RESEARCH INITIATIVE: CLINICAL PLACEMENTS AND THE SHORTAGE OF MEDICAL LABORATORY TECHNOLOGISTS

PREPARED FOR:
MEDICAL LABORATORY PROFESSIONALS' ASSOCIATION OF ONTARIO (MLPAO)

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Cambrian College
Cambridge Memorial Hospital
Dryden Regional Health Centre
Eastern Ontario Regional Laboratory Association (EORLA)
Georgian Bay General Hospital
Grey Bruce Health Services
Hamilton Health Sciences
Health Sciences North (HSN)
Ontario Association of Medical Radiation Sciences (OAMRS)
Ontario Tech University
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Canadian Society for Medical Laboratory Science (CSMLS)
Northshore District Laboratory Program (NDLP)
Sault Area Hospital
South Bruce Grey Health Centre (SBGHC)
St. Clair College
St. Lawrence College
The Michener Institute of Education at UHN
Thunder Bay Regional Health Sciences Centre (TBRHSC)
University Health Network (UHN)

The Medical Laboratory Professionals' Association of Ontario (MLPAO) has provided funding for this research project.

EXECUTIVE SUMMARY

Nearly all clinical laboratories interviewed for this project, from urban to rural laboratories, stated that they had a shortage of MLTs. The impact of this shortage was felt most strongly in Ontario's rural and remote communities. In Toronto, where most MLT jobs in Ontario are located, the time to hire is two to three times longer than compared to previous years.

Increased demand for medical laboratory testing, particularly during the COVID-19 pandemic, coupled with MLT shortages have led to increased workloads for staff. This increased workload has significant implications on staff mental health, burn out, and fatigue. This is supported by demographic information that suggests that there has been a significant decline in the number of MLTs in the 41-50 age group from 2006 to 2019, but no corresponding increase in the 51-60 age group. Collectively, this implies that MLTs are leaving the profession for other reasons, such as burnout or sick/disability leave.

The number of registered practising MLTs in Ontario has decreased, on average, about 1.66% year-over-year from 2011 to 2019. Simultaneously, the increase in demand for medical laboratory testing has corresponded with an average 16.68% increase in MLT job postings in Ontario from 2016 to 2020. Over the next several years, from 2021 to 2025, the number of projected job openings for MLTs is 2001 to 3000 jobs alone.

Barriers for medical laboratory education programs to increase student intake include lack of commitment from clinical sites about the number of clinical placements available, lack of laboratory space, and lack of equipment and teaching resources. Major barriers for clinical sites to accept student clinical placements include staff shortages, lack of clinical preceptors and clinical coordinators/instructors, and differences in the curriculum and assessment across different programs.

The key findings from this project are:

- Clinical laboratories need dedicated funding in order to increase the number of students accepted for clinical placements.
- Medical laboratory education programs need to evaluate their programs to increase student throughput. They need dedicated resources to increase student seats to accommodate the current and future health human resource shortage.

- Significant long-term investments and resources need to be dedicated to simulation education.
- Ontario needs a long-term human resource recruitment and retention strategy to support rural and remote laboratories.

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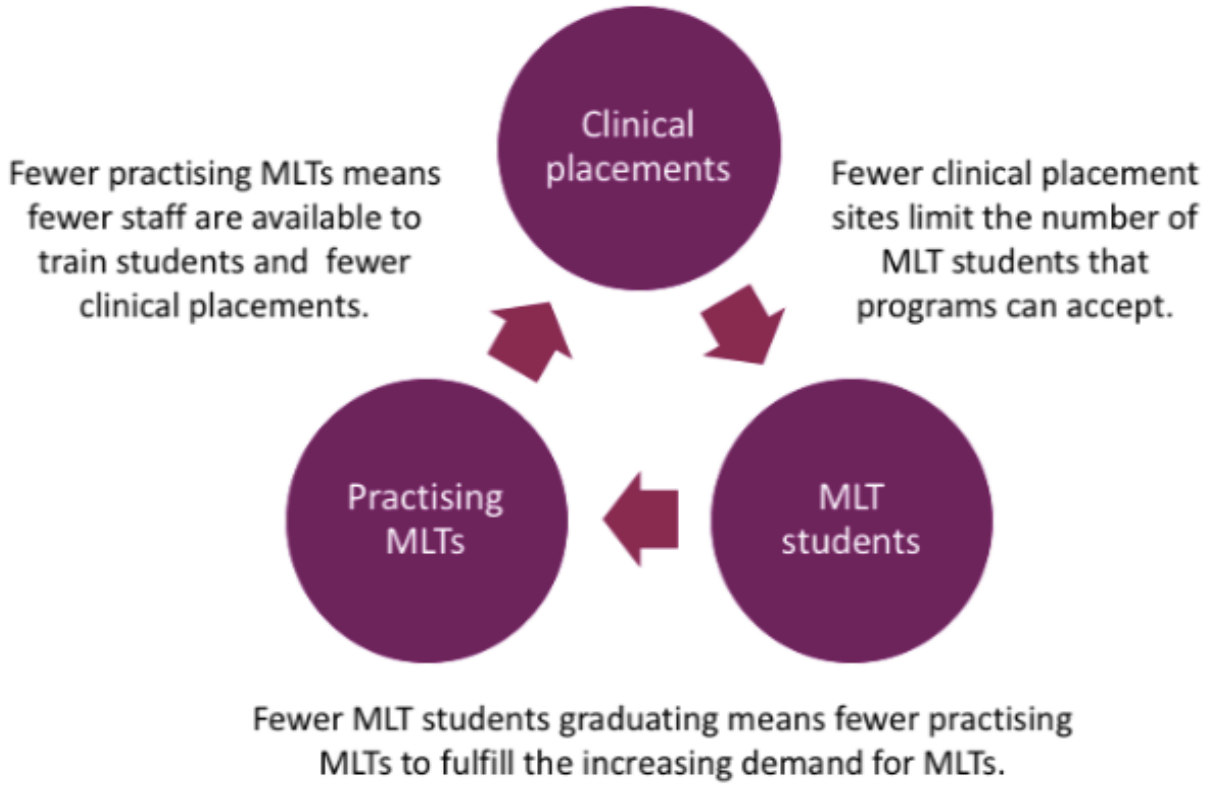
INTRODUCTION AND OVERVIEW

The shortage of medical laboratory technologists (MLTs) in Ontario is a complex, multifaceted issue, with several causes and complicating factors. With the closure of seven programs back in the 1990s and a growing population of over 14.5 million people in Ontario, the number of MLTs has not matched the demand for testing for several years now. The current COVID-19 pandemic has amplified this health human resource shortage (HHR). Employers have described how difficult it is to recruit MLTs with the exponential growth in COVID-19 testing. Ontario faces a severe health human resource shortage of MLTs. This dire situation has been felt most in Ontario's rural and remote communities.

Clinical placements, the mandatory portion of MLT programs where students complete their training in a professional laboratory environment, have been identified as a primary bottleneck. The number of clinical placements often determines the number of seats in an academic program.

Figure 1 illustrates the complex, cyclical relationship between the shortage of clinical placements, the lack of MLT students, and the shortage of practising MLTs.

Figure 1. The Relationship between Clinical Placements, MLT Students, and Practising MLTs



PURPOSE

This research project aims to document the current state of the human resource shortage of general MLTs. The project also focuses on solutions for clinical placements by interviewing stakeholders about challenges with clinical placements and developing a proposal for moving forward.

This report provides the key learnings of this research project. It begins with a review of human health resource information and demographic information related to the College of Medical Laboratory Technologists of Ontario (CMLTO) during initial registration and annual membership renewal. It also describes projected demand for MLTs, the different accredited medical laboratory education programs in Ontario, and the barriers to clinical placements.

RELEVANT STAKEHOLDERS

Apart from the accredited medical laboratory education programs and the clinical placement sites/employers, there are two critical stakeholders described in this report:

- The Canadian Society for Medical Laboratory Science (CSMLS) is the national certifying body for medical laboratory technologists and medical laboratory assistants (MLA/Ts) and the national professional society for Canada's medical laboratory professionals (Canadian Society for Medical Laboratory Science, n.d.-c). The CSMLS sets qualification standards in medical laboratory science, conducts certification examinations across Canada, and issues certificates to candidates who meet the prescribed standards. The CSMLS also provides prior learning assessments (PLA) to internationally educated MLTs seeking Canadian certification. The PLA process evaluates an applicant's academic credentials, language proficiency, clinical training, work experience, and competency level to write the certification examination (Canadian Society for Medical Laboratory Science, n.d.-b). Students who have completed an accredited medical laboratory education program in Canada are qualified to write the CSMLS certification exam. Candidates must successfully pass the exam before applying for membership with the College of Medical Laboratory Technologists of Ontario (CMLTO).

- The College of Medical Laboratory Technologists of Ontario (CMLTO) is the regulatory body for MLTs in Ontario. The CMLTO exists to ensure the public receives quality laboratory services from competent and ethical professionals. The CMLTO sets the requirements for entry to practice to the profession and the standards of practice within the profession. Graduates of accredited medical laboratory education programs who have successfully passed the CSMLS certification exam must register with the CMLTO before practising as an MLT in Ontario.

METHODS AND SOURCES

A literature review was conducted on the current state of the health human resource shortage of MLTs using:

- Annual CMLTO reports;
- The CSMLS national report card; and
- Other publicly available labour market information.

Twenty-one interviews were conducted with twenty-two individuals in Ontario. Each interview lasted approximately 30 to 60 minutes. Participants included:

- medical laboratory science/technology professors, program chairs, and coordinators (*n* = 6);
- medical laboratory technologists (MLTs) and senior/charge technologists, including a recent graduate of MLT programs (*n* = 2); and
- laboratory management (e.g., managers, directors, and vice presidents) (*n* = 13)
- the President and CEO of the Ontario Association of Medical Radiation Sciences (OAMRS) (*n* = 1). The purpose of this interview was to gain insights into potential solutions to clinical placement shortages and strategies adopted in other allied health care professions, such as medical radiation science programs.

A two-hour think tank was also conducted with eighteen participants to brainstorm possible solutions for clinical placements and evaluate the support of proposed solutions.

THE SHORTAGE OF MLTs IN ONTARIO

Is there a shortage of MLTs in Ontario?

Nearly all laboratories interviewed for this project, from urban to rural laboratories, stated that they had a shortage of MLTs. The impact of this shortage was felt most strongly in Ontario's rural and remote communities.

The only exception was in Toronto, where the majority of MLTs in Ontario work. In 2020, 46% of all job postings were in Toronto (Ministry of Labour, Training and Skills Development, 2021). Although every job vacancy in Toronto will eventually be filled, the time to hire has increased. The time to hire measures the number of days between when a candidate applies and accepts a job offer. It now takes over 45 days to fill a vacancy in Toronto, which is two to three times longer than in previous years. In Ontario, 66% of survey laboratories reported positions remaining unfilled for more than three months (Medical Laboratory Professionals' Association of Ontario, 2021a).

Another potential indicator of a shortage of MLTs is the deviation from best practices. This means that laboratory activities are prioritized to minimize the impact on patient care and safety, and clinical laboratories may defer non-urgent or non-essential services and projects. These projects might include the validation of new equipment, quality improvement projects, preventive maintenance, and research projects.

