SPECIAL REPORT

A Literature Review on How We Can Address Medical Laboratory Scientist Staffing Shortages

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Abbreviations: BLS, Bureau of Laboratory Statistics; MLS, medical laboratory scientist; CLS, clinical laboratory scientist; MT, medical technologist; MLT, medical laboratory technician; CLT, clinical laboratory technician; LT, laboratory technician; NAACLS, National Accrediting Agency for Cliical Laboratory Sciences; CLIA, Clinical Laboratory Improvement Amendments 1988; ASCP, American Society for Clinical Pathology; PT, proficiency testing; CMS, Centers for Medicare & Medicaid Services; MeSH, Medical Subject Headings; ASCLS, American Society for Clinical Laboratory Science; BOR, ASCP Board of Certification; CMP, certification maintenance program; STEM, science, technology, engineering, and mathematics.

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ABSTRACT

Objective: Laboratories are facing a critical shortage of medical laboratory scientists (MLS) and medical laboratory technicians (MLT) to address an increasing demand for laboratory testing. Training program closures, fewer student applicants, and financial decisions have contributed to staffing shortages. Lack of visibility, low wages, and perceived lack of opportunities for upward career mobility contribute to challenges in recruiting and retaining qualified individuals and students who are unaware of laboratory medicine careers. Our goal was to review the literature to determine the current state and consequences of staffing shortages, and potential solutions to address these shortages.

Methods: Medline/PubMed, PubMed Central, MeSH, Google Scholar, and Marshall Digital Scholar were used as resources.

Discussion/Conclusions: A collaboration of stakeholders is needed to identify staffing challenges, barriers, and solutions and to increase visibility of laboratory professionals. Early recruitment is best started in the middle and high school educational process.

Based on the US Bureau of Labor Statistics (BLS) in 2020,[1] there were 335,500 jobs for medical laboratory/clinical laboratory scientists (MLS/CLS) and medical laboratory/clinical laboratory technicians (MLT/CLT), previously known as medical technologists (MT) and laboratory technicians (LT), respectively, with an 11% projected increase in jobs to fill annually between 2020 and 2030.[1] The BLS however, placed medical laboratory professionals into 1 category regardless of education and credentials. The US Department of Health and Human Services, Health Resources and Service Administration placed MLS and MLT in separate categories in their National Center for Health Workforce Analysis, and each category was projected to grow by 22% between 2012 and 2025[2] suggesting we may be faced with an even greater workforce shortage then predicted by BLS.

There is no difference between MLS, CLS, and MT certifications. They all require a 4-year baccalaureate degree in medical laboratory science or a baccalaureate degree in life sciences followed by a 1-to-2-year internship in a clinical laboratory program accredited by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS) for an individual to perform Clinical Laboratory Improvement Amendments (CLIA) 1988 complex tests and procedures requiring specialized scientific and technical knowledge. In contrast, MLT and CLT certifications typically require either a 2-year associate degree, completion of at least 60 semester hours (including 6 hours of chemistry and 6 hours of biology) of academic credit from an accredited college or university, completion of a US military medical laboratory training course, 3 years of full-time acceptable clinical laboratory experience and successful completion of an accredited MLT program, or a nondegree with a specialized training certificate. Completion of 1 of these tracks allows an individual to perform CLIA-waived and moderately complex tests under the supervision of an MLS, laboratory manager, or director, with a minimal risk of an incorrect result.[3,4] The terms MLS and MLT will be used throughout the article to designate these 2 laboratory professional groups.

