Note: Participants responded to more than one category

Table B4. Challenges in retaining histotechnicians (HT)

Challenges	No. and % of 10 HT Participants
Competition with other laboratories/ institutions	4 (40%)
Lack of career pathways	3 (30%)
Burnout	2 (20%)
Lack of engagement	2(20%)
Lack of understanding from management	2(20%)
Salary	2(20%)
Retirement	1(10%)
Rural area	1(10%)

Note: Participants responded to more than one category

Table B5. Strategies used to retain histotechnicians (HT)

Strategies	No. and % of 10 HT Participants
Promote positive workplace culture	6 (60%)
Offer financial incentives	4 (40%)
Offer flexible schedule	4 (40%)
Career pathways	3 (30%)
Solutions to address lack of engagement	3 (30%)

Note: Participants responded to more than one category

Table B6. Career pathways oppportunities for histotechnicians (HT)

Strategies	No. and % of 10 HT Participants
Support pursuit or completion of an academic degree/ certification or continuing education (CE)	4 (40%)
Career advancement opportunities	3 (30%)
Established institutional Initiatives	2 (20%)
Promotions	2 (20%)

Note: Participants responded to more than one category

MEDICAL LABORATORY ASSISTANTS

Table B7. Challenges in recruiting medical laboratory assistants (MLA)

Challenges	No. and % of 3 MLA Participants
Lack of clear hiring specifications	3 (100%)
Licensure	2 (67%)
Salary	2 (67%)

Note: Participants responded to more than one category

Table B8. Strategies used to recruit medical laboratory assistants (MLA)

Strategies	No. and % of 3 MLA Participants
Recruitment outreach and partnership	1 (33%)
Partner with training programs	1 (33%)
Financial Incentives	1 (33%)

Note: Participants responded to more than one category

Table B9. Existing activities/strategies to create positive environment/relationships for recruiting medical laboratory assistants (MLA)

Challenges	Strategies on creating positive environment/relationships
Communication issues with training new hires/temps	Create rigorous and clear training plan with training modules that was used to help develop new competency. Exit interviews with temps revealed that they've been impressed with the training and how they felt like they were able to be set up to be successful.
Hiring and recruitment issues	Develop good relationship with HR department and recruiter/temp agencies – outcomes reveal ease of recruiting and hiring new staff

Note: Participants responded to more than one category

Table B10. Challenges in retaining medical laboratory Issistants (MLA)

Challenges	No. and % of 3 MLA Participants
Lack of benefits*	3 (100%)
Competition with other laboratories/institutions	2 (67%)
Retirement	2 (67%)
Salary	2 (67%)
Burnout	1 (33%)
Lack of recognition	1 (33%)
Lack of understanding from management	1 (33%)
Workload	1 (33%)

Note: Participants responded to more than one category
*For this study, the lack of benefits identified include e.g. tuition reimbursement, sign-on bonuses, and lack of flexible schedules.

Table B11. Strategies used to retain medical laboratory assistants (MLA)

Strategies	No. and % of 3 MLA Participants
Offer financial incentives	3 (100%)
Promote positive workplace culture	2 (67%)
Institutional initiatives	2 (67%)
Existing programs	1 (33%)
Career pathways	1 (33%)
Offer flexible schedule	1 (33%)

Note: Participants responded to more than one category

MEDICAL LABORATORY TECHNICIANS

Table B12. Challenges in recruiting medical laboratory technicians (MLT)

Challenges	No. and % of 9 MLT Participants
Geographic location	5 (56%)
Rural area	5 (56%)
Salary	4 (44%)
Competitive recruitment due to demand (between institutions and states)	2 (22%)
Lack of qualified laboratory professionals	1 (11%)

Note: Participants responded to more than one category

Table B13. Strategies used to recruit medical laboratory technicians (MLT)

Strategies	No. and % of 9 MLT Participants
Financial incentives	4 (44%)
Recruitment outreach and partnerships	3 (33%)
Partnering with training programs	3 (33%)
Competitive benefits packages	2 (22%)
Raise awareness of the profession	2 (22%)

Note: Participants responded to more than one category

Table B14. Challenges in retaining medical laboratory technicians (MLT)