Responses to MLPAO's May 2021 survey of laboratory leaders have reflected the shortage of MLTs. Data on MLT shortages from a survey of 120 laboratory workplaces out of 214 laboratories accredited by Accreditation Canada include the following reported shortages (Medical Laboratory Professionals' Association of Ontario, 2021a):

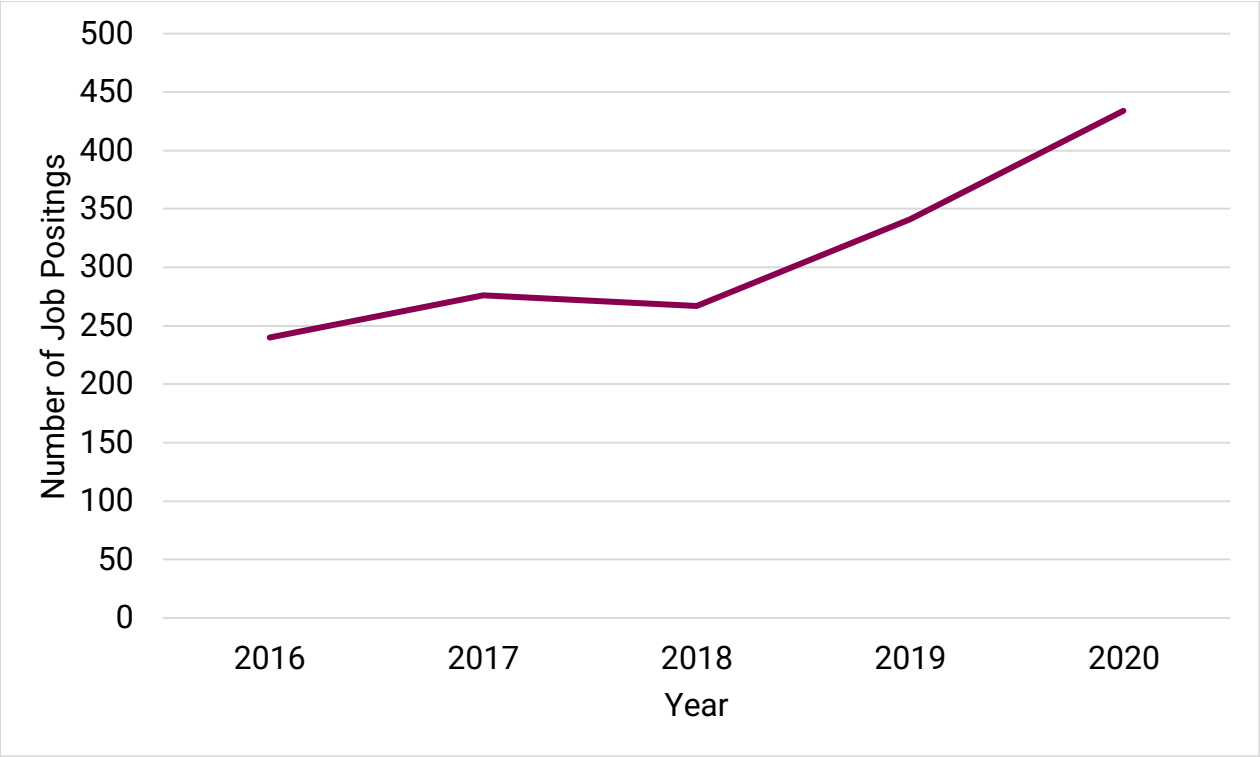
- Full-Time MLTs (Senior Technologists and MLTs): 221
- Part-Time MLTs: 245
- **Total MLT Shortage (Full-Time and Part-Time MLTs): 466**

What is the demand for medical laboratory services?

There has been an increase in demand for medical laboratory tests, even before the COVID-19 pandemic. From 2005 to 2010, Ontario had projected a 1.8% annual increase for laboratory tests (Sweetman, 2015). However, there was an actual increase of almost 4% per year. This 4% increase in laboratory tests exceeds the growth rate of Ontario's MLT workforce.

The increase in demand for medical laboratory testing has corresponded with increased MLT job postings in Ontario from 2016 to 2020, as shown in **Figure 2**, with an average year-over-year increase of 16.68% (**Table 1**; Ministry of Labour, Training and Skills Development, 2021).

Figure 2. MLT Job Postings in Ontario from 2016-2020



Source: (Ministry of Labour, Training and Skills Development, 2021; Burning Glass Technologies, Labour Insight™)

Table 1. Annual Number of MLT Job Postings from 2016-2020

Year	Number of Job Postings	Year-over-Year Change
2020	434	27.27%
2019	341	27.72%
2018	267	-3.26%
2017	276	15.00%
2016	240	
Average Change in Job Postings from 2016-2020		16.68%

Source: (Ministry of Labour, Training and Skills Development, 2021; Burning Glass Technologies, Labour Insight™)

Over the past two years, demand for medical laboratory services has exponentially amplified because of the COVID-19 pandemic. 15,949,282 COVID-19 tests have been performed in Ontario from the start of the COVID-19 pandemic until June 30, 2021 (Ontario, 2021).

During the COVID-19 pandemic, the shortage of medical laboratory professionals and the backlog in COVID-19 laboratory tests highlighted the desperate need for medical laboratory workers in the province. The Ontario government funded a new program to prepare up to 600 laboratory workers. The program consisted of a condensed, intensive two-day online course, followed by two hours of in-person laboratory training at The Michener Institute of Education at UHN (Russell & Jarvis, 2020).

What is the impact of MLT shortages in Ontario?

In a survey of 120 accredited Ontario laboratories, 52% of laboratories indicated turnaround times were affected or somewhat affected by HHR shortages (Medical Laboratory Professionals' Association of Ontario, 2021b). Further, as the demand for medical laboratory tests continues to increase and laboratories continue to work with staff shortages, the number of tests per full-time equivalent (FTE) has steadily increased. This increase in workload leads to staff fatigue, job stress, burnout, decreased morale, and higher turnover intention, leading to mental health illness and stress leaves. The burnout and stress leave compound the issue and contribute to more significant staff shortages. This leads to a constant cycle of increased workload, poor mental health, staff illness and absences, and staff shortages, as illustrated in **Figure 3**.

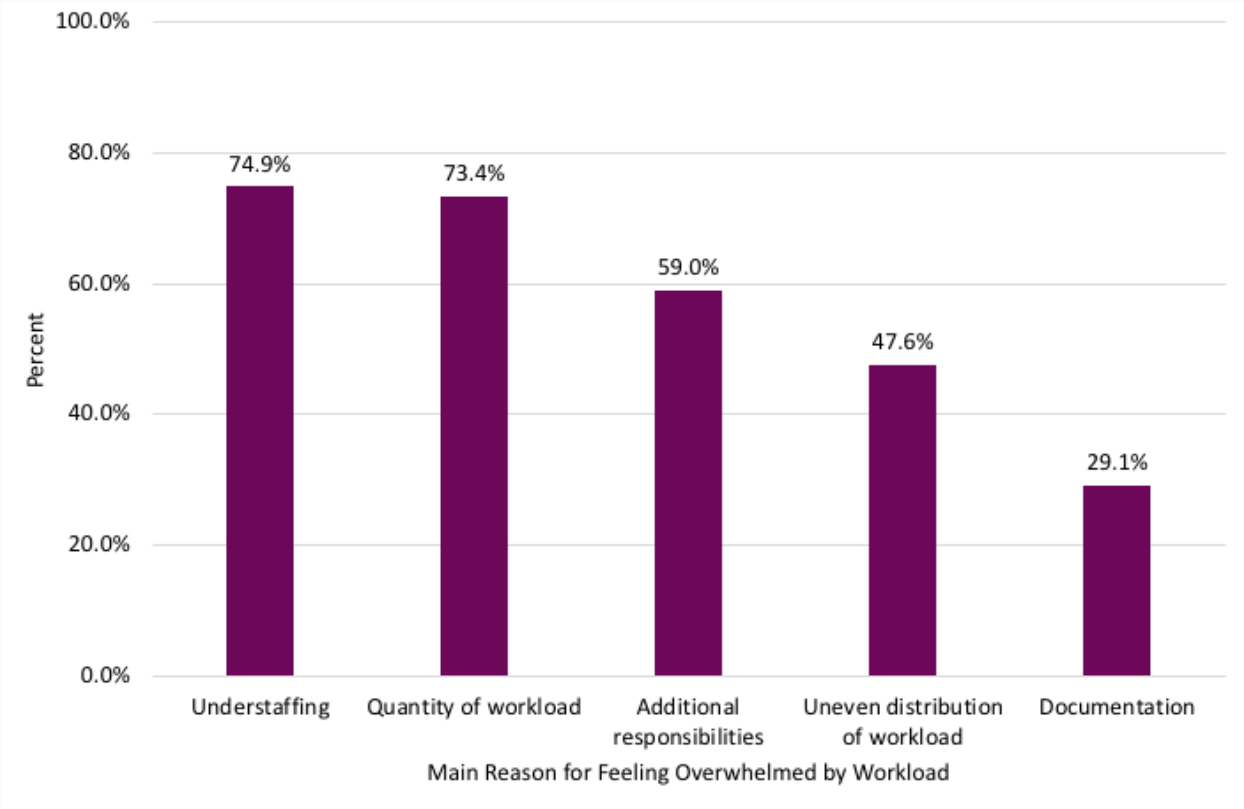
Figure 3. The Relationship Between Staff Shortages, Workload, and Staff Mental Health

In a survey of 348 Ontario laboratory professionals, 303 (87%) reported experiencing burnout after a year of testing 24/7 (Medical Laboratory Professionals' Association of Ontario, 2021a).

Similarly, a survey of 4,613 laboratory professionals across the U.S. found (Garcia et al., 2020):

- Over half of respondents (53.4%) reported feeling a lot of stress (a little bit of stress, 42.7%; no stress at all, 3.8%; not sure/don't know, 0.1%).
    - More than half of these respondents reported the cause of their stress to be workload or call duties (74.6%).
- 85% of respondents surveyed reported feeling overwhelmed by their workload:
    - 37.6% felt slightly overwhelmed
    - 29.5% felt moderately overwhelmed; and
    - 17.9% felt very overwhelmed.
- The main reasons for feeling overwhelmed by their workload were (**Figure 4**)**:**

Figure 4. Main Reasons for Feeling Overwhelmed by Workload as Reported by U.S. Laboratory Professionals



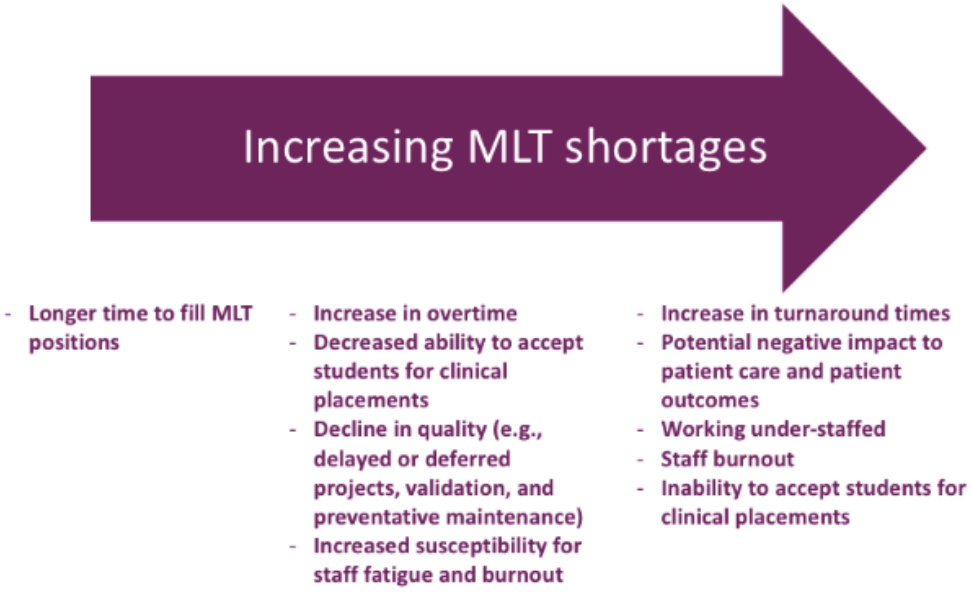
Source: (Garcia et al., 2020)

A focus group of 29 MLTs and MLA/Ts hosted by the CSMLS found similar results. The key findings were (Grant et al., 2016):

- Workplace stress
    - 31% (9/29) of participants reported experiencing stress at work almost all day, every day.
    - 52% (15/29) of participants reported experiencing stress at work at least once or twice daily.
    - Only one participant (3%) experienced stress at work once a month, while 14% (4/29) reported experiencing stress once a week.
- Burnout
    - 21% (6/29) of respondents felt burned out because of work at least daily.
    - 55% (16/29) of respondents felt burned out because of work at least weekly.
    - Only one respondent (3%) never felt burned out because of work, while two respondents (7%) felt burned out due to work yearly.
- The five major causes of workplace stressors cited included inadequate staffing, increased workload, management issues, coworker issues, and inadequate equipment (Grant et al., 2016).