Certification, although optional, is required for employment by many laboratories. The ASCP certification, for example, designated MLS(ASCP) in the United States, does not expire if awarded prior to January 1, 2004, whereas individuals certified after that date receive a time-limited certification valid for 3 years.[5] They are required to participate in a credential maintenance program to keep and renew their certification using the designation MLS(ASCP)^{CM}. Besides certification, laboratory professionals may need to be licensed, depending on the state where they will be practicing. Currently there are 11 states plus 1 territory that require licensure.[6]

In small laboratories defined by the number of billable tests and staff employed, individuals often work as generalists, where they perform a variety of different tests. In larger laboratories, employees may

specialize in a specific department or section within the laboratory. Medical laboratory professionals are key members of the clinical care team working in collaboration with physicians, nurses, pharmacists, and other healthcare professionals. They are skilled in testing patient's specimens to provide results that aid clinicians in clinical decision-making for diagnosis, treatment, and management of patients.[7]

Factors Contributing to the Need for Increased Laboratory Staffing

Several factors account for the projected need for increased staffing that require increased testing; for example, population growth, an aging population, chronic diseases, COVID-19, expanded insurance coverage under the Affordable Care Act, newer technology including molecular assays, point-of-care testing that requires laboratory oversight to comply with regulatory and testing compliance, frequent data building for laboratory information system upgrades, and automation.[8,9]

Laboratory Vacancy Rates

According to the ASCP 2020 national vacancy survey of medical laboratories in the United States based on 476 respondents, the Central Northeast region reported the highest overall vacancy rate (10.2%) and the Central Southwest the lowest rate (5.3%) compared to other areas of the United States. Chemistry/toxicology had the highest staff vacancy (13.1%) and 5 year projected retirement (17.9%) rates, whereas cytology (4.3%) and flow cytometry (4.9%) had the lowest vacancy and projected retirement rates, respectively. However, compared to the ASCP 2016–2018 survey data, with few exceptions, laboratory departments saw a decrease in vacancies. This drop was related to the elimination of elective procedures during the Covid-19 pandemic with an accompanying decrease in non-Covid-19 test volumes and subsequent staff furloughs and resignations. The survey also showed an overall decrease in retirement rates, suggesting that those employees projected to retire had already retired.[8]

Qualified scientists and technicians are needed to fill vacancies to address the increased demand for laboratory services. Employment vacancy rates are exceeding the number of MLS and MLT graduates due in part to declining accredited educational programs, related to financial decisions, decreasing hospital rotation sites because of laboratory staffing shortages, and increasing testing demands.[9] Between 2000 and 2022, there was a decrease in NAACLS-accredited programs, from 263 to 243 MLS and 248 to 238 MLT programs, respectively.[10] To address this shortage, some programs have reduced their clinical rotations from 22 weeks to 12 weeks, a reduction that may compromise a student's preparedness to enter the workforce.[11]

Challenges in Recruiting and Retaining Staff

Managers have cited challenges in recruiting, hiring, and retaining personnel. Compared to other professions, low wages, poor health and retirement benefits, no tuition or continuing education reimbursements, and no sign-on bonuses contribute to recruiting challenges. That said, providing incentives like sign-on bonuses and tuition reimbursement may be welcomed, but may not be financially feasible because of reductions in laboratory reimbursements. In addition, budget constraints; administrative justification, hiring freezes, and competition for trained and certified individuals continue to be obstacles in laboratory staffing. To add to the dilemma, there are fewer students pursuing a career in laboratory medicine due to a lack of career awareness, resulting in a decline in staffing with qualified and certified laboratory professionals.[9]

The following reasons have been cited by employees for low retention rates: lack of premium pay for overtime, holidays and weekends, scheduling flexibility, and career ladders; limited upward mobility; high stress levels; failure of administration, public, and other health care providers to recognize medical laboratory professionals; increased workload without additional staff due to assimilation of additional hospitals into their health care system; issues with their manager; and noncompetitive compensation compared to other jobs requiring similar educational backgrounds.[8,9,11] Based on the 2021 US BLS, the annual median wage for a MLS/MLT is $57,800. That said, wages vary based on geographic location, certification, and experience. Currently, the top paying states are New York, Rhode Island, Connecticut, Oregon, and California.[1,12]

An ongoing issue relates to lack of visibility, recognition, and respect for the work of laboratory professionals. The public frequently hears about front-line caregivers but rarely hears about laboratory professionals and their contributions to patient care. One of the main reasons for the lack of recognition and respect for MLSs relates to the fact they do not have 1 standardized designation based on their education and training.[13] They may be referred to as an MLS, CLS, or MT. Likewise, there has not been a clear distinction between an MLS and an MLT. As a result, multiple professional titles have led to public confusion on how to address them, so they end up referring to MLSs as "med techs" or "lab techs."