Challenges	No. and % of 9 MLT Participants
Competition with other laboratories/ institutions	3 (33%)
Salary	3 (33%)
Retirement	2 (22%)
Lack of career pathway	1 (11%)
Lack of recognition	1(11%)
Rural area	1(11%)

Note: Participants responded to more than one category

Table B15. Strategies used to retain medical laboratory technicians (MLT)

Strategies	No. and % of 9 MLT Participants
Offer financial incentives	6 (67%)
Offer flexible schedule	4 (44%)
Career pathways	3 (33%)
Promote positive workplace culture	2 (22%)
MLT workforce feedback	1 (11%)

Note: Participants responded to more than one category

Table B16. Career pathways opportunities for medical laboratory technicians (MLT)

Strategies	No. and % of 9 MLT Participants
Support pursuit or completion of an academic degree/ certification or continuing education (CE)	2 (22%)
Established institutional initiatives	2 (22%)
Career advancement opportunities	1 (11%)
Promotions	1 (11%)
Mentoring opportunities	1 (11%)

Note: Participants responded to more than one category

PHLEBOTOMISTS

Table B17. Challenges in recruiting phlebotomists (PBT)

Challenges	No. and % of 8 PBT Participants
Salary	3 (38%)
Lack of qualified laboratory professionals	2 (25%)
Benefits	1 (13%)
Geographic location	1(13%)
Rural area	1(13%)

Note: Participants responded to more than one category

Table B18. Strategies used to recruit phlebotomists (PBT)

Strategies	No. and % of 8 PBT Participants
Competitive benefits packages	2 (25%)
Financial incentives	2 (25%)
Recruitment outreach and partnerships	1 (12%)
Partnering with training programs	1 (12%)

Note: Participants responded to more than one category

Table B19. Challenges in retaining phlebotomists (PBT)

Challenges	No. and % of 8 PBT Participants
Salary	5 (63%)
Lack of recognition	4 (50%)
Lack of understanding from management	4 (50%)
Lack of benefits*	3 (38%)
Workload	3 (38%)
Burnout	3 (38%)
Negative work environment	1 (13%)
Competition with other laboratories/institutions	1 (13%)
Lack of career pathways	1 (13%)

Note: Participants responded to more than one category
*For this study, the lack of benefits identified include e.g. tuition reimbursement, sign-on bonuses, and lack of flexible schedules.

Table B20. Strategies used to retain phlebotomists (PBT)

Strategies	No. and % of 8 PBT Participants
Offer flexible schedule	5 (63%)
Offer financial incentives	4 (50%)
Promote positive workplace culture	4 (50%)
Institutional initiatives	3 (38%)
Existing programs	3 (38%)
Career pathways	2 (25%)
Employee feedback	2 (25%)

Note: Participants responded to more than one category

Table B21. Career pathways opportunities for phlebotomists (PBT)

Strategies	No. and % of 8 PBT Participants
Career advancement opportunities	6 (75%)
Support pursuit or completion of an academic degree/ certification or continuing education (CE)	3 (38%)