Figure 5 summarizes the impact of MLT shortages in clinical laboratories on employee well-being, clinical operations, and patient outcomes, as described by interview respondents.

Figure 5. The Impact of Increasing MLT Shortages on Clinical Laboratories



What is the difference between a practising and non-practising MLT?

There are two classes of CMLTO member registration:

- **Practising Members:** "Members have met all the registration requirements (education, examination, active engagement in the profession) and are able to practise without restriction (except those members who are subject to terms, conditions, and limitations on their certificate of registration)" (College of Medical Laboratory Technologists of Ontario, n.d.).

- **Non-Practising Members:** "Members have met the CMLTO registration requirements, but are not permitted to practise" (College of Medical Laboratory Technologists of Ontario, n.d.). Examples of Non-Practising members include those who take parental leave because they will not be working during the parental leave period and members who move out of Ontario for two years who choose to change to Non-Practising.

What are the sources of MLTs in Ontario?

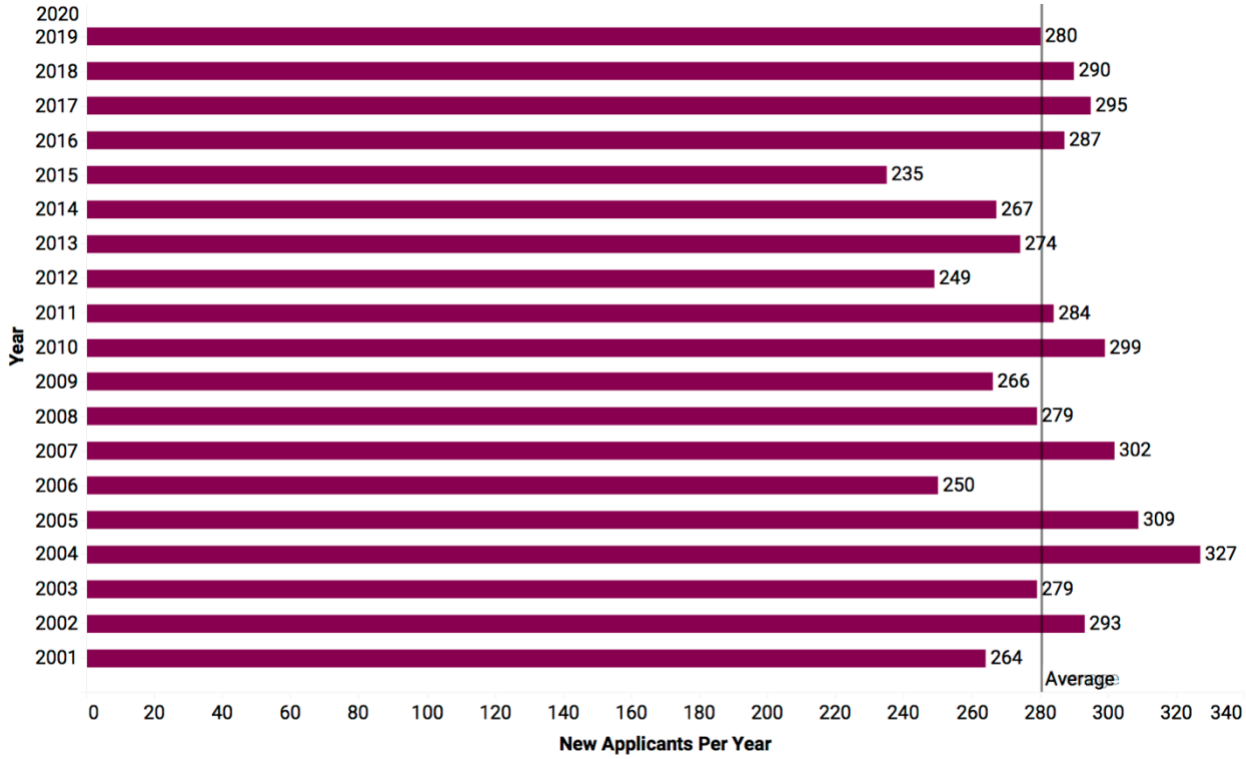
New applicants to the CMLTO fall into one of three categories:

1. **Trained in Ontario.** Most applicants in this category have recently graduated from a medical laboratory technology/medical laboratory science program accredited by Accreditation Canada and passed the CSMLS certification exam. This category also includes applicants who have completed an accredited education program and written the exam in a previous year but who have not applied for membership with the CMLTO. This category also includes retired MLTs who have retired from employment and wish to apply as a Practising MLT.
2. **Internationally trained.** These individuals have been educated and/or trained as a MLT outside of Canada and have had their experience assessed through the CSMLS's Prior Learning Assessment (PLA). This process reviews an internationally educated professional's education, training, and work experience. It evaluates it compared to expectations for Canadian educated professionals. Applicants may or may not be required to complete a learning plan, consisting of refresher or subject-specific courses, theory courses, and/or clinical training. These professionals can then challenge and must pass the CSMLS certification exam before applying to the CMLTO as a new applicant.
3. **Trained in other Canadian provinces.** These applicants have completed their medical laboratory education program at a program accredited by Accreditation Canada.

How many new applicants to the CMLTO are there each year?

The number of new applicants in Ontario has remained relatively stable over the past two decades, with an average of 280 new applicants annually, from 2001 to 2019 (**Figure 6**). However, the closure of seven MLT programs in Ontario in the 1990s resulted in the loss of 209 to 249 student seats. New applicants include those trained in Ontario, internationally trained applicants, and applicants trained in other Canadian provinces.

Figure 6. Number of New Applicants in Ontario from 2001-2019

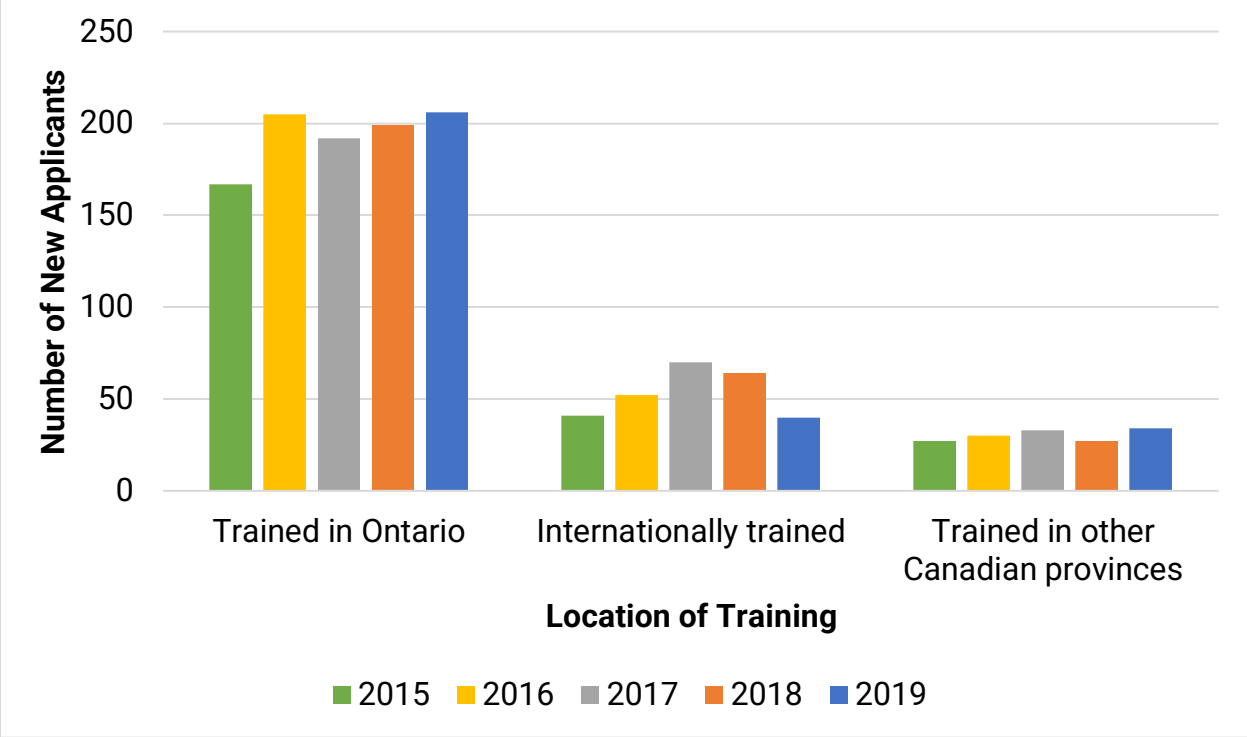


Source: (College of Medical Laboratory Technologists of Ontario, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020)

Where have new CMLTO applicants trained?

Figure 7 shows that there has been an upward trend in the number of new applicants trained in Ontario since 2015. Since 2017, there has been a slight decline in the number of internationally trained MLTs. The number of new applicants trained in other Canadian provinces has remained relatively stable, with an average of 30 applicants per year from 2015-2019. Collectively, this data suggests that the number of Ontario-educated MLTs is slowly increasing. However, the overall number of new MLTs applying for registration remains relatively constant.

Figure 7. Distribution of New CMLTO Applicants from 2015-2019



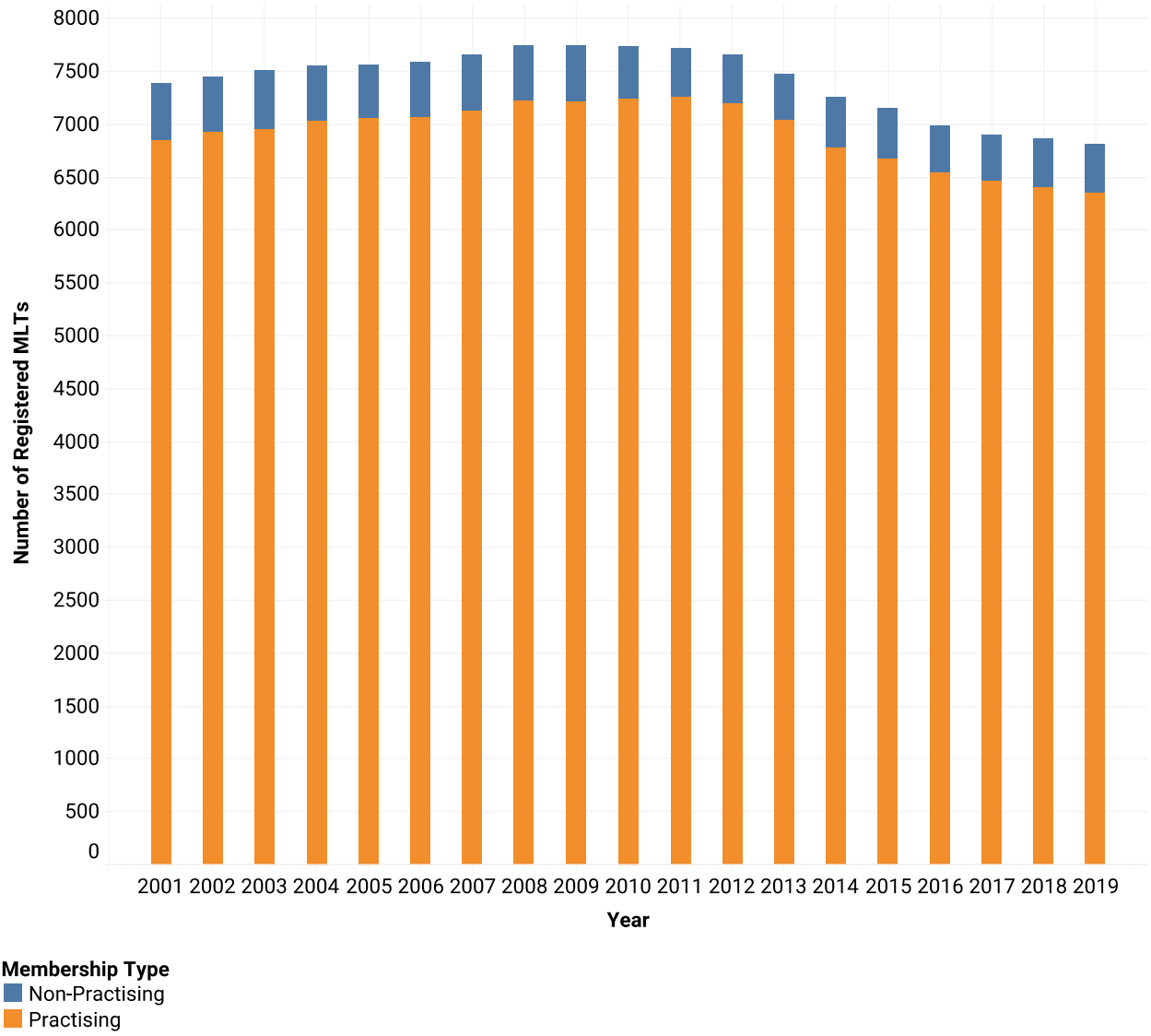
Source: (College of Medical Laboratory Technologists of Ontario, 2016, 2017, 2018, 2019, 2020)