Consequences of Staffing Shortages

Managers may be faced with several obstacles; for example, staffing shortages to fill night, weekend, and double shift positions, fewer qualified applicants to fill positions, and less time for sufficient training. Also, losing a valued staff member can put additional stress on the remaining staff to pick up the slack, maintain quality, prevent reporting errors, and avoid employee dissatisfaction. The hiring process may take 3 to 6 months to advertise, interview, hire, and train a new employee. During this time, managers usually can expect additional payroll costs to cover overtime until a new employee is hired.[9,14,15]

Staffing shortages have led to less restrictive employment requirements, particularly in those states where there is no requirement for certification through an accredited MLT or MLS program or licensure. To address these staffing shortage challenges, a significant problem in small rural laboratories, managers have resorted to using traveling laboratory professionals who work locum tenens (temporary, part-time, per diem, or pro re nata). Traveling MLSs may receive a renewable contract with benefits including financial incentives, health and flex spending benefits, private housing, and sign-on bonuses. They also may pose a financial hardship to employers related to higher salaries than permanent employees and time-consuming training to fulfill immediate needs.[9]

With increasing workloads and demand for staffing, some managers are compelled to hire personnel with a bachelor's degree in biology or chemistry without certification or laboratory experience. These individuals are given on-the-job training to perform moderate and high complexity testing if they are in a state that does not require certification or a license.[9] They may be eligible for national certification as an MLT or MLS once they have documented proof of qualifying clinical laboratory work experience and successful completion of a certification examination in one or more laboratory specialties. The apparent rise in the

TABLE 1. Strategies for Improving Medical Laboratory Scientist and Medical Laboratory Technician Staffing