Note: Participants responded to more than one category

Table B22. Academic recruitment activities

Session Type	Elementary school students	Middle school students	High school students	Post-secondary/adults
Histotechnicians (HTs)	1. Participate in health festivals and have a booth that includes histology activities for kids. Use same model for middle school and high school students. Examples: show kids microscope, get them interested in anatomy and cells.		1. Partner with high schools in the area to expose kids in the profession (e.g. for students to participate in institutional summer program that provides opportunities to shadow in the Histology Department). 2. Get involved in the ASCP Ambassadors program and reach out to high school students.	1. Get involved in the ASCP Ambassadors program and reach out to college students. 2. Suggest to incorporate Histology in college science lab curriculum (e.g. One university created a six-week winter internship where students will take part in a lab course that exposes them to different parts of an actual clinical lab). 3. (1+1) Program -partner with university for a 2-year degree. One year in the University and the second year in the HT program 4. Pre-professional Program for those pursuing AA and above but for allied health professionals (e.g. speak at various colleges, universities, have a website up to talks about HT, as well as we have a work on pamphlets to be distributed to all campuses)
Medical Laboratory Assistants (MLAs)	1. Teacher for a day program - target 3rd and 5th graders and teach them about lab (PPE, microscope)		1. Encourage lab training program faculty and program directors to go in-person to high schools in the area for recruitment. 2. Offer continuing education with basic lab experiments for the AP science teachers. Examples are activities in chemistry and hematology. Partner with high school administrators and STEM coordinators to allow their AP science teachers to participate. *Outcome: received a lot of follow up for this activity.* 3. MLA open houses on evenings and Saturdays where high school students can come with their parents	1. Training programs partner with labs to form an education team /workgroup to discuss strategies on how to secure rotation spots for students by partnering with other hospital institutions throughout their area 2. Training program offer incentives such as tuition reimbursements, help students map career ladders
Medical Laboratory Technicians (MLTs)		1. Technical school that offer (SCRUBS Camp) to middle school and high school students to give them exposure to different health careers. 2. Community college offers a program for 8th grade students to sign up to attend the school free for two years. Those at the college in the different health care programs reach out to the students. Program directors have talked to students about being a lab personnel or lab professional. 3. Career day or career week where the students from fifth, sixth and seventh grade would go to the college to expose them in the lab. 4. Quality education person for the lab bring in middle school to high school kids for laboratory tours. 5. Offer/incentivize lab employees top tier wellness discount if they volunteer or perform community outreach - participate in a health science fair in their community or state college.	1. Technical school that offer (SCRUBS Camp) to middle school and high school students to give them exposure to different health careers. 2. Hospital institution work with some of the local schools to do a health care fair, where a member of different lab specialties come to the high school. Students can walk around in booth and learn what each lab department does. 3. Offered internships with the high school kids to bring them in the lab and expose them to the profession. 4. Lab participate in an established a program for high school seniors from different minority groups to showcase the lab and introduce the students to the profession. *	1. Partner with local hospitals to give students access to both clinic and hospital environments. 2. Partner with other MLT programs to start a track for certified medical assistants to become MLTs. 3. Programs where high school students can start their college programs during high school to help give them an advantage and get started on their college education, graduate from the community college and have a make livable wage to start out with, and still stay in the community. 4. Partner with universities and technical schools in rural area to pledge that they would give scholarships (pay for tuition) to students who attend the MLT program and sign an agreement that they will stay in the community for two years when they finish the program.**
Phlebotomists (PBTs)			1. Hold three career fairs per year on careers in health care which includes a section on Phlebotomy.	1. Created an onboarding tool for PBT students that is similar to a paid internship. Students are paid to attend the program once accepted. Students also receive guaranteed rotation spots. This has made the program popular in their area and they receive double their capacity in applications every year.

*Avera Academy - junior year high school students apply to the program so they can shadow different hospital healthcare professions. They also help with resume building and exposure to other universities; **Build Dakota Scholarship

Table B23. Future suggestions

Session Type	Future Suggestions
Histotechnicians (HTs)	Be more aware of generational differences. Generationally, people expect different things. Essential in changing workplace culture.
	Mentorship
	Create supportive environments - Empower HTs to ask questions and promote verbal and written communication to avoid toxic environments in the lab
Medical Laboratory Assistants (MLAs)	Identify regional, state and city needs, such as competencies needed before lab professionals come to their labs. Determine how to help training programs regionally. Figure out how to help support the lab professionals get the right skill set at the right location and not over or under educating them. (ONE SIZE DOES NOT FIT ALL)
	Suggestion for grow your licensure- start with 50% licensed employees, grandfather them in and gradually grow over time.
	Educational institutions and programs come together to align with the needs of the lab professional and avoid teaching them outdated lectures and for lectures to reflect current practices.
	Create supportive environment
Medical Laboratory Technicians (MLTs)	Create supportive environment 1. Have tangible evidence that MLTs are truly being appreciated through incentives, flexible hours, employee assistance program - mental health. 2. Have "coffee" chats to voice colleague concerns. 3. Survey that allows MLTs to submit their concerns or ideas. Leadership provides feedback.
Phlebotomists (PBTs)	Create supportive environment 1. Encourage open communication 2. Promote positivity