How many practising and non-practising MLTs are there in Ontario?

There were 6676 practising and non-practising MLTs in Ontario in 2020. Of these 6676 registrants, 6203 (92.9%) were practising MLTs (College of Medical Laboratory Technologists of Ontario, 2021).

Despite relatively constant numbers of new applicants to the CMLTO, the number of registered practising MLTs in Ontario has decreased, on average, about 1.66% year-over-year from 2011 to 2019, as shown in **Figure 8**. Conversely, the number of non-practising MLTs in Ontario has remained relatively stable since 2011. Since the number of new applicants has remained relatively stable, this has contributed to an overall reduction of MLTs across the province.

Figure 8. Number of Registered MLTs in Ontario from 2001-2019

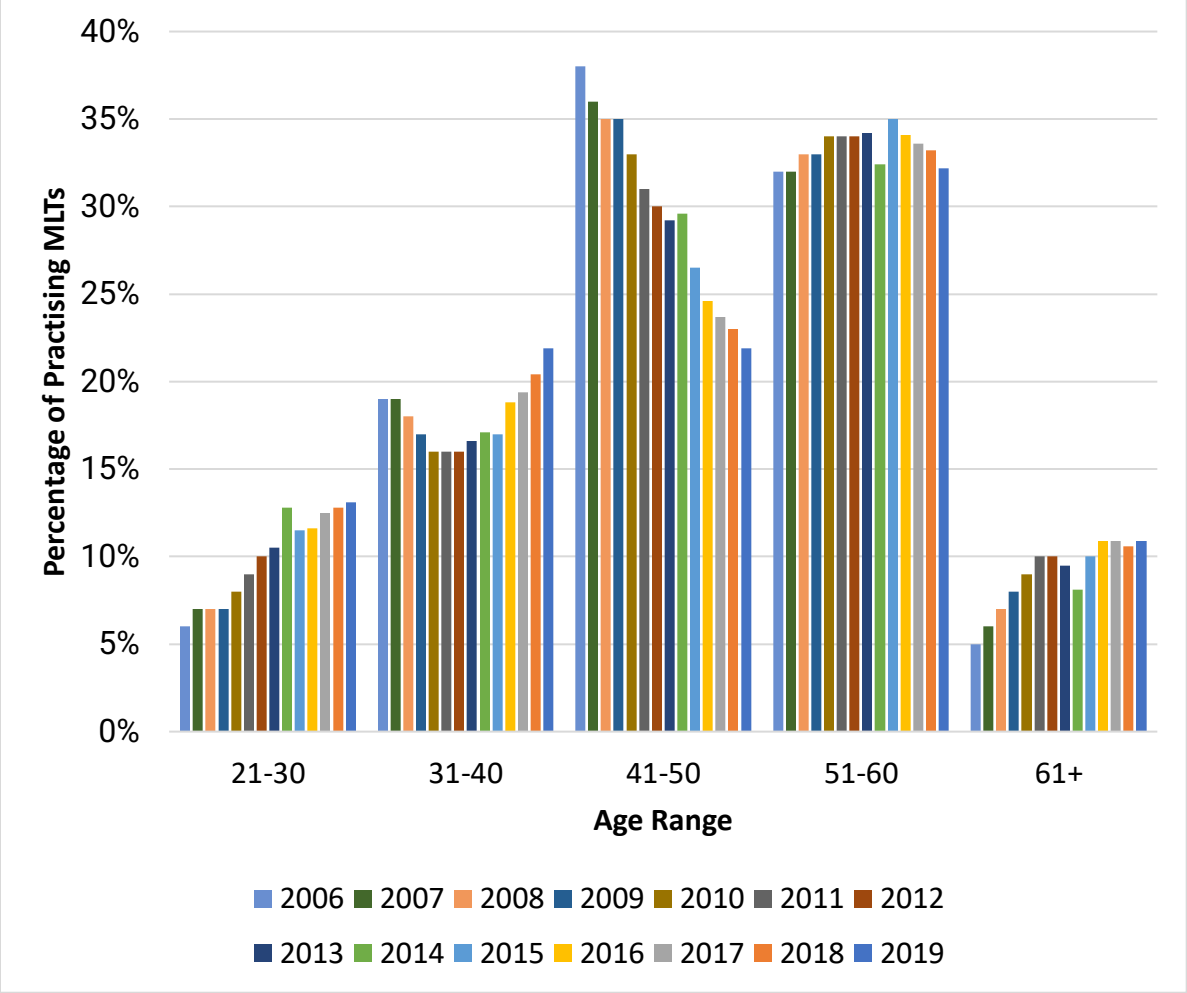


Source: (College of Medical Laboratory Technologists of Ontario, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020)

What is the demographic for practising MLTs?

A more detailed breakdown of the demographics for practising MLTs in **Figure 9** shows a significant decline in the number of MLTs in the 41-50 age group from 2006 to 2019, but no corresponding increase in the 51-60 age group. It is unlikely that these MLTs have completed 30 years of eligibility service to qualify for retirement under the Healthcare of Ontario Pension Plan (HOOPP). Thus, members are likely leaving for reasons other than retirement (e.g., burnout, long-term disability or sick leave, etc.).

Figure 9. Practising MLT Demographics by Age Group from 2006-2019



Source: (College of Medical Laboratory Technologists of Ontario, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020)

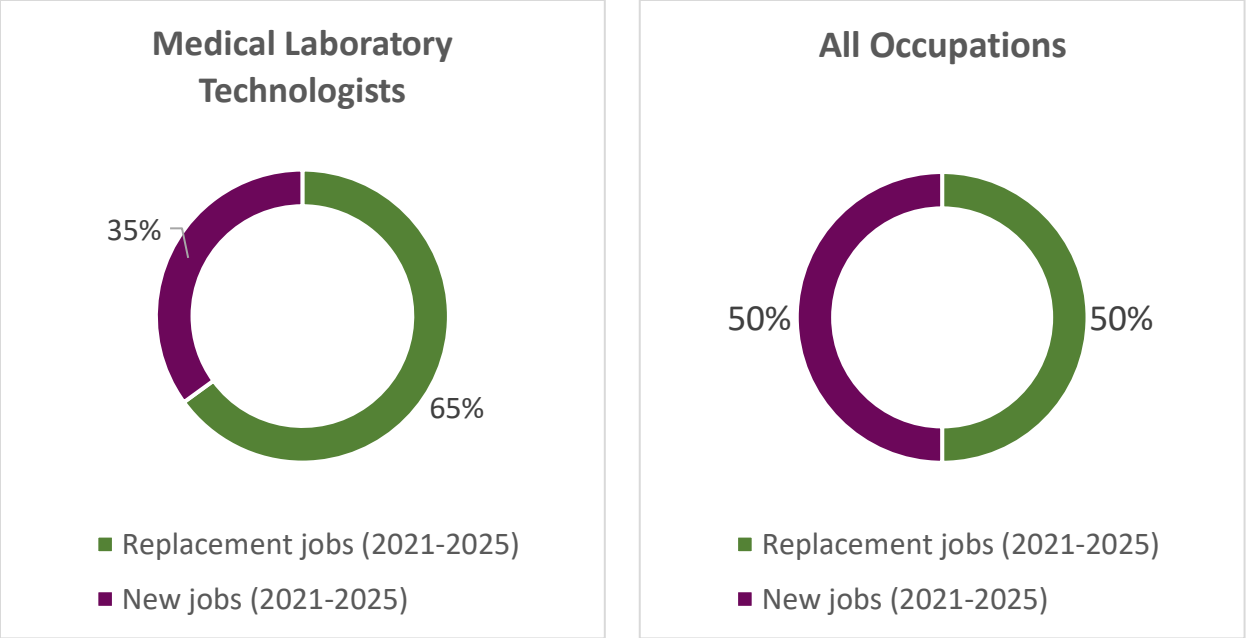
What is the projected demand for MLTs?

From 2021 to 2025, the total projected number of job openings is 2001 to 3000 jobs (Ministry of Labour, Training and Skills Development, 2021).

As shown in **Figure 10**, 35% of these job openings are expected to be new jobs (Ministry of Labour, Training and Skills Development, 2021). In comparison, 65% of these jobs are expected to replace retirement, death, and emigration. The projected change in employment levels from 2021 to 2025 is 8.1-9.0% (Ministry of Labour, Training and Skills

Development, 2021). This current job outlook does not reflect the impact on the labour market caused by COVID-19.

Figure 10. Projected Job Prospects for MLTs from 2021-2025 Compared to All Occupations



Source: (Ministry of Labour, Training and Skills Development, 2021)

What has the response been from stakeholders?

The CMLTO does not currently have a position statement regarding MLT shortages in Ontario. The CMLTO states they do not have any quantitative data supporting an MLT shortage in Ontario. However, they have heard firsthand from employers how difficult it is to recruit MLTs, especially in 2020 and 2021 with the exponential growth in COVID-19 testing (J. Tzountzouris, personal communication, May 11, 2021).

The CSMLS has issued "The Canadian Medical Laboratory Profession's Call to Action." Projecting data from the Canadian Institute for Health Information (CIHI), their backgrounder states the following: "**approximately 400 additional student seats are required** by medical laboratory technologist programs in Canada to offset retirements. **CSMLS recommends at least 20% of all current and future students should have expectations of obtaining rural or remote positions** after certification, regardless of the

province in which they are trained" (Canadian Society for Medical Laboratory Science, n.d.-a).

MEDICAL LABORATORY EDUCATION

What are the accredited medical laboratory education programs in Ontario?