	Strategies
Visibility[23]	
1	Consistently use the titles "Medical Laboratory Scientist" and "Medical Laboratory Technician."*[13,23]
2	Offer incentives for those who attend laboratory awareness programs or perform community outreach.[23]
3	Promote the profession to students and educators during career days.[7,8]
4	Encourage professional clinical laboratory educational organizations to invite students and educators to attend their meetings and provide awards to students for their scientific achievements.[23]
5	Engage a national television channel to feature a video on the clinical laboratory profession.[24]
6	Invite the C-suite, Executive Board, and health care professionals to visit their laboratory and educate them on the skills, education, and contributions of laboratory professionals to the health care system.[7,23]
7	Use social media such as Linkedin, Facebook, Instagram, and Twitter to increase public visibility.[23]
*The American Society for Clinical Laboratory Science (ASCLS) and ASCP Board of Certification (BOC) wrote a position paper outlining the importance of adopting unified professional titles "Medical Laboratory Scientist" and "Medical Laboratory Technician."[13,23] In 2009, upon uniting the National Certification Agency and ASCP BOC into a single certifying agency, ASCP BOC declared the credential designations Medical Laboratory Scientist (MLS) and Medical Laboratory Technician (MLT) for these professions. Laboratory professionals who formerly held medical technologist (MT) and clinical laboratory scientist (CLS) certifications are now called Medical Laboratory Scientists (MLS) using the designation MLS(ASCP)^{CM} if they participate in the Certification Maintenance Program (CMP) that requires continuing education and performance of activities to remain current. Individuals who were certified as a MT(ASCP) prior to 2004 and who do not participate in the CMP will retain the designation MT(ASCP) without the superscript CM.[5] All stakeholders are encouraged to endorse the use of the declared designations when engaged in discussions related to laboratory personnel, encourage all educational programs to adopt these terms, and advocate for use of the MLS job title for those with a baccalaureate degree and national ASCP certification.[13,23] Declaring the use of the MLS(ASCP)^{CM} or MLT(ASCP)^{CM} credential designations is a step toward linking standard designations with education, credential, and job title. However, organizations other than ASCP have certified laboratory professionals; for example, American Medical Technologists, American Association of Bioanalysts, and have maintained the name Medical Technologist. Arguably the same designations should be used by all laboratory professionals with consideration to grandfather those individuals holding comparable certifications regardless of the certifying agency. That said, standardizing nomenclature to improve public awareness is a major undertaking that can create challenges for human resources in reevaluating jobs and titles and for certifying agencies to change their program names.[13]	
Recruitment[23,24]	
1	Identify mentors from professional laboratory organizations, the medical community, and volunteers to educate and promote laboratory sciences in the classroom.[23,24]
2	Develop a marketing pipeline plan that includes a website to reach broad audiences of prospective laboratory candidates to fill vacancies.in well-populated areas and attract qualified individuals into laboratories in rural, remote, or hard-to-reach areas of the country.[23,25–27]
3	*Form an outreach program to distribute educational and promotional brochures to local and rural communities. *Use social media such as Facebook, Instagram, and Twitter to recruit.[23,24,27] *Hold virtual information sessions for students and educators. *Produce video tours of your laboratory department and team explaining why they chose a career in laboratory medicine. *Add video links to your institution's webpage and recruiter's website, and *Use a recruitment toolkit that includes videos and student brochures created by ASCLS and the Committee for Educational Programs and Initiatives.[25,26]
4	Plan events for Lab Week and Career Days to educate and recruit high school and college/university students.
5	Develop an electronic clearinghouse to advertise vacancies at MLS and MLT clinical laboratory training sites.[9]
6	Consider marketing rural communities by highlighting information on a blog with their career page; for example, low cost of living, provision of relocation expenses, onsite daycare, and hiring spouses with appropriate backgrounds.[27]
7	Explore government funding to develop and support internships and mentoring programs for students including underserved communities. Advocate to administration and government agencies for higher salaries competitive with other employers and commensurate with their education, skills, and experience, and increases in funding for laboratory training programs, student stipends, and scholarships,[23,24] such as Build Dakota Scholarships, Health Occupations Students of America, Future Health Professionals, and Avera Academy financial assistance programs.
8	Encourage distance-learning to deliver didactic information, particularly beneficial for students in rural areas.[28,29]
9	Change the process of recruiting by taking a more individualistic approach to staff management and not assume that a "one size fits all" approach will be appropriate to suit the values and views of all candidates.[14,23]
10	Provide financial incentives, including attendance in continuing education and training programs, flexible schedules to allow a work-home balance or pursuit of an advanced degree or certification, competitive benefits, paid vacations, job descriptions, career ladders for employee development, and advancements with an increase in pay and title.[8,15,23,30]
11	Educate employers as to the importance and benefits of providing clinical laboratory training rotations for students while supporting laboratory certifying programs.[16,31]
12	Provide nontraditional approaches of student training during off-shifts, virtual or simulation training.[9,24] Offer on-the-job training for candidates seeking to minimize education costs and earn income while in training.[14,23]
13	Provide multiple points of entry for individuals with adult responsibilities to enroll in an accelerated, clinical laboratory-based curricula to enter the workforce again as a laboratory professional.[32]
14	Perform a market salary adjustment at least annually.[30]
15	Hire medical laboratory scientists from other countries.[8]
*The American Association for Clinical Chemistry has recommended that Congress provide Title VII funding to allied health training programs to expand their MLS training programs, allocate funding to support clinical rotation training of MLS students in hospitals and/or reference laboratories, and create a loan forgiveness program to reduce laboratory professional student debt for those who work in underserved areas.	