Table B24. Future skills needed

Skills	Histotechnicians (HTs)	Medical Laboratory Assistants (MLAs)	Medical Laboratory Technicians (MLTs)	Phlebotomists (PBTs)
Future soft skills needed	Communication skills, resilient and leadership skills, better two-way communication	Communication skills, resilience	-	Communication skills, positive energy, self- motivation
Future technical skills needed				
Automation	Move towards automation will need more HTs who are knowledgeable in using and operating these machines	The role of lab professionals is going to change with automation, but it's not going to reduce the number of techs required	-	-
Computer systems	Prepare for future move into digital pathology	Better understanding of computer systems to build confidence in utilizing the computers and avoid overwhelm.	-	-
Critical thinking	Depth of understanding crucial especially in digital pathology and molecular techniques	Critical thinking skills especially in using automated machines and trouble shooting and when customer service isn't available.	-	-
Detail-oriented	-	-	-	Attention to detail especially when performing specimen processing
Educational requirements	Seeing more applicants with Masters in other sciences but need applicants with Associate degree	Need MLAs who have their degree and certification	Need MLTs with experience and education to meet the CLIA requirements to take over leadership positions, especially those being vacated by LPs who are retiring.	Needs more PBTs instead of hiring other health care personnel who only had experience but not degree as a PBT - avoid error and retains quality of the profession
Troubleshooting	Need HTs who know how to troubleshoot and problem solve	-	-	-

APPENDIX C:
Focus Group Results Related to COVID-19 in the Laboratory

Table C1. Challenges due to COVID-19 for histotechnicians (HT)

Challenges	No. and % of 10 HT Participants
Staffing	8 (80%)
Furlough	4 (40%)
Hiring freeze	3 (30%)
Staff departure	2 (20%)
Redeployment	1 (10%)
Salary (COVID-related)	1 (10%)
Increased workload (COVID)	2 (20%)

Table C2. Challenges due to COVID-19 for medical laboratory assistants (MLA)

Challenges	No. and % of 3 MLA Participants
Staffing	3 (100%)
Furlough	2 (67%)
Lack of resources	2 (67%)
Redeployment	2 (67%)
Salary (COVID-related)	2 (67%)
Staff departure	1 (33%)
Increased workload (COVID)	3 (100%)
Work-life balance (COVID)	2 ((67%)
Burnout	2 (67%)
Care giving challenges	1 (33%)
Geographic location (COVID)	1 (33%)

Table C3. Challenges due to COVID-19 for medical laboratory technicians (MLT)

Challenges	No. and % of 9 MLT Participants
Staffing	9 (100%)
Staff departure	7 (78%)
Lack of resources	3 (33%)
Salary (COVID-related)	3 (33%)
Furlough	1 (11%)
Increased workload (COVID)	2 (22%)
Work-life balance (COVID)	5 (56%)
Burnout	5 (56%)

Table C4. Challenges due to COVID-19 for phlebotomists (PBT)

Challenges	No. and % of 8 PBT Participants
Staffing	6 (75%)
Staff departure	4 (50%)
Furlough	2 (25%)
Hiring freeze	2 (25%)
Lack of resources	2 (25%)
Salary (COVID-related)	1 (13%)
Increased workload (COVID)	4 (50%)
Work-life balance (COVID)	1 (13%)
Burnout	1 (13%)

Table C5. Academic challenges during COVID-19 pandemic

	Type of Training Program			
Challenges	Histotechnician (N=10)	Medical Laboratory Assistant (N=3)	Medical Laboratory Technician (N=9)	Phlebotomist (N=8)
Clinical rotations	60%	67%	56%	13%
Recruitment challenges	10%	33%	0%	13%

Table C6. Strategies to assist students during COVID-19 pandemic

	Type of Training Program			
Strategies	Histotechnician (N=10)	Medical Laboratory Assistant (N=3)	Medical Laboratory Technician (N=9)	Phlebotomist (N=8)
In-person training strategies	0%	33%	0%	0%
Virtual classes	0%	33%	0%	13%
Virtual rotations	0%	0%	11%	0%