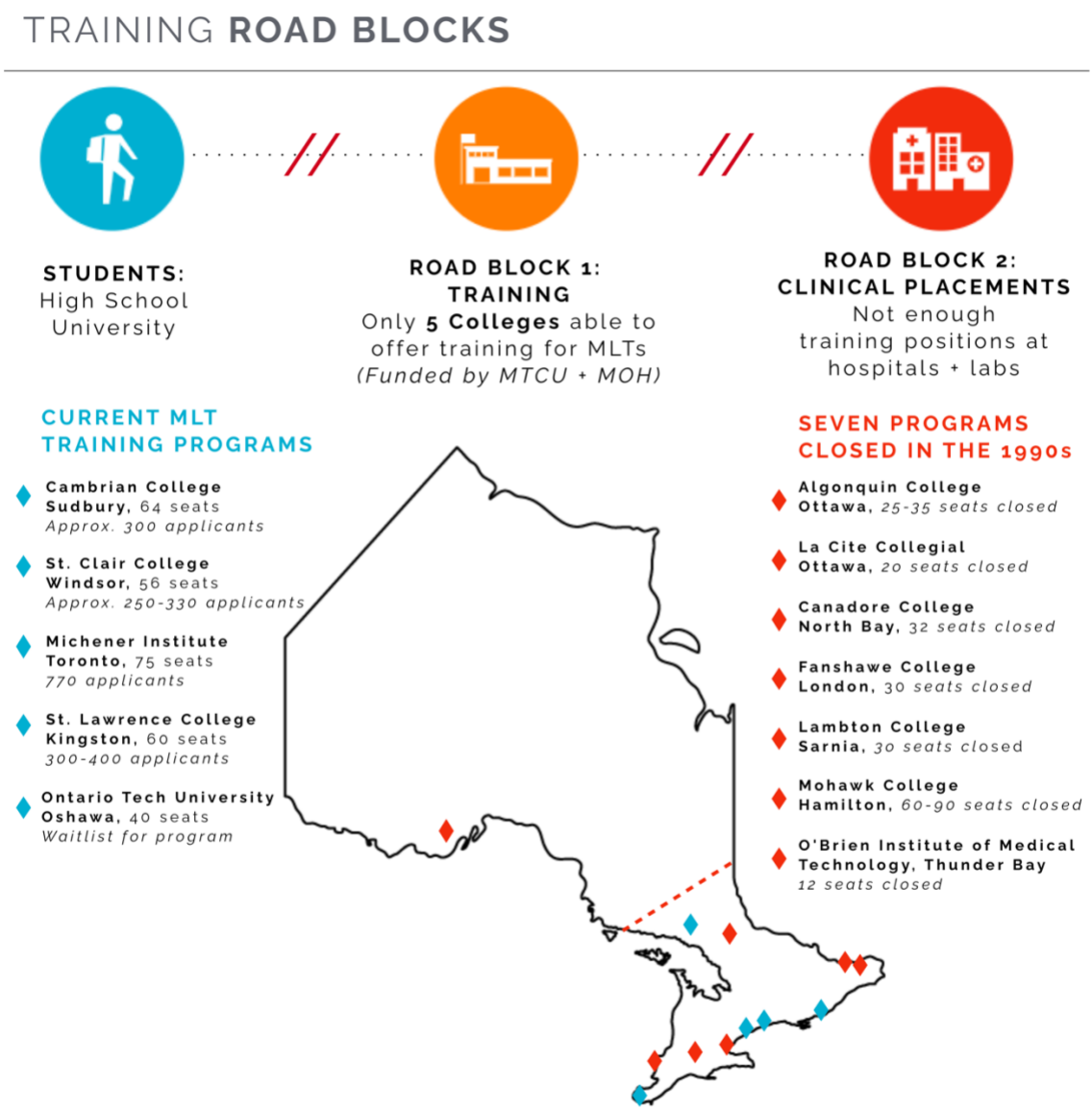
There are currently five accredited post-secondary training programs in medical laboratory sciences in Ontario:

- Cambrian College in Sudbury,
- The Michener Institute of Education at UHN in Toronto,
- St. Clair College in Windsor,
- St. Lawrence College in Kingston, and
- Ontario Tech University (formerly University of Ontario Institute of Technology) in Oshawa.

Figure 11 shows a map of the accredited medical laboratory education programs in Ontario. The map shows that much of northern Ontario is under-served by education programs, particularly with the closure of seven MLT programs in the 1990s, which resulted in the loss of 209 to 249 seats in Ontario. Graduates of accredited medical

laboratory education programs can write the general MLT certification exam administered by the Canadian Society for Medical Laboratory Science (CSMLS). Certification qualifies students to apply for registration with the College of Medical Laboratory Technologists of Ontario (CMLTO) or another provincial equivalent, which is a requirement to practice in Canada.

Figure 11. Map of Accredited Medical Laboratory Education Programs in Ontario



Source: (Medical Laboratory Professionals' Association of Ontario, 2021c)

Table 2 summarizes all the accredited medical laboratory science programs in Ontario.

Table 2. Accredited Medical Laboratory Science Programs in Ontario

School	Funded by	Credential Earned	Program Name	Program Length
Two- to Three-Year Accredited Medical Laboratory Science Programs in Ontario				
The Michener Institute of Education at UHN	Ministry of Health; Ministry of Long-Term Care	Ontario College Advanced Diploma	Medical Laboratory Science	2.5 years
Cambrian College	Ministry of Colleges and Universities	Ontario College Advanced Diploma	Medical Laboratory Technology	3 years
St. Clair College	Ministry of Colleges and Universities	Ontario College Advanced Diploma	Medical Laboratory Science	3 years
St. Lawrence College	Ministry of Colleges and Universities	Ontario College Advanced Diploma	Medical Laboratory Science	3 years
Four-Year Accredited Medical Laboratory Science Programs				
Ontario Tech University	Ministry of Colleges and Universities	Bachelor of Health Sciences (Honours)	Medical Laboratory Science	4 years

Cambrian College

Cambrian College is the only accredited medical laboratory education program in northern Ontario. Cambrian's geographic location allows it to play an essential role in serving Ontario's northern rural and remote laboratories. Cambrian has partnered with several laboratories in north Ontario for student practicum training, which provides these short-staffed laboratories with an opportunity to recruit and hire students after graduation. Further, Cambrian has historically attracted students from northern Ontario. Students from this area are more likely to stay and work in Ontario's northern rural and remote laboratories. In recent years, however, an increasing number of applicants and students from Cambrian College are from southern Ontario and choose to return home after completing their education.

The Michener Institute of Education at UHN

The Michener Institute of Education at UHN is the only accredited medical laboratory science program funded by the Ministry of Health and Ministry of Long-Term Care, which allows it access to resources that are not necessarily available to the other programs. Prior to starting their clinical rotations, Michener students spend 10 weeks in an immersive simulated clinical environment as part of their summer semester. The environment replicates the actual rotations and discipline-specific benches students will experience during their clinical placement.

Besides its medical laboratory science program, Michener is also one of two schools in Canada to offer an accredited Clinical Genetics program and one of two schools in Canada to provide an accredited Diagnostic Cytology program.

St. Clair College

St. Clair College is the southernmost medical laboratory education program. As such, it also serves an important demographic for both students and clinical sites.

St. Lawrence College

St. Lawrence College is the only medical laboratory science program that has two distinct cohorts during clinical placement. Half the class starts their clinical placements in late May/early June and complete their placement in December. The rest of the class start in September/October and are done no later than May of the following year. This allows the earlier cohort to write their certification exam in February and the other cohort to write their exam in June. Over the past six years, the two-cohort model has been in place and allows St. Lawrence to graduate more students.

Over the years, St. Lawrence has also significantly cut their clinical placement time from 50 weeks to 46 weeks to 34 weeks. Clinical placements are currently 28 weeks long.

St. Lawrence College also offers a medical laboratory assistant/technician (MLA/T) program, alongside a medical laboratory science program. There is no bridging program that allows MLA/T students or graduates to obtain advanced standing in the MLS program; however, graduates who have completed the MLA/T program receive additional points for consideration for admission into the MLS program.

Ontario Tech University

Ontario Tech University is the only program to offer a four-year Bachelor of Health Sciences (Honours). This has several significant implications. First, most students in the program are direct from high school, and the program typically has a younger cohort of students compared to other accredited programs in Ontario. Second, a key part of the curriculum is for students to complete a project during their final year with the clinical sites (e.g., a method evaluation, a quality management project, a turnaround time study, etc.). This project requires students to do academic writing and a poster presentation at the end, all of which adds time to the clinical placement length.

What is the demand for medical laboratory education programs?

All five medical laboratory education programs are currently oversubscribed and receive more applications than student spots or places. For example, in fall 2020, 154 students applied to Ontario Tech University, but only 46 students were registered.

How are class sizes determined?

Some program chairs set program sizes and enrollment targets at least one year in advance with input from relevant stakeholders and funders. While the factors and specific stakeholders differ across the different medical laboratory education programs, some factors and relevant stakeholders include:

Factors:

- Projected labour market demand (labour market statistics)
- Historical attrition rates
- Expected/anticipated number of clinical placement sites

Internal stakeholders include:

- Educational administrators (chair or dean of the department or faculty)
- Department of planning and research at Cambrian
- Medical laboratory science/medical laboratory technology program students

External stakeholders include:

- Program advisory committee
- Clinical instructors from clinical placement sites

- Government funders (e.g., Ministry of Health, Ministry of Long-Term Care, Ministry of Colleges and Universities)
- Ministry of Labour

How many students are admitted to each medical laboratory education program? How many pass the CSMLS exam?

Nearly all medical laboratory education programs have increased their intake over the past several years, as shown in **Table 3**. Ontario Tech University, despite the increased number from 2016 to 2020 does not change their student intake.

Table 3. Incoming Class Size, CSMLS Pass Rates, and Attrition Rates by School

School	Incoming Class Size (Fall 2016)	CSMLS Pass / Attempts (Pass rate) Examination Year	Attrition Rate for Incoming Class of 2016*	Incoming Class Size (Fall 2020)
The Michener Institute of Education at UHN	~75 students	60/62 (96.8%) February 2019	12/75 = 16%	75 students
Cambrian College	~50 students	23/23 (100%) June 2019	27/50 = 54%	64 students
St. Clair College	~48 students	27/27 (100%) June 2019	21/48 = 44%	56 students
St. Lawrence College	~40 students	11/13 (84.6%) June 2019 9/9 (100%) February 2019	18/40 = 45%	60 students

Ontario Tech University	~39 students (3-year average from 2016-2019 used)	32/32 (100%) June 2019	7/39 = 18%	46 students

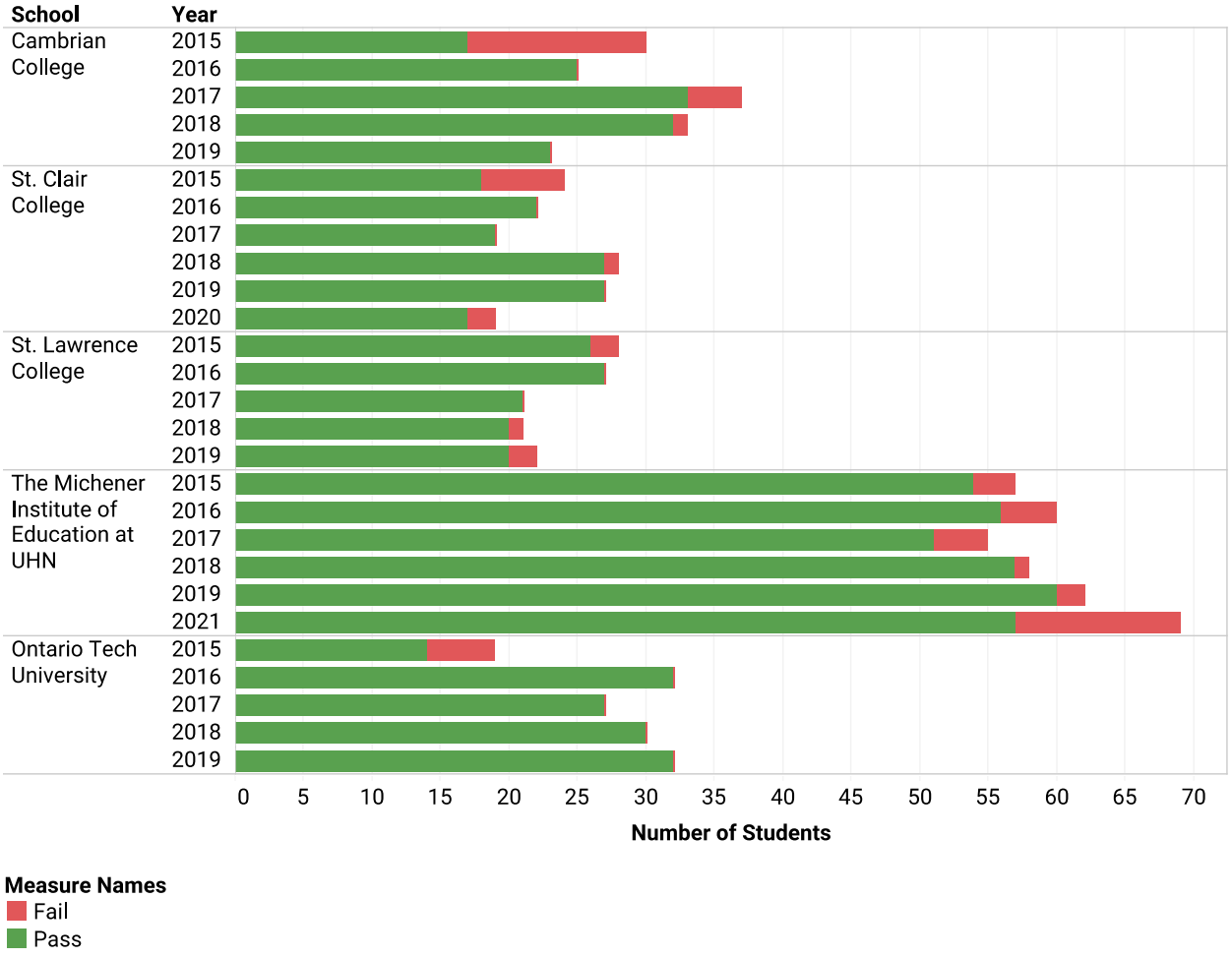
Source: (Canadian Society for Medical Laboratory Science, 2021)