TABLE 1. Continued

	Strategies
Diversity and Inclusion[23]	
1	Support employer's focus on promoting gender, race, and ethnicity diversity in recruitment.[23,24]
2	Engage in outreach to students, parents, and councilors, and partner with underserved communities for their help in distributing informational brochures in multiple languages.[23]
3	Before interviewing candidates from diverse populations, check out their profile so you can personalize your outreach message rather than sending a general notice.[23]
4	Provide strong student support and participate in mentorship and diversity training programs to help in retaining staff from underrepresented groups.[23,32]
5	Understand the importance of recognizing multigenerational diversities in the workplace and learn strategies to accommodate diverse needs of individuals.[14,24]
6	Search for federal agency programs; for example, Area Health Education Center supports medical laboratory training for diverse, underserved, and rural areas a federal agency for people in rural and underserved areas.[23]
Retention[23,24]	
1	Create a positive environment for new employees using on-boarding to familiarize the new employee with their new work environment.[14,15]
2	Use a mentoring system for new hires during orientation to build relationships, integrate them into the organization, and give them a sense of belonging.[14,15]
3	Motivate staff and provide meaningful, challenging work where employees feel their skills and abilities are used effectively. Staff tend to be engaged if they feel their manager is concerned about their growth.[14]
4	Offer career ladders that outline the responsibilities, skills, and experience required for each job on the organizational ladder, a roadmap of steps required to move up the ladder, and career pathways as a guide to determine progression towards their goal.[15,24,32]
5	Mentor laboratory staff to build leadership skills for upward mobility.[23]
6	Incentivize employees to obtain certifications[5,6,8,23] and encourage noncertified individuals with a postbaccalaureate degree; for example, biology or microbiology and interested in a microbiology career to enroll in an American Society of Microbiology (ASM)-Weber State University program for certification.[33]
7	Encourage online training and bridge programs as part of a career ladder to move from an MLT position to an MLS using their current workplace to obtain advanced laboratory training.[28,29]
8	Show that you trust your staff by giving them autonomy within their position, encourage suggestions, and act on their feedback.[14,15]
9	Promote ways to prevent burnout; for example, develop a laboratory stewardship test utilization committee to decrease unnecessary tests and provide creative staffing.[14]
10	Consider financial incentives; for example, annual increases, sign-on bonus after 1-year anniversary, retention bonus each year thereafter, employee referral bonus, shift differential, employee fund for special needs, tuition support, stipends, or scholarships for employees to pursue educational opportunities.[23,24]
11	Provide flexibility; for example, virtual meetings for staff who cannot regularly attend in-person meetings or educational programs, flexible scheduling, and cross-training.[9,32]
12	Recognize staff for contributions to patient care and team efforts.[14]
High retention rates lead to increased productivity and decreased costs related to recruiting and training new employees. Success in retaining employees depends on strong and creative leadership starting in the C-suite and extending through all levels of management. Using an on-boarding strategy for retention that includes a comprehensive orientation with management and co-workers to familiarize them with laboratory procedures, policies, career development, history of the institution, values, expectations, compliance, and the laboratory's role in the operation, is helpful in engaging and motivating new employees so they will feel they made the right decision in joining the team.[14,15] Unfortunately, some managers fail to understand the importance of motivation or they lack the skills to provide a motivating environment. Clear goals, immediate feedback, and tasks that are neither too difficult nor too simple, help to foster a motivating environment.[18] Understanding the needs of the workforce while addressing the needs of the laboratory will go a long way to improving recruitment and retention of qualified laboratory professionals. A complaint among dissatisfied MLSs is the lack of career advancement opportunities and limited upward mobility. Providing career ladders and encouraging certifications can enhance opportunities for career mobility while improving work quality.[16,31] The odds of career advancement from an entry-level position were found to be close to 70% higher for every additional certification a laboratorian obtains, for example, specialist certifications demonstrating competency (P=.018).[16] As an example, students with a baccalaureate degree in a life science and an interest in microbiology can enroll at Weber State University and then apply to the American Society of Microbiology-MLS program. Students who successfully complete 11 credit hours in clinical microbiology, biostatistics and a 4-week clinical laboratory rotation are eligible to take the Microbiology specialist exam through ASCP. If successful, they will receive a Microbiology certificate.[33] For those motivated to advance their career, they also have the opportunity of enrolling in the Doctor of Clinical Laboratory Science degree program that focuses on patient care management, education, research, and delivery of health care services.	
Student Recruitment[23,24]	
1	Increase career awareness through science fairs, educators, and mentoring[23]
2	Identify opportunities to encourage students' interest in a clinical laboratory career.[34] Emphasize the significant role MLSs play in the management of patients, what a "day in the life of a medical technologist" is like, the importance of certification, what is required to become an MLS, and the opportunities for financial stability and advancement to positions of greater responsibility and renumeration.[7,23]
3	Mentor and provide age-appropriate, hands-on laboratory experiences and shadowing of a laboratory professional.[24,34]
4	Partner with a laboratory or a local middle or high school with science, technology, engineering, and mathematics (STEM) discovery-based, hands-on learning experiences. Mobile laboratories provide access to STEM-based learning for children in several states throughout the United States, including rural areas.[23–25,35]
5	Provide tuition, stipends, or scholarship incentives to potential students to attend laboratory training programs.[24,25]

TABLE 1. Continued

	Strategies
	Students are often unaware of career options in laboratory medicine. Engaging students early in their educational journey can be a significant inducement to focus on a career in laboratory medicine. Strategies promoting student interest in laboratory medicine can best be accomplished using a collaboration of stakeholders; for example, health science educators, K-12, magnet and precollege educational program administrators and academic advisors, hospital administrators and laboratory staff, community and volunteer role model mentors, student and professional organizations, clinical laboratory science NAACLS-accredited program directors, legislators, and county school supervisors responsible for strategic business partnerships that help to provide opportunities for students in laboratory medicine.[23] Many of these individuals can also be valuable resources for providing information on what is required to become an MLS and opportunities for advancement to positions of greater responsibility and renumeration.
	Attention needs to be focused on middle and high school students ages 11–14 years to develop face-to-face educational programs to stimulate their interest for a career in laboratory medicine by emphasizing the opportunities that would be available to those taking the path to becoming an MLS. To that point, the authors performed a national survey of Board-certified physicians, microbiologists, and chemists to confirm an earlier observation that a notable number of doctoral level microbiologists and chemists were ASCP-certified or equivalent and had worked on the bench early in their career prior to or during graduate school as a stepping-stone to becoming a board-certified CLIA laboratory or technical director and/or consultant. Survey results showed a sizable number of individuals were certified medical laboratory scientists early in their career. They gained laboratory experience and then took the opportunity to move up the ladder in their career to a position of more responsibility and remuneration. The results of their survey highlight opportunities students can aspire to once they become an MLS. The authors are currently collaborating with the County Public Schools Supervisor of Business Partnerships for careers, technology, and education, who will be a conduit to health science instructors and staff in the public and magnet school system using interactive learning modules and experiential virtual learning programs. In addition, there are plans to work with a large College of Health Sciences to participate in educational programs they offer; for example, Science Festivals, Career Days, Mayor's Youth program, Explorers "summer science exploratory camp," and pre-freshman college orientation, and increase awareness of college bio/science professors and deans to ensure they are aware of MLS careers and the important work the MLS performs.
	Because of increased accredited training program closures, other educational alternatives need to be explored. One option is distance learning (DL) that can reach more students and provide greater schedule flexibility. Currently, there are 23 ASCLS online MLS programs, 24 online MLT programs, and 30 current MLTs enrolled in a bridging program to pursue an MLS online degree completion program. Reported barriers appear to have limited the number of DL programs, although this modality could increase educational opportunities for career preparation to many, including those in rural and remote areas of the country.[29,30]

number of noncertified individuals that are performing moderate and high-complexity tests with no previous laboratory experience should be a wake-up call to address this concern.

Using noncertified personnel rather than certified and experienced testing personnel raises concerns related to maintaining the quality of laboratory results. A retrospective study[16] was designed to compare the measurable outcome of proficiency testing (PT) performance based on testing personnel's college major, degree, certification, and years of laboratory experience. Participants with an MLS major and those with more than 2 years of experience produced a significantly higher percent of acceptable PT results (P=.035 and P=.042, respectively) compared to staff without a clinical laboratory major (P=.035). Although the study results suggest that managers should hire staff who have completed an accredited certification program to maintain quality and minimize laboratory errors, they may be challenged by a lack of qualified applicants.