*Note: In the above table, the attrition rate = $\frac{\text{Number of students who left the program}}{\text{Number of students who entered in Fall 2016}}$. The number of students who left the program is calculated as the incoming class size subtracted by the total number of students who **attempted** the CSMLS exam. The attrition rate formula **does not** include those students who failed the CSMLS exam.

Figure 12 shows the number of students who have passed and failed the CSMLS General MLT exam from 2015 to 2020. Although programs have increased their student intake over the years, the number of graduates who have successfully passed the CSMLS exam each year varies. As the admission requirements differ between programs, the students also differ, resulting in different retention and attrition rates across programs. For example, most Ontario Tech University students are direct-from-high school. In contrast, most students from The Michener Institute of Education at UHN have a bachelor's degree or higher. Students may leave the program for various reasons (e.g., not being a good fit for the program, inability to pass certain courses, etc.).

Strategies to improve retention or reduce attrition are managed by the programs. In recent years, some programs have been able to improve student retention rates through academic policy changes. For example, Cambrian College allows students to proceed throughout the program on an independent timetable. If students fail a course, they are permitted to continue onto the subsequent semester and take the courses for which they have the necessary prerequisites. While students require an additional year to complete the program, the program decreases its attrition rates.

Figure 12. Pass and Fail Numbers for the CSMLS Certification General MLT Examination by School from 2015-2020



Source: (Canadian Society for Medical Laboratory Science, 2021)

What proportion of new CMLTO applicants are composed of recently graduated, Ontario-trained MLTs?

As shown in **Figure 13**, in 2019, out of 280 new applicants to the CMLTO:

- 162 students (57.9%) had recently completed an accredited medical laboratory education program in Ontario and passed the CSMLS national certification exam (Canadian Society for Medical Laboratory Science, 2021).
    - This represents the **maximum** number of new applicants trained in Ontario that recently graduated and passed the exam.

    - There were 166 attempts for the CSMLS exam in 2019 (Canadian Society for Medical Laboratory Science, 2021).
- A minimum of 44 applicants (15.7%) were trained in Ontario but graduated before 2019 (e.g., a retiree applying to return to practise or an Ontario graduate who passed the CSMLS exam in a previous year but did not apply to CMLTO).
- 40 applicants (14.3%) were internationally trained (College of Medical Laboratory Technologists of Ontario, 2020).
- 34 applicants (12.1%) trained in other Canadian provinces (College of Medical Laboratory Technologists of Ontario, 2020).

Figure 13. Breakdown of New Applicants to CMLTO in 2019

Source: (College of Medical Laboratory Technologists of Ontario, 2020)

Why don't medical laboratory education programs take more students?

Despite the need to expand the number of seats in medical laboratory education programs, program coordinators and chairs identified several barriers to increasing the program size during interviews:

- ***Uncertainty about Clinical Placements.*** Clinical placements were described as a significant bottleneck. Currently, program coordinators and clinical placement administrators contact clinical sites months (even a year) in advance to determine the number of students they can accept. The uncertainty about the number of clinical placements available makes it difficult for medical laboratory education programs to take more students. It is incredibly challenging when clinical placements that have historically accepted students opt out of clinical placements in any given year.

- ***Lack of Laboratory Space.*** During the COVID-19 pandemic, this was challenging because students were required to distance themselves according to public health guidelines physically. The laboratory space limits the number of students in each laboratory section. The laboratory size determines the size of laboratory groups. Thus, many schools prefer to increase their class size based on the size of the laboratory group.

- ***Additional Resources Associated with Accepting More MLS Students.*** Accepting a more significant number of students also means the need for additional faculty/staffing, equipment, and instructional supplies.

CLINICAL PLACEMENTS

Clinical placements are the mandatory portion of medical laboratory education programs where students complete their training in an affiliated professional laboratory environment. Working closely under the supervision of MLTs, students have the opportunity to integrate knowledge and skills into practice. Clinical placements give students hands-on experience in work environments and the opportunity to network with potential employers.

Where do students complete their clinical placements?

Students complete their clinical placements at clinical placement sites, which include:

- Academic teaching and community hospital laboratories,
- Public health and regional laboratories, and
- Private laboratories.

Students must complete their clinical placements across all five disciplines: Clinical Chemistry, Hematology, Transfusion Science/Blood Bank, Clinical Microbiology, and

Histotechnology/Histology/Pathology. Students may complete their clinical placement at one or multiple sites depending on the required competencies and the range of services and disciplines offered at the clinical sites. If an organization has more than one laboratory site, students may also be required to rotate across the different sites. Historically, medical laboratory education programs have had their own informal "region" or "territory" of clinical sites. If one program attempted to breach into another program's "clinical site," this would often be communicated to other program out of courtesy.

Are all clinical placements in Ontario?

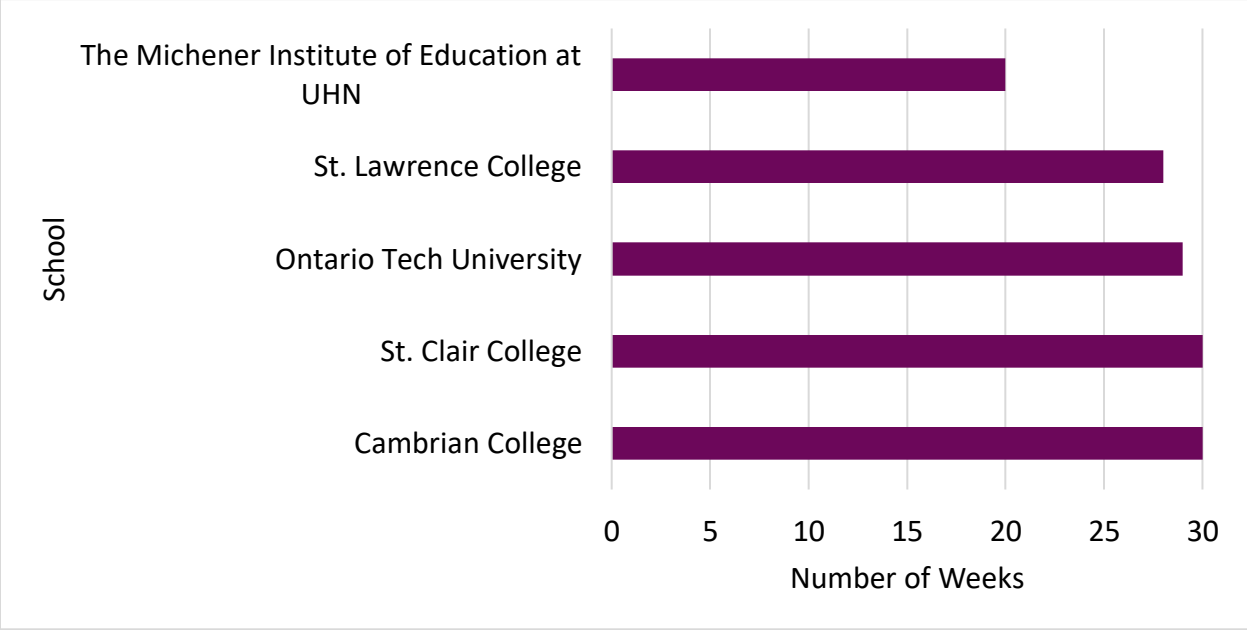
The majority of student clinical placements are located in Ontario. However, The Michener Institute of Education at UHN has occasionally placed students in out-of-province laboratories (e.g., St. John's, Newfoundland; Yellowknife, Northwest Territories; Winnipeg, Manitoba).

How long are clinical placements?

As shown in **Figure 14**, the length of clinical placements varies across the different medical laboratory education programs. The length of clinical placements ranges from 20 weeks (The Michener Institute of Education at UHN) to 30 weeks (St. Clair College and Cambrian College).

Michener is the only school that offers a clinical simulation program in the summer preceding clinical placements. This allows them to shorten their clinical placements significantly. At other clinical placement sites, each discipline is four weeks long.

Figure 14. Clinical Placement Lengths in Medical Laboratory Education Programs in Ontario



NOTES:

1. At Ontario Tech University, a clinical placement length of 29 weeks is recommended. Clinical sites can customize the length based on competency completion.

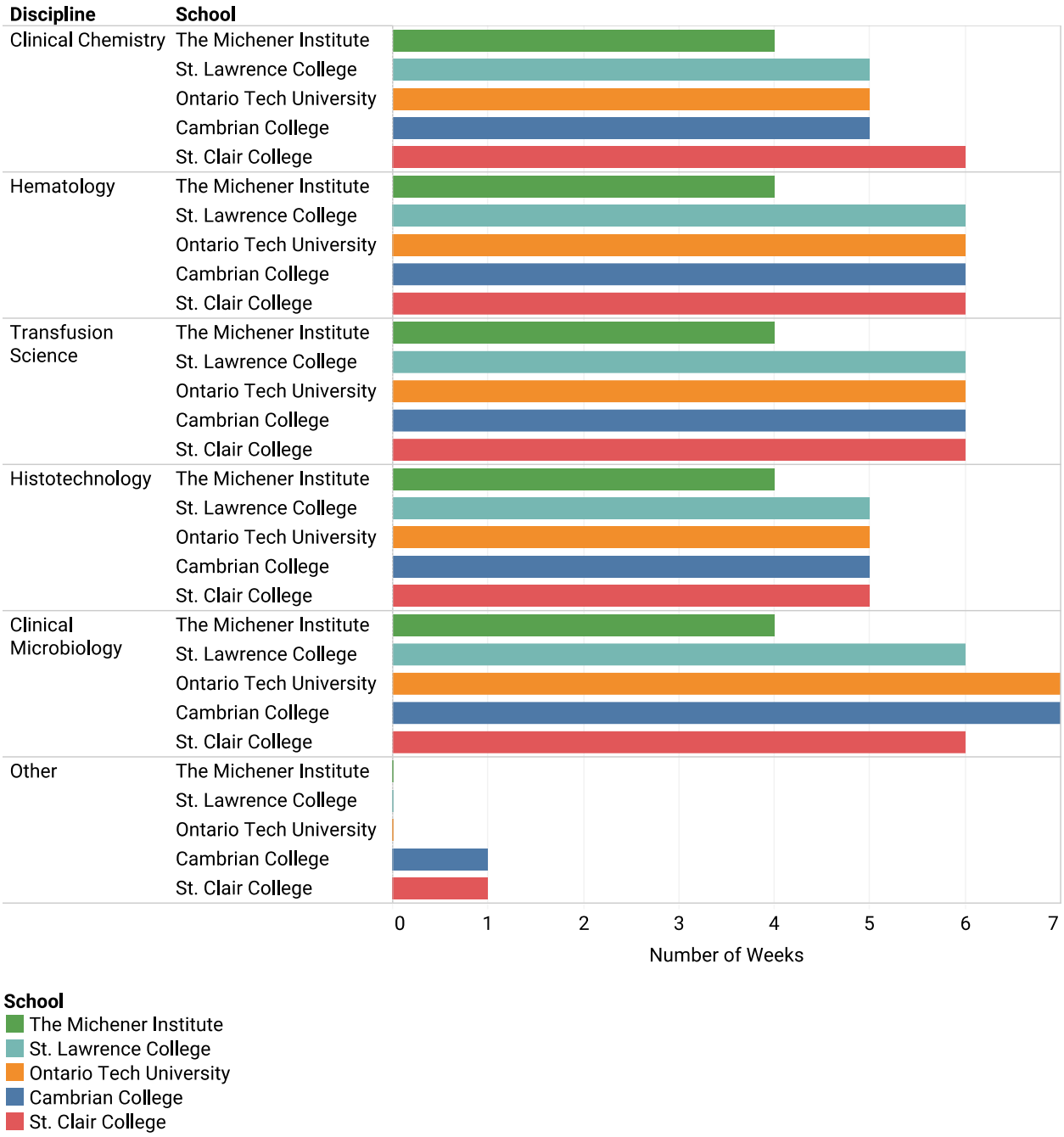
2. For Michener students completing their clinical placements at the University Health Network (UHN), students complete three weeks per discipline plus a 5-week enrichment rotation. The 5-week enrichment rotation can consist of a project, training and preparation for a job.

How long do students spend in each discipline?

Figure 15 shows the breakdown of clinical placements across the different disciplines. Clinical placements in Clinical Chemistry, Hematology, and Transfusion Science range from 4 to 6 weeks.

Clinical Microbiology has the largest variation amongst medical education programs, ranging from 4 to 7 weeks, while Histotechnology has the least variation, ranging from 4 to 5 weeks.

Figure 15. Clinical Placement Lengths Across Different Disciplines in Ontario Medical Laboratory Education Programs



NOTE:

1. At Cambrian College, “Other” represents an orientation week.
2. At St. Clair College, “Other” represents a discretionary week, which allows students to have additional training in any discipline.
3. For Ontario Tech University, the clinical placement length for each discipline is based on the school’s recommended number of weeks. Clinical sites can customize the length based on competency completion.

How do medical laboratory education programs assign student clinical placements?

Each medical laboratory education program has its unique clinical placement assignment process. In many cases, students will rank their top choices of location for clinical placement.

For popular or oversubscribed areas, there may be a lottery process. Most schools have a policy in place, which states that when students accept in the program, they also accept going to any one of the program's affiliated clinical sites available.

Some education programs will consider students' personal circumstances (e.g., a student’s medical background, a student's marital status, whether the student has young children, financial factors, whether a student has a mortgage, etc.). Some programs will also consider a student's hometown and GPA in determining the students' clinical placement site.

Occasionally, a student may come from a region or province with a laboratory not affiliated with their school. In this case, the education program may reach out and establish an agreement with the clinical site (or vice versa), which would allow the clinical site to accept the student for their clinical placement. This is beneficial for both the student and the clinical site. The student can train in a location closer to home, where they may want to work after becoming a registered MLT. The clinical site has the opportunity of recruiting a student who the site knows will probably stay after their clinical placement.

Do medical laboratory education programs pay for clinical placements?

Some medical laboratory education programs pay clinical sites for accepting clinical placements; however, not all do. Education programs that pay clinical sites will often pay based on the number of students accepted for clinical placements. This ranges from roughly $2,500/student to $6,000/student. Other education programs will provide clinical sites with a modest monetary fund that can be used for staff professional development or laboratory operations. Finally, some education programs offer free preceptor training for new preceptors, which can be used for continuing education and professional development (PD) hours.

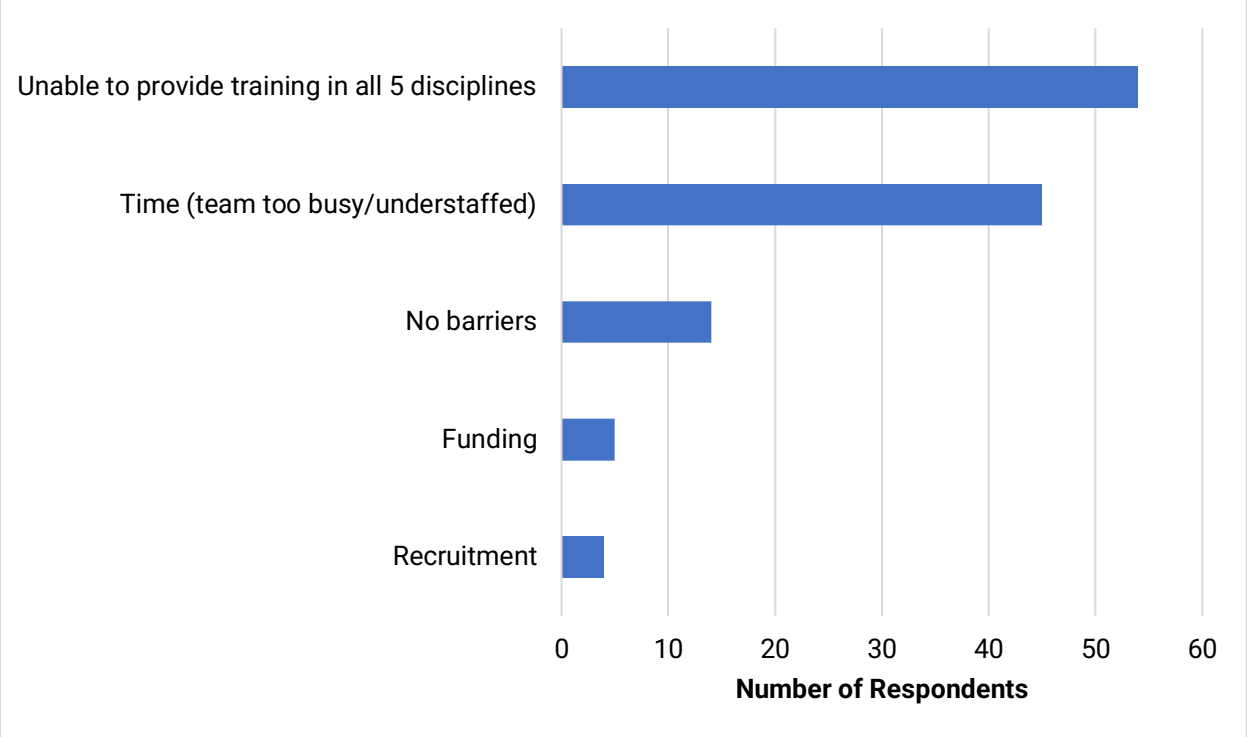
Some programs have previously paid clinical sites for clinical placements but have since stopped because of the high financial costs to the programs. One program that used to pay for clinical placements but stopped lost around ten student placements. Some sites that continued to take students for their clinical placements cut their intake.

Whether programs pay for clinical placements, all programs have agreed that the model of paying for clinical placements is financially unsustainable for them in the long term.

Why do clinical placement sites not accept more students?

Figure 16 shows data from a May 2021 survey conducted by MLPAO on barriers to accepting clinical placement students. 120 laboratory workplaces out of 214 laboratories accredited by Accreditation Canada responded to the survey (Medical Laboratory Professionals' Association of Ontario, 2021b).

Figure 16. Barriers to Accepting Clinical Placement Students (May 2021)



Source: (Medical Laboratory Professionals' Association of Ontario, 2021b)

During interviews with laboratory administrators, senior/charge MLTs, and MLTs, they identified the following barriers to accepting additional students for clinical placements:

- ***Regionalization of Microbiology and Histology/Pathology Laboratories.*** Regionalization (also referred to as consolidation, centralization, merger, or amalgamation) occurred when services, particularly in microbiology and histology/pathology, in adjacent local laboratories were amalgamated to form a larger regional laboratory for greater cost-effectiveness and efficiency. One example of regionalization is EORLA (Eastern Ontario Regional Laboratory Association), composed of 18 hospital-based laboratories.

  Regionalization has significantly reduced the overall number of laboratories offering clinical microbiology and histology/pathology services. Since students must complete their clinical placements in all five disciplines, this reduction has made it difficult for education programs to place students in these disciplines. Many regional laboratories already accept students. Thus, it is difficult for them to accommodate students from other sites that do not offer microbiology and

histology. Consequently, this has led to a significant decrease in the number of clinical placements.

- ***Staff Shortages.*** Staff shortages have made it extremely difficult for clinical sites to accept clinical students. Some rural and remote laboratories, which have the greatest need for MLTs, have had to stop taking clinical placement students because of how short-staffed their laboratories are. In some cases, clinical sites have found themselves needing to prioritize or balance the training of newly hired MLTs with clinical students.

- ***Staff Burnout.*** In all sites interviewed, staff who are directly responsible for training students (called clinical preceptors or clinical educators) are required to complete their clinical and/or administrative duties without additional pay. The added responsibility of training students means that the staff are more likely to experience burnout.

  Clinical preceptors also do not necessarily perform with the same efficiency and effectiveness as staff members focused solely on their clinical work because they are required to teach and explain concepts to students. As a result, this requires other team members to take on increased workloads to accommodate the clinical preceptors' training duties.

- ***Lack of Dedicated Clinical Preceptors.*** Clinical preceptors[1] or clinical educators are employees identified by the clinical placement site to work with, teach, and/or supervise students during their clinical placements. Clinical preceptors are bench technologists/MLTs, senior MLTs, and/or charge MLTs assigned to work with students. Some preceptors express an interest in teaching students. In contrast, others possess specialized skills, knowledge, or experience in an area that makes them ideal for teaching students.

  Clinical preceptors are responsible for completing their clinical work in addition to their clinical supervision and teaching duties. None of the sites interviewed provided additional remuneration to clinical preceptors for teaching students. The lack of dedicated clinical preceptors means balancing clinical duties with teaching responsibilities, often in a short-staffed environment. Further, the lack of dedicated

[1] The terminology for clinical preceptors differs across the different medical laboratory education programs. Some programs will refer to these individuals as clinical educators, among other terms. Clinical preceptors teach and work directly with students.

clinical preceptors means that they are not always given the support and training needed to work with students effectively.

- ***Differences in Clinical Placement Requirements Across Different Medical Laboratory Education Programs.*** There were several notable differences in clinical placement requirements between the different medical laboratory education programs. First, the clinical placement length was different for each program. This created scheduling challenges and difficulties with coordinating students from other programs. Second, programs required different competencies to be signed off during clinical placements and used different software to track the completion of these competencies. Some students had some competencies signed off within their programs (e.g., during simulation), while others did not. This required clinical sites to become familiar with each set of competencies and with the different software. Last, each program had various assessments (e.g., written tests, a project, etc.) during the clinical placements. Collectively, this made it more difficult and time-consuming for clinical staff to become familiar with each program's requirements.

- ***Lack of Clinical Coordinators/Clinical Instructors/Placement Clerks.*** In contrast to clinical preceptors, who teach and work directly with students, clinical coordinators[2] are responsible for administering and coordinating students' clinical education at the clinical site(s). Although specific titles and duties differ across different sites, clinical coordinators work closely with all levels of clinical staff to integrate student activities into the routine of the clinical environment. These individuals generally provide overall supervision for the education and education of clinical students. Clinical coordinators are often responsible for liaising and communicating directly with medical laboratory education programs.