In 2016, at least in part due to a shortage of clinical laboratory personnel in rural areas, the Centers for Medicare & Medicaid Services (CMS) issued an unprecedented and controversial policy of concern to the laboratory community.[17,18] As stated in the Survey & Certification Letter 16-18 CLIA, CMS ruled that an associate's and bachelor's degree in nursing are equivalent to an associate's or bachelor's degree in a life science that meet the educational requirements for moderate and high complexity personnel, respectively.[17] Numerous laboratory leaders have opposed this policy, stating a lack of educational equivalency. Whereas a baccalaureate degree in a biological science includes high level science coursework and laboratory experience, nursing degrees have a therapeutic focus with little to no laboratory training. Concerns were raised that testing quality and patient safety may be affected as well as loss of jobs for qualified and experienced MLS and MLT personnel.[19,20] The CMS responded to the question of why this rule was proposed by stating that this was not a new CLIA policy or change but a clarification of an existing policy. Laboratories are not "required" to allow nurses to perform moderate and high complexity testing. They can, and in some cases already do, adopt stricter standards; for example, requiring more experience, specialty certification, or more advanced degrees than CLIA regulations require. Also, state law may impose stricter standards than the CLIA regulations require.[21] In 2014, Congress enacted the Promoting Access to Medicare Act for reimbursement of clinical laboratory services. The significant decreases in reimbursement are a threat to providing services to beneficiaries, particularly true for small community and rural hospitals that need to centralize and consolidate their laboratory services to lower costs. As a result, there could be unacceptable consequences to laboratory staffing levels because of reduced test volume.[22]

Methods

The purpose of this review was to determine the current state of laboratory staffing, factors contributing to the need for increased staffing, challenges in recruiting and retaining staff, consequences of staffing shortages, and strategies and potential solutions to address staffing shortages. Inclusion criteria included information in Medline/PubMed, PubMed Central, Medical Subject Headings (MeSH), and Google Scholar related to the list above. References were deselected if there was insufficient or redundant information related to the purpose of the review. Resources were accessed between 2008 and 2022 to obtain relevant and current information pertaining to staffing shortages, including recent US statistics and survey results, CLIA required personnel qualifications, ASCP certifications, visibility of laboratory medicine, recommended strategies for recruitment of students and rural staffing as well as retention of a diverse and inclusive workforce.

Discussion

Strategies to Improve Visibility, Recruitment, Diversity and Inclusion, and Retention

The ASCP in partnership with the University of Washington conducted a detailed analysis using focus groups and one-on-one interviews of management and staff to gather ideas on how to address workforce concerns.[23] The information gleaned from these interviews was used to create a "Blueprint for Action" for engaging stakeholders to work collectively to improve visibility, recruiting, retention, and diversity and inclusion, and address challenges in recruiting staff in rural communities. An abbreviated list of potential solutions for strengthening the clinical

laboratory workforce can be found in **TABLE 1**. For a more comprehensive list, readers are directed to the Blueprint for Action references.[23,24]

Conclusion

Laboratories are facing a critical shortage of MLSs and MLTs to address an increasing demand for laboratory testing. Challenges in recruiting and retaining personnel have added to the dilemma. Staffing shortages have led to less restrictive employment requirements and the use of traveling MLSs, especially in rural areas. Without a collaboration of stakeholders, laboratory staff shortages will continue to plague our laboratories. Fortunately, organizations such as ASCP in partnership with the University of Washington are leading efforts to improve visibility and recognition of medical laboratory professionals. The Blueprint for Action provides a guide for solutions that will increase the number of qualified MLS and MLT candidates while increasing diversity and inclusion within the clinical laboratory. Early recruitment is best started in the middle and high school educational process in collaboration with STEM programs that highlight the role of MLSs, what it takes to become a laboratory professional, and the potential opportunities afforded students who choose a career in laboratory medicine.

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