  Only St. Lawrence College has hired dedicated placement clerks who were recent graduates. This role specifically administers assessments and examinations and liaising directly with St. Lawrence College. Some clinical sites previously had dedicated clinical coordinators, which had to be eliminated due to budgetary cuts and constraints. Instead, most clinical coordinators were laboratory staff that assumed the responsibilities in addition to their clinical duties.

[2] Depending on the clinical site and the medical laboratory education program, clinical coordinators are sometimes referred to as placement clerks, clinical educators, or clinical instructors, among other terms.

- ***Poor Student Retention.*** Some clinical sites expressed that their staff felt discouraged and frustrated when students expressed their intention not to continue working at the clinical site after becoming a registered MLT or chose not to return to the clinical site for employment. Sometimes, this has led to less enthusiasm for training students and decreased morale and the feeling that training students was a "lost investment."

- ***Lack of Laboratory Space.*** Some laboratories simply did not have the physical space to accommodate more students. Laboratories undergoing renovations also had to decrease student intake or temporarily could not accommodate student placements.

- ***Additional Resources Associated with Accepting More Clinical Placement Students.*** Accepting more students is associated with more supplies and laboratory consumables (e.g. microscope slides, test kits, cleaning of laboratory coats), which can be costly and are often unaccounted for.

KEY FINDINGS

There was an overall consensus that the clinical placement model required significant change (rather than incremental change) to overcome the shortage of clinical placements and the lack of MLTs. Many stakeholders interviewed stated that previous strategies to overcome clinical placement shortages were no longer effective.

Clinical laboratories need dedicated funding in order to increase the number of students accepted for clinical placements.

- It is recommended that MLPAO advocate for dedicated funding of $6000 per student for clinical placements, which clinical sites can apply for, up to a maximum of 10 students. This funding helps to guarantee student clinical placements (based on the funding applied for), which will help medical laboratory education programs better plan.

- The funding provides a short-term financial incentive for laboratories not previously accepting students to evaluate their ability to accept students for clinical placements.
- Laboratories with staff shortages or precarious positions (e.g., temporary, part-time positions) can use the funding to hire new staff or full-time or permanent positions.
- Medical laboratory education programs will no longer need to pay for clinical placements.
- One challenge cited among hospital clinical laboratories is that hospital funding is rarely explicitly earmarked for clinical laboratories. This recommendation recognizes that different laboratories have different needs. Ensuring that the budget is dedicated to clinical placements will allow laboratories to use these funds to accommodate their clinical needs best. Examples of how this funding could be used include:
    - Purchasing of laboratory consumables
    - Protected time for a clinical coordinator or clinical educator (e.g., someone to oversee student assessments, student scheduling, communication with the medical laboratory education programs)
    - Dedicated clinical preceptors

Medical laboratory education programs need to evaluate their programs to increase student throughput. They need dedicated resources to increase student seats to accommodate the current and future health human resource shortage.

One of the themes that emerged throughout the interviews was the need to rethink existing clinical placement models. Some individuals felt that the current model of starting placements in September was too restrictive. Rather, sending cohorts of students throughout the year (for example, like St. Lawrence College's model of starting in May/June and September/October) would allow clinical sites to accommodate more students.

Many clinical sites also felt that it was important for the programs to collaborate to harmonize the curriculum. While the medical laboratory education programs previously worked together in an attempt to harmonize the microbiology curriculum, the results of

these attempts were mixed due to varying levels of engagement and buy-in from the different programs. Many clinical sites expressed the need for education programs to work together to harmonize the curriculum and agree upon the same set of competencies for sign-off during clinical placement. This would help minimize the amount of time clinical sites need to familiarize themselves with differences in the curriculum and focus their efforts on training students.

Medical laboratory education programs are inherently costly because of instrument and equipment costs, reagent costs, laboratory space required, etc. Yet, as shown during the COVID-19 pandemic, they fulfill an essential role in the Ontario healthcare system.

As shown in **Table 4**, only two of the five Ontario accredited medical laboratory education programs can expand intake if clinical sites guaranteed clinical placements. Other programs are limited to space. Additional resources need to be invested in helping expand the program size significantly to accommodate the current and future health human resource shortage.

Table 4. Ability of Medical Laboratory Education Programs to Expand Student Intake

School	Ability of Program to Expand Student Intake?
The Michener Institute of Education at UHN	"Yes, in multiples of 15 students, to a maximum of 150 students per year – if, and only if, number of available clinical placements was guaranteed at intake (and with at least 1 year advance notice)."
Cambrian College	"If we could confirm that we would have placement I think we could increase by backfilling in semesters and placing 35-40 students instead of our current ~30. So for example, we take in 60 but we know all will not be successful. We could allow more students in the upper semester and fill up to 40-45 which gives students a second try to get back in and also means more students going into placement. I think our lab didactic labs cannot hold any more than the initial 60 and then dropping by around 45 for second year clinical labs would be normal. This is due to lab space at the college as well. If we could build dedicated MLS labs we could put more through over all. We need more space."
St. Clair College	"In theory, if laboratories could increase clinical placement seats for students then we could increase the number of students in the MLT program. In reality, as it stands we are at our maximum since we are now at 4 blocks of students in year 1 and year 2. Whether we could admit more students would also depend on the college's willingness and ability to fund additional staffing, equipment purchases and instructional supplies."
St. Lawrence College	"If funding was provided we could investigate increasing clinical intake, yet this would be ultimately decided by the clinical site. If the sites were able to increase clinical spots we could in turn increase program intake."
Ontario Tech University	"We are open to increasing enrollment pending availability of resources and infrastructure to accommodate the capacity coupled with assistance with capacity in clinical and assistance with allocation of placements."

Significant long-term investments and resources need to be dedicated to simulation education.

Simulation has consistently been perceived as a promising but highly costly solution to tackle the lack of microbiology and histotechnology/histology/pathology laboratories in Ontario. Simulation education has been used in many industries, including nursing, surgical and medical education, and aviation. For example, St. Clair College's Nursing and Paramedic programs received $450,000 of funding from the Ministry of Health and Long-Term Care to open two new simulation labs (St. Clair College, n.d.). Despite the large presence of simulation labs across the country, many do not focus on simulation within medical laboratory education.

There are many benefits to simulation. The National Council of State Boards of Nursing (NCSBN) has conducted and published an award-winning and ground-breaking study on the longitudinal study of simulation in ten prelicensure nursing programs in the U.S. (Hayden et al., 2014). The study provided substantial evidence that up to 50% of traditional clinical experience can be substituted with simulation in prelicensure core nursing courses under certain conditions. Interestingly, their study followed the cohort for the first six months of clinical practice as registered nurses. Researchers found no differences in manager ratings of overall clinical competency and readiness for practice (Hayden et al., 2014). Other studies have reached similar conclusions (Roberts et al., 2019). A systematic review in nursing found that substituting clinical placement with simulation did not significantly impact clinical competency, critical thinking, knowledge acquisition, and self-confidence (Larue et al., 2015).

Simulation has been described as a way for medical laboratory education programs to reduce the length of their clinical placements. The Michener Institute of Education at UHN is currently the only accredited medical laboratory education program to offer simulation before clinical placement. Michener has demonstrated the ability to sign off on clinical competencies within a simulated environment, which reduces the length of clinical placement and the burden on clinical sites. In 2020, because of the COVID-19 pandemic, Michener delivered their entire simulation curriculum remotely. In 2021, Michener adopted a hybrid format so that two out of six days of simulation training for each discipline are online while the rest are in the laboratory.

Despite the broad interest in adopting simulation in MLS, there are still differences in understanding what simulation entails in practice. For this report, the CSMLS definition of simulation has been used. It is defined as:

> *"Simulation is an educational technique used to imitate real life scenarios (in part or whole), which enables participants to demonstrate and receive feedback on knowledge, skills, abilities and/or judgment. This can include but is not limited to communication, problem-solving, critical thinking and the ability to collaborate and work effectively within a health care team. Simulation can reflect simple to complex situations or processes and can be accomplished in any of the following examples:*
>
> - *through interactive written case-based scenarios;*
> - *computerized laboratory information system gaming;*
> - *inter- or intra-professional role playing;*
> - *standardized patients;*
> - *task trainers such as rubber arms for phlebotomy;*
> - *virtual simulation for specimen identification;*
> - *haptic simulation;*
>
> *Similar to healthcare simulation, academic student simulation encompasses a range of activities with a broad common purpose of improving the effectiveness and efficiency of services and ultimately, enhancing competency acquisition by students in a safe and secure environment that reduces potential harm to patients, students, and the laboratory and general healthcare systems"* (Canadian Society for Medical Laboratory Science, 2016).

There are also questions about how each program can best incorporate simulation in its curriculum. Although CSMLS has issued a position statement on simulation and previously worked with SIM-one and Simulation Canada to offer a course in medical laboratory-specific simulation-based education, the work has been paused due to the COVID-19 pandemic (Canadian Society for Medical Laboratory Science, 2018). There is an opportunity for leadership in simulation within the context of medical laboratory

education. Simulation is a significant investment with buy-in and interest from many stakeholders. Still, it requires commitment and, ideally, its own funded project.

Ontario needs a long-term human resource recruitment and retention strategy to support rural and remote laboratories.

A significant human resource challenge that was consistently identified was the challenge with the recruitment and retention of MLTs, particularly in rural and remote laboratories in Ontario. Out of 120 surveyed laboratories in Ontario, 66 self-identified as being in rural and remote communities and 24% of MLT job postings in Ontario are in rural and remote laboratories (Medical Laboratory Professionals' Association of Ontario, 2021a).

Most medical laboratory science students come from urban and suburban communities. Students from non-rural and non-remote communities who complete their clinical placements in rural and remote laboratories often choose to return home after their clinical placement, even if employment opportunities are available at their clinical placement site. Further, none of the clinical laboratories interviewed had any financial resources or incentives to attract prospective employees or assist new employees with moving or relocating costs.

Due to the consolidation of microbiology and histotechnology/histology/pathology laboratories in Ontario, most rural and remote laboratories cannot offer students training in all five disciplines for their clinical placements. This means that students were required to complete their clinical placement at multiple clinical sites, which poses significant challenges for students, MLS programs, and the rural and remote laboratories. Students often had difficulty finding short-term housing. There were no dedicated resources to assist students with moving or relocating to a rural or remote community. For education programs, it was difficult to place students in rural and remote laboratories because they could not find microbiology and histology/pathology laboratories that would accept additional students for training in these disciplines, as these laboratories already had students.

In response to MLT shortages, there are differing perspectives among rural and remote laboratories in Ontario. Some laboratories are eager to accept students to help attract and recruit prospective employees. Conversely, some laboratories have become so

under-staffed that they no longer have the capacity to accept clinical placement students. Similarly, others feel that they are unable to offer students with a "complete" clinical placement experience and it would be unfair to students to have them rotate through multiple clinical laboratories.

As a result, there is an opportunity to establish a long-term recruitment and retention strategy for rural and remote laboratories in Ontario, some of the most under-staffed laboratories in the province. Proposed strategies could include:

- A student loan forgiveness program, similar to the one offered to family doctors and nurses. Under the current program, to be eligible for the Canada student loan forgiveness program, family doctors or nurses must be employed in under-served rural or remote communities and complete at least 400 hours total of in-person service over the course of the 12-month period for one or more employers (Government of Canada, 2019).
- Funds to assist with moving and relocation expenses.
- A living allowance, similar to the Northern Living Allowance. For example, the Northwest Territories offers a Northern Living Allowance ($3,700 for Yellowknife; Practice NWT, n.d.).

There was a greater need to promote medical laboratory science as a profession in high school, particularly within rural and remote communities, not only online but actively through collaboration with high schools.